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Journal
Journal of Alternative and Complementary Medicine, 30(7)

ISSN
1075-5535

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Publication Date
2024-07-01

DOI
10.1089/jicm.2023.0427

JOURNAL OF INTEGRATIVE AND COMPLEMENTARY MEDICINE
Volume 30, Number 7, 2024, pp. 620–644

DOI: 10.1089/jicm.2023.0427

JICM

REVIEW ARTICLE

Mind–Body Interventions for Youth with Chronic Medical Conditions: A Scoping Review of the Literature

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Abstract

Background and purpose: Little is known about the applicability, utilization, and effectiveness of mind–body interventions (MBIs) for conditions that are not predominantly pain, neoplastic, or psychiatric, particularly in pediatric patients. This scoping review describes research pertaining to such interventions in youth with nonpain, noncancer, and nonpsychiatric predominant chronic medical conditions.

Methods: Searches of EBSCO CINAHL, Elsevier Scopus, Ovid for MEDLINE, and Ovid PsycInfo were conducted to investigate MBIs in youth under 18 years of age with nonpain, noncancer, and nonpsychiatric predominant chronic medical conditions. Articles published between 2010 and 2020 were included. Abstracts were screened by three authors for inclusion, and disagreements were resolved by a designated author. Selected full-text articles were divided among all authors for review of study quality, intervention feasibility and acceptability, and effectiveness.

Results: The search yielded 1010 titles with 15 meeting the final inclusion criteria, studying a total of 641 youth. Participants ranged in age from 6 to 19 years (included studies had data on participants <18 years reported separately); 61.5% were female ($n = 394$) and 38.5% were male ($n = 247$). The two most common conditions studied were asthma and irritable bowel syndrome, with yoga being the most popular intervention. Overall, MBIs showed promising preliminary evidence for improving symptoms and quality of life in youth with chronic medical conditions.

Conclusion: MBIs have been successfully delivered and show promise in symptom palliation and quality of life improvement for youth with a variety of chronic medical conditions. More data from high-quality randomized controlled trials are needed to further characterize the effectiveness of specific modalities for specific conditions.

Keywords: scoping review, mind–body interventions, pediatric, chronic disease

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Introduction

Nearly one in four children in the United States are affected by chronic and often lifelong medical conditions.[1,2] Children with chronic conditions often require repeated hospitalizations, home health care, and rehabilitation.[3,4] The most common chronic conditions in children include asthma, epilepsy, and diabetes, leading to estimated additional medical expenses of $1,378 to $9,059 per child annually.[5] This translates to ~$25 to $167 billion in additional health care costs for these conditions alone.[6]

Children often feel and are out of control of their circumstances, which may thereby worsen their burden of stress and lead to behavioral problems and emotional dysregulation.[7,8] Care for children with chronic conditions has generally focused upon treating the presenting medical concern, with limited resources available to address the additional allostatic load imposed by these chronic medical conditions on other parts of their lives.[9]

Mind–body interventions (MBIs) present an innovative, accessible, and effective means to improve coping in chronic health conditions.[10] In the 2007–2012 National Health Interview Survey, MBIs were ranked among the top 10 complementary and integrative health (CIH) practices utilized by both adults and children.[11] MBIs demonstrate compelling benefit for psychiatric conditions, such as posttraumatic stress disorder,[12] and are increasingly being utilized for pain conditions as well as quality of life improvement in various cancers.[13,14] Innovations in delivering MBIs remotely, through telehealth or electronic smartphone-based applications, or in group settings are also promising.[15] Many seekers of CIH turned to virtual care during the coronavirus disease 2019 pandemic.[16]

While the impact of MBIs is extensively described in the literature for all ages—predominantly adults—in the management of pain, cancer, and psychiatric conditions, less is known about their applicability, utilization, and effectiveness for other chronic medical conditions, particularly in pediatric patients.[17–20] Thus, the objective of this scoping review was to describe the literature addressing MBIs delivered to pediatric patients with chronic, nonpain, and nonpsychiatric predominant medical conditions with regard to feasibility, acceptability, and effectiveness.

Methods

Ethics approval was not required for this scoping review, and a review protocol does not exist for this study.

Eligibility criteria and information source

This review was conducted in accordance with the Preferred Reported Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines extension for scoping reviews.[21] The inclusion criteria for this review were as follows: (1) articles were published between September 1, 2010 and September 30, 2020, and were designed as prospective cohort trials, randomized controlled trials (RCTs), mixed-methods studies, waitlist-control trials, case series, or clinical replication series; (2) included data for youth under 18 years of age with chronic, nonpain, noncancer, and nonpsychiatric predominant medical conditions, broadly defined as any medical diagnosis affecting children and requiring long-term management with a health care provider; and (3) utilized MBIs including, but not limited to, biofeedback, guided imagery, hypnosis, meditation, Tai Chi, and yoga.

Owing to the extensive variation in definitions of ''chronic conditions'' across professional societies and medical bodies,[22] the term was left intentionally broad to include how it was defined in each article obtained during literature search. Concussion was included as a chronic condition because, although acute in onset, subsequent symptoms often require prolonged management; exact search terms for chronic conditions are enumerated in Appendix A1.

The criteria for exclusion from this review included studies that (1) included children older than or equal to 18 years of age or did not report data for those under the age of 18 years separately; (2) investigated nutrition, exercise, or psychotherapy-based interventions; (3) MBIs that consisted of acupuncture interventions (as the body of literature exploring acupuncture is large and already established); (4) included pain as the primary outcome measure; and/or (5) were review articles or editorials.

A search strategy was generated for the concepts of MBIs in pediatric patients with chronic illnesses. Both controlled vocabulary and title and abstract fields were used for the search terminology. Searches of EBSCO CINAHL, Elsevier Scopus, Ovid for MEDLINE, and Ovid PsycInfo were conducted, and search results were articles limited to the English language and published between the dates of September 1, 2010 and September 30, 2020. Reviews, editorials, and commentary were removed before exporting results to a Covidence database for review.

Covidence is a web-based collaboration software platform that streamlines the production of systematic and other literature reviews.[23] The search was conducted by a single author (M.N.). Three authors (M.M., D.W.M., and M.E.C.) screened and reviewed the title, abstract, and full text of each retrieved article. Any disagreements were resolved by one author (M.M.). Appendix A1 provides a detailed description of the search strategy. While the initial search strategy included acupuncture, articles with acupuncture interventions were excluded during screening by authors.

Data extraction and analysis

The Covidence database was utilized for data collection from generating the search strategy, initial abstract and full-text review, and initial data collection. The following components were used to adequately extract data from the included studies: study type; number, age, and demographics of participants; chronic medical condition studied; intervention type and setting; measures of MBI feasibility and acceptability; outcome measurement instruments; and outcomes following MBI. Data were extracted and further analyzed by two authors (R.S. and D.W.M.) using an Excel spreadsheet.

Study quality assessment

Study quality was assessed using a modified Newcastle-Ottawa Quality Assessment Scale[24] for all included articles. Scale Four categories were included: (1) representativeness of the sample; (2) comparability of intervention and control groups; (3) assessment of outcomes; and (4) statistical tests used.

Results

Article selection

A total of 1010 articles were screened after 264 duplicate studies were removed. Of these, 112 articles were selected for full-text review, and 898 articles were excluded (Fig. 1). Studies were excluded on the basis of the aforementioned exclusion criteria. Fifteen publications met the final inclusion criteria.[25–39] All 15 included studies were published between 2010 and 2019.

Study types

Studies' target conditions, population, intervention details, setting, measures, design, presence/absence of a control group, and presence/absence of a home practice component are presented in Table 1. Most of the included studies were prospective cohort trials ($n = 6$, 40%), followed by RCTs ($n = 3$, 20%), mixed-methods studies ($n = 2$, 13%), and one each of waitlist-control, multiple baselines, case

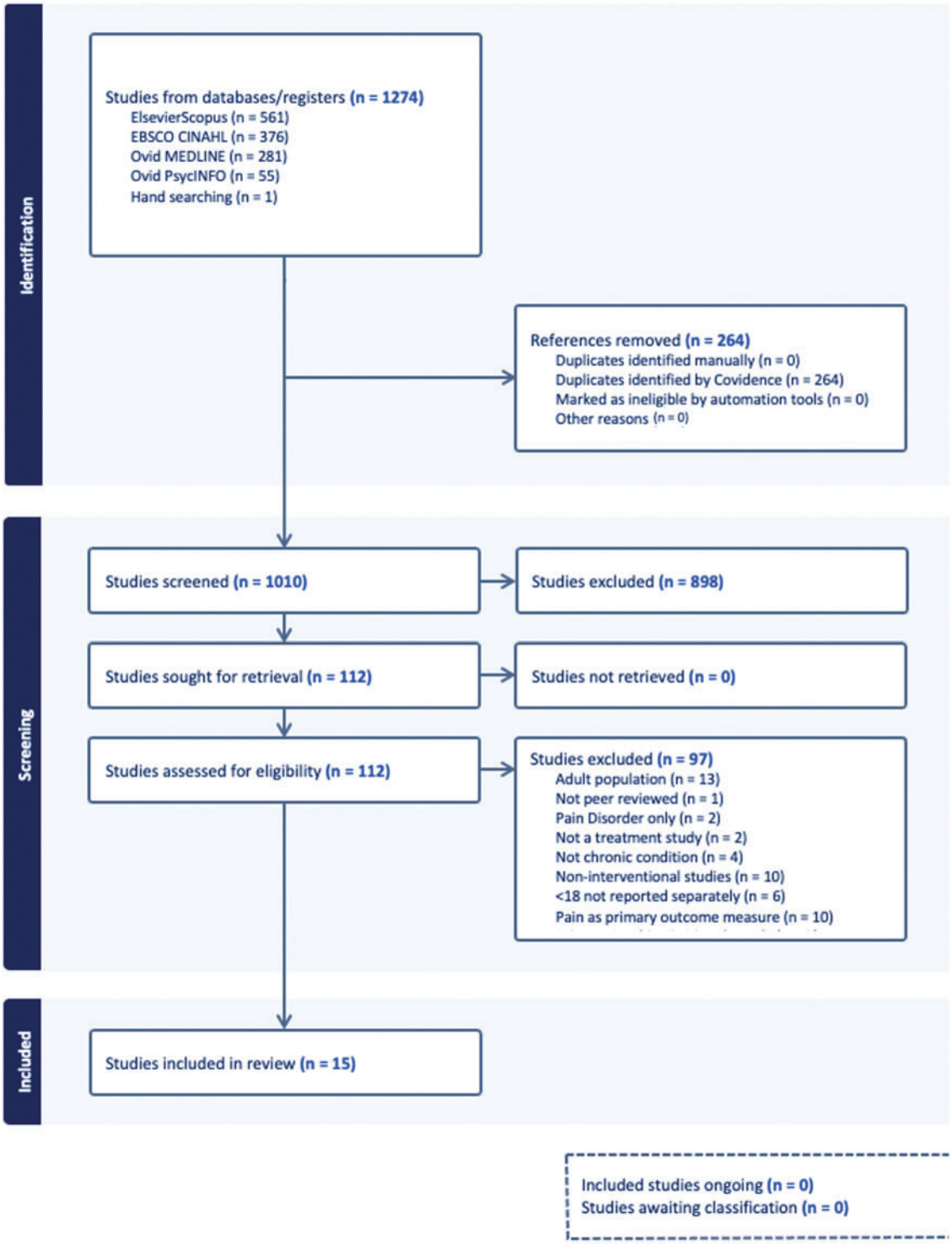

FIG. 1. Preferred Reported Items for Systematic Reviews and Meta-Analyses flow diagram.

Table 1. Study Characteristics

Study	Medical condition	Population	Intervention details	Setting	Study design	Pilot	Control present	Home practice
Kapoor et al. (2010)	Asthma and anxiety disorder	High school students with clinically diagnosed asthma and anxiety ($n=3$); two 15-year-old females and one 15-year-old male	Participants engaged in 20-min RGI sessions, 3×/week for 4 weeks. Data were collected at baseline, intervention, and 4-month follow-up.	School	Multiple baseline	Yes	No	No
Lin et al. (2017)	Asthma	Elementary school students with and without asthma ($n=38$); mean age: 10 years	Participants engaged in 60-min Tai Chi sessions once per week for 12 weeks at school. Home practice using videos was requested. Control group was asked to maintain regular daily activities. Outcomes were measured pre- and postintervention.	School	Prospective cohort	No	Yes	Yes
Tahan et al. (2014)	Asthma	Pediatric patients with asthma ($n=24$) Mean age: 7.5 years (positive) and 9.5 years (negative)	Two groups of children, consisting of those with either positive responses to exercise challenge or negative responses, took part in the study. Participants engaged in 1 h of yoga training twice per week for 12 weeks.	Outpatient	Prospective cohort	No	No	No
Chadi et al. (2018)	Chronic health conditions	Adolescents with chronic health conditions ($n=14$); mean age: 15.3 years	Intervention consisted of an adapted 8-week MBI delivered in person or through a secure e-health audiovisual platform. Outcomes were measured on first and last day of MBI and 2 months postintervention.	Outpatient: in-person, virtual	Mixed-methods	No	No	Yes

(*continued*)

TABLE 1. (CONTINUED)

Study	*Medical condition*	*Population*	*Intervention details*	*Setting*	*Study design*	*Pilot*	*Control present*	*Home practice*
Paniccia et al. (2019)	Concussion	Youth with concussive symptoms ($n=6$); mean age: 15.7 years	Intervention consisted of an 8-week MBY intervention delivered once per week for 45 min per session. Assessments were collected pre-, post-, and 3-months postintervention.	Outpatient	Case series	Yes	No	No
Bingham et al. (2010)	Cystic fibrosis	Pediatric inpatients ($n=10$); mean age: 12 years	Intervention consisted of five to six 15-min sessions of an electronic breath biofeedback game consisting of tracking moving targets. Eye-breath tracking, breathing rate, and tidal volume were assessed during the intervention. Structured interviews were conducted after the intervention to obtain subjective responses regarding the game.	Inpatient	Prospective	Yes	No	N/A
McNamara et al. (2016)	Cystic fibrosis	Children and young adults with cystic fibrosis ($n=20$); mean age: 11 years	Intervention consisted of six 60-min one-on-one yoga sessions over a span of 10 weeks. Each yoga practice was designed from a pre-set list of 30 asanas. Questionnaires were administered pre- and 2 week postintervention.	Outpatient	Prospective	Yes	No	Encouraged, but not required

(*continued*)

Table 1. (Continued)

Study	*Medical condition*	*Population*	*Intervention details*	*Setting*	*Study design*	*Pilot*	*Control present*	*Home practice*
Kajbafzadeh et al. (2011)	Dysfunctional elimination syndrome DES	Children with DES ($n=80$); mean age: 8.5 years (intervention); 9 years (control)	The intervention comprised biofeedback therapy delivered twice weekly for a total of 6–12 sessions as well as education on topics including coordinated function of the urinary tract and GI tract, scheduled voiding, pelvic floor exercises, hydration, and a high-fiber diet. Patients were also instructed to practice Kegel exercises for 15 min twice daily. The control group received education on behavioral modifications without biofeedback therapy. Outcomes were assessed at 6 and 12 months after treatment.	Outpatient	RCT	No	Yes	Yes
Wright et al. (2011)	HTN/elevated BP	Black 9th graders ($n=121$); mean ages: 14–15 years	Participants were randomly assigned to a 12-week behavioral intervention of BAM, HE, or LS during school health class. Measures were obtained preintervention, postintervention, and at 3 months follow-up.	School	Prospective	No	Yes	BAM group only (weekend 10-min meditations)
Gregoski et al. (2011)	HTN/elevated BP	Black youth with pre-hypertension ($n=162$); mean age: 15 years	Intervention comprised a 12-week behavioral intervention, either (1) HEC, (2) LST, and (3) BAM. Data were collected pre- and postintervention.	School	RCT	No	Yes	BAM group only (weekend 10-min meditations)

(*continued*)

Table 1. (Continued)

Study	*Medical condition*	*Population*	*Intervention details*	*Setting*	*Study design*	*Pilot*	*Control present*	*Home practice*
Evans et al. (2014)	IBS	Adolescents and young adults with IBS ($n=51$); mean age: 19 years[a]	Intervention comprised 1.5-h yoga classes twice per week for 6 weeks, with a waitlist-control group. Poses were tailored to the developmental age/stage of participants. Data were collected at 3 time points: baseline, post treatment, and 2-month follow-up.	Outpatient	Waitlist-control	Yes	Yes	Encouraged, but not required
Evans et al. (2018)	IBS	Adolescents with IBS ($n=18$); mean age: 16.4 years	Intervention comprised 1.5 h yoga classes twice per week for 6 weeks, with a waitlist-control group. Outcome measures were collected at 3 time points: baseline, post-treatment, and at 2-month follow-up.	Outpatient	Mixed-methods	No	Yes	Encouraged, but not required
Stern et al. (2014)	IBS and FAP	Pediatric patients diagnosed with either IBS or FAP ($n=27$); mean age: 10.69 years (IBS), 12.18 years (FAP)	Intervention consisted of psychophysiological education about the ''brain-gut'' relationship, followed by an average of eight 30-min HRVB sessions. Patients were also instructed to breathe at home for minimum of 20 min per day using either computer/phone applications to simulate their resonant frequency breath rate.	Outpatient	Clinical replication series	No	No	Yes

(*continued*)

Table 1. (Continued)

Study	*Medical condition*	*Population*	*Intervention details*	*Setting*	*Study design*	*Pilot*	*Control present*	*Home practice*
Weigensberg et al. (2014)	Metabolic syndrome	Latino adolescents with obesity ($n=35$); mean age: 16.1 years (DS), 15.5 years (GI)	Participants received either 12 weekly sessions of (1) a lifestyle education and guided imagery program or (2) lifestyle education and DS program. Lifestyle education program included a 12-week course on intuitive eating and modification of dietary carbohydrate intake. Measures were assessed at baseline and postintervention.	Outpatient	RCT	Yes	Yes (DS)	Encouraged, but not required
Wang et al. (2013)	Chronic prostatitis	Pubertal patients with chronic prostatitis ($n=22$); mean age: 16.5 years (group 1) and 16.3 years (group 2)	Participants received 12-week biofeedback training and were then divided into two groups; group 1 received further training for more than 24 months, while group 2 received further training for less than 24 months.	Outpatient	Prospective	No	No	No

[a]Results analyzed separately for adolescents; subgroup mean age not provided

BAM, breathing and awareness meditation; BP, blood pressure; DS, digital storytelling; FAP, functional abdominal pain; GI, guided imagery; HE, health education; HEC, health education control; HRVB, heart rate variability biofeedback; HTN, hypertension, IBS, irritable bowel syndrome; LST, life skills training; MBI, mind-body intervention; MBY, mindfulness-based yoga; N/A, not applicable.

series, and clinical replication series. Pilot studies constituted 40% ($n=6$) of the included studies, and 47% of the included studies had a control group ($n=7$).

Population

Demographic details of participants and studies, including study location, number of participants, mean ages, gender, and race, are presented in Table 2. There were a total of 641 participants (394 female and 247 male) across the 15 included studies, with an overall mean sample size of 43 participants, ranging from a case series with 3 participants[39] to as many as 162 participants[27]; the latter was an RCT. Ages of study participants ranged from 7.5 to 19 years; however, in included studies with participants above 18 years of age, data for individuals under 18 years of age were reported separately and examined in this review. Notably, female participants predominated in all studies, constituting an average of 61.5%.

Study locations—country of origin, study setting

Most studies took place in various cities throughout the United States ($n=10$, 67%); of the remaining five studies, one each (6.7%) was conducted in Canada, China, Iran, Taiwan, and Turkey, respectively. A map indicating the locations of the 15 included studies is shown in Figure 2.

Chronic medical conditions

Asthma was studied in three articles (20%), which utilized MBIs including yoga, Tai Chi, and guided imagery; irritable bowel syndrome (IBS) or other gastrointestinal disorders were also studied in three articles (20%). Hypertension or elevated blood pressure was explored in two studies (13%), as was cystic fibrosis (13%). The full array of chronic medical conditions studied in this scoping review is illustrated in Figure 3.

Interventions

Types of MBIs. The included studies assayed many different types of therapeutic interventions. Of the 15 included studies, five utilized some form of yoga as the primary intervention, four employed biofeedback, three employed breathing and awareness meditation (BAM), two used guided imagery (including ''relaxation and guided imagery''), and one focused on Tai Chi.

MBIs were investigated for the following conditions: yoga for asthma, concussion, cystic fibrosis, and IBS (two studies). Biofeedback was utilized for children with cystic fibrosis, DES, IBS, and chronic prostatitis (CP). Guided imagery was used in cohorts of participants diagnosed with obesity, as well as asthma with associated anxiety disorders. BAM was delivered to a group of youth at risk of hypertension (HTN), and Tai Chi was used in youth with asthma.

Interventions also varied by the settings in which they were delivered. Four studies were conducted in the school setting, where they were integrated into the school day; 10 took place in community or clinical research settings, and one, Chadi et al., had partial virtual delivery.[38] Only one study, Bingham et al., was delivered exclusively in an inpatient setting.[31]

Group versus solo. Most MBIs (60%) were delivered in a group setting. Six studies described MBIs that were delivered one-on-one to participants: all four biofeedback studies were delivered one-on-one, as was a case series of guided imagery for asthma and anxiety, and a trial of yoga for cystic fibrosis.

Home practice. Home practice was a required element of the intervention in six (40%) of the included studies; home practice was encouraged, but not required, in four (27%) of the included studies. The remaining five studies (33%) did not include a home practice element.

Outcomes

Studies' main outcomes are presented in Table 3. Participants generally demonstrated improvements in self-reported medical symptoms and objective measurements after MBIs. The heterogeneous nature of the data from these 15 studies meant that calculations such as meta-analysis would yield results of limited practical utility and are outside the scope of this scoping review.[40] Therefore, this section summarizes studies by condition and intervention type as one means of collating results for better conceptualization and comparison.

Asthma. A case series of youth with asthma and anxiety suggested that engaging in a relaxation/guided imagery intervention yielded improvements in lung function and anxiety.[39] In youth with asthma alone, a Tai Chi intervention was associated with improvements in lung function and quality of life as compared with nonasthmatics[30]; yoga training yielded improvements in lung function in youth with exercise-induced asthma. Interestingly, after the yoga intervention, youth with exercise-induced asthma subsequently became exercise-tolerant.[29]

Other chronic health conditions. A single mixed-methods study assessed the impact of an adapted 8-week MBI delivered either virtually or in person in a group of youth with various chronic health conditions.[38] No untreated control group was used for comparison. Results showed a statistically significant decrease in depressive symptoms and positive impacts on well-being, stress, pain, and sleep in both groups, whereas no significant differences were observed in salivary cortisol levels in either group.

Concussion. A small pilot study of mindfulness-based yoga training for youth with concussive symptoms ($n=6$) demonstrated increased heart rate variability (a measure of healthy neurophysiological function), decreased concussive symptomatology, and ability to engage in strenuous exercise both immediately and 3 months postintervention compared with baseline.[25] No control group was included.

Cystic fibrosis. For hospitalized youth with cystic fibrosis ($n=12$), a video-based biofeedback intervention yielded improvements in eye-breath coordination (i.e., eye tracking of a moving target that represented the breath) as compared with baseline.[31] In another study, youth who engaged in a 10-week yoga intervention demonstrated significant improvements in anxiety, depression, and joint pain

Table 2. Participant Demographics Within Included Studies

Author name	*Type of study*	*Location*	*Number of participants*	*Mean age of participants (SD if reported), years*	*% Female*	*Race*
Bingham et al. (2010)	Repeated measures (pilot) study	Burlington, VT (USA)	10	12	60%	Not reported
Wright et al. (2011)	Prospective cohort study	Lexington, KY; Charleston, SC; Augusta, GA (USA)	121	14.97	60%	African American/Black
Chadi et al. (2018)	Single-center randomized mixed-methods study	Toronto, Canada	14	15.3	78%	Not reported
Evans et al. (2014)	RCT	Los Angeles, CA (USA)	51	19.0 (3.9)	84.30%	72% White (36) 18% Multiracial (9) 4% Asian (2) 6% African American (3)
Evans et al. (2018)	Mixed-methods study	Los Angeles, CA (USA)	18	16.4	89%	10 Non-Hispanic/non-Latino White 1 African American 1 Asian 1 Hispanic Latino 5 Multiracial
Gregoski et al. (2012)	RCT	Augusta, GA (USA)	162	15.0–15.2	58%	African American/Black
Kajbafzadeh et al. (2011)	Case–control	Tehran, Iran	80	Group A: 8.5 (2.7); group B: 9 (2.3)	77.50%	Not reported
Kapoor et al. (2010)	Multiple baseline study/ prospective cohort study	Northern Massachusetts (USA)	3	15.33	67%	White
Lin et al. (2017)	Prospective cohort study	Taipei, Taiwan	61	10.31	52%	Asian
McNamara et al. (2016)	Repeated measures (pilot) study	Minneapolis, MN (USA)	20	11	60%	80% Caucasian (16) 5% African American (1) 5% Hispanic (1) 10% Not answered (2)
Paniccia et al. (2019)	Repeated measures case series (pilot) study	Ontario, Canada	6	15.67	63%	Not reported
Stern et al. (2014)	Multiple clinical replication series	San Diego, CA (USA)	24	IBS: 10.69 (3.401); FAP: 12.18 (3.06)	58.33%	Not reported
Tahan et al. (2014)	Prospective cohort study	Kayseri, Turkey	20	Exercise-response-positive group: 7.5; exercise-response-negative group: 9.5	55%	Not reported
Wang et al. (2013)	Prospective cohort study	Hunan Province, China	22	Group 1: 16.5 (1.1); group 2: 16.3 (1.2)	N/A	Asian
Weigensberg et al. (2014)	RCT	Los Angeles, CA (USA)	29	DS group: 16.1 (0.95); GI group: 15.5 (1.0)	52%	Latino

FIG. 2. Geographic location of included studies.

immediately postintervention.[33] These changes were not sustained at follow-up. Neither study included a control group for comparison.

Dysfunction elimination syndrome. Among youth with dysfunction elimination syndrome ($n = 80$), those who received an intervention consisting of animated biofeedback therapy alongside behavioral modification and pelvic floor exercises demonstrated significant improvements in subjective and objective voiding problems (including daytime wetting, fecal soiling, staccato voiding, and urinary tract infection) compared with those who received behavioral modification and pelvic floor exercise education alone.[32]

Hypertension. Two studies employed BAM versus life skills training (LST) interventions for Black youth at risk of

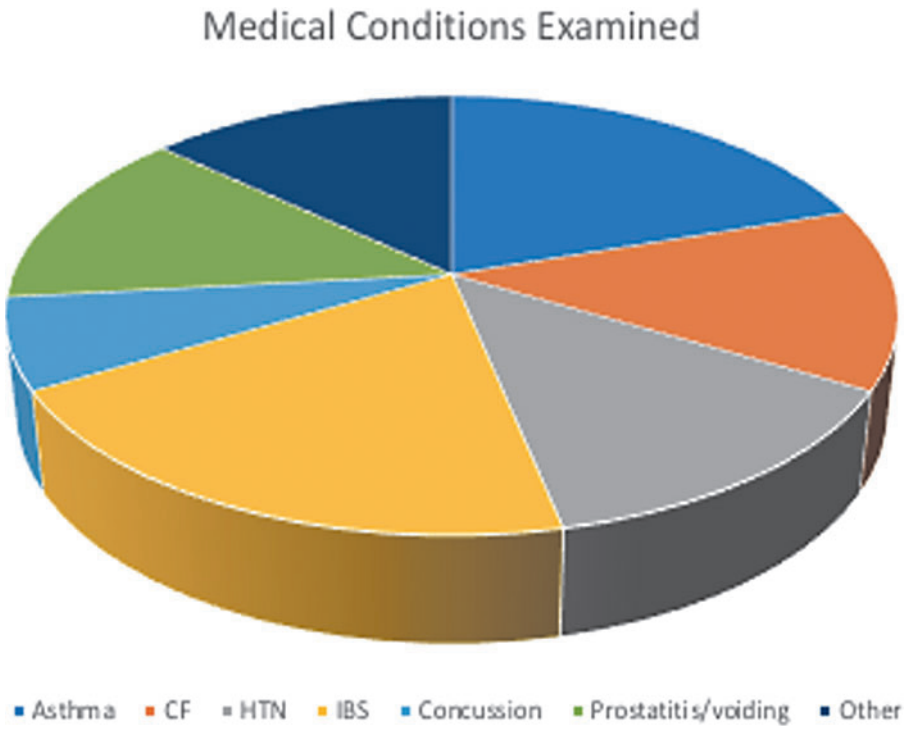

FIG. 3. Chronic medical conditions.

Table 3. Outcome Measures and Key Results of Included Studies

Reference	*Medical condition*	*Intervention (summarized)*	*Measures*	*Main results*
Kapoor et al. (2010)	Asthma and anxiety disorder	RGI	Spirometry; State-Trait Anxiety Inventory for Youth; daily asthma diary to record medication use and physical symptoms; PAQLQ; Multidimensional Students' Life Satisfaction Scale; consumer satisfaction questionnaire	RGI had a greater beneficial effect on large airway functioning than small airway functioning (improved in 2/3 participants). Anxiety scores lowered for all participants. All participants demonstrated improved quality of life; 2/3 improved happiness.
Lin et al. (2017)	Asthma	Tai Chi	Spirometry; FeNO; International Study of Asthma and Allergies in Childhood questionnaire; PAQLQ	Lung function improvement (FEV1/FVC and PEFR increased and FeNO decreased) as well as improved quality of life was seen after Tai Chi for 3 months in both TC groups but not in non-TCC groups; FEV1 increased significantly in asthma-TC group after TC practice. Significant improvement in PAQLQ during study period in asthmatic-TC group.
Tahan et al. (2014)	Asthma	Hatha yoga consisting of 10 min of pranayama, 40 min of asana, and 10 min of relaxation.	Global Initiative for Asthma guidelines for diagnosing asthma in participants; IgE, eosinophil counts, spirometry; skin allergen testing	No significant spirometric difference in pulmonary function between groups. There was significant improvement in the exercise-response-positive group's fall of maximum FEV1% after exercise. All members of exercise-response-positive group became exercise-response-negative after yoga training.
Chadi et al. (2018)	Chronic health conditions (including epilepsy, chronic pain, anorexia nervosa, thalassemia, rheumatologic conditions, respiratory conditions, and diabetes)	Adapted 8-week MBI, Mindful Awareness and Resiliency Skills for Adolescents delivered in person vs. virtually	Quantitative (instruments not specified): mindfulness skills; depression symptoms; anxiety symptoms; illness coping; self-esteem; salivary cortisol; qualitative: self-reported weekly home practice, intervention acceptability	There was a statistically significant decrease in depressive symptoms was seen at 2 months post-MBI. Participants in both groups reported feeling a sense of community and experiencing a positive impact on well-being, stress, pain control, and sleep after the MBI. No significant differences in salivary cortisol levels or other outcomes were observed between groups at all time points.
Paniccia et al. (2019)	Concussion	MBY	HRV; Children's Assessment of Participation and Enjoyment questionnaire; Self-Efficacy Questionnaire for Children; Post-Concussion Symptom Inventory; Godin Leisure Time Exercise Questionnaire.	Increased HRV, decreased concussive symptoms, and shifts from mild to strenuous exercise occurred immediately post-MBY intervention, and were maintained at 3 months follow-up. Trends in increased self-efficacy across domains seen from pre- to postintervention.
Bingham et al. (2010)	Cystic fibrosis	Breath biofeedback computer game	Resting minute ventilation; tidal volume; eye-breath coordination; structured interviews after intervention	Participants demonstrated improvement in eye-breath coordination over 5 sessions as well as demonstrated enthusiasm for the game, self-reflection behaviors, and awareness of breath flow.

(*continued*)

Table 3. (Continued)

Reference	*Medical condition*	*Intervention (summarized)*	*Measures*	*Main results*
McNamara et al. (2016)	Cystic fibrosis	Yoga	Cystic Fibrosis Questionnaire-Revised, MSAS, Hospital Anxiety and Depression Scale, Center for Epidemiological Studies-Depression Scale for Children, APSA, STAIC	Participants demonstrated improvement in immediate anxiety between first and last yoga sessions per STAIC scores. No improvements were seen in sustained anxiety and depression postintervention. APSA scores reflected improvements in joint pain after intervention. No notable changes in sleep disturbance per MSAS.
Kajbafzadeh et al. (2011)	DES	Animated biofeedback therapy with behavioral modification education and pelvic floor exercises.	DVSS Questionnaire; pelvic floor muscle EMG; uroflowmetry results; voiding pattern	Significant decrease in DVSS scores at 6 months and 1 year; normalization of objective voiding parameters. Fecal soiling and constipation resolved within 6 months. Vesicoureteral reflux resolved in 78% of children and UTI did not recur in 71% of children within 1 year. No significant improvements in bladder capacity and voided volume improve postintervention. PVR and voiding time decreased, while maximum and average urine flow increased significantly. The intervention group also showed lowered risk of daytime wetting, fecal soiling, staccato voiding, and UTI.
Wright et al. (2011)	HTN/elevated BP	Stress reduction interventions including BAM, LST	Adolescent Version Cook-Medley Hostility Inventory (ACMI); height, weight, BMI, 24-h ambulatory blood pressure; heart rate; qualitative assessments of program implementation using Likert-type scale ratings	Participants in the BAM group demonstrated significant reductions in self-reported hostility and 24-h systolic ABP. Participants in the LS group showed significant reductions in hostility between postintervention and follow-up. Participants in the HE group did not demonstrate any significant reductions in hostility or 24-h ABP.
Gregoski et al. (2011)	HTN/elevated BP	Stress reduction interventions including HEC, BAM, and LST	Endothelin genotyping, ambulatory and nighttime blood pressure; Everyday Discrimination Scale	Participants from low chronic stress environments in the BAM group showed reductions in ABP among ET-1 SNP carriers. Among noncarriers, all interventions yielded reductions in ABP for those from low-chronic stress environments. Among noncarriers with high stress exposure, only BAM yielded reductions in ABP.

(*continued*)

TABLE 3. (CONTINUED)

Reference	*Medical condition*	*Intervention (summarized)*	*Measures*	*Main results*
Evans et al. (2014)	IBS	Iyengar Yoga delivered twice per week for 6 weeks.	Global Improvement Scale, NRS, CSI, Health-Related Quality of Life—Short Form-36, Functional Disability Index; BSI-18; FACIT-Fatigue	Abdominal pain intensity was statistically unchanged. However, 44% of adolescents and 46% of young adults showed a clinically significant reduction in pain; 33% of young adults showed clinically significant symptom improvement globally. Immediately post-yoga intervention, global improvement, worst pain, constipation, and nausea; at the 2-month follow-up, global improvement, worst pain, and nausea were maintained.
Evans et al. (2018)	IBS	Iyengar Yoga delivered twice per week for 6 weeks.	NRS, CSI, BSI-18, Pittsburgh Sleep Quality Index; FACIT-Fatigue, Visceral Sensitivity Index	Half of the teens responded successfully to yoga, with significant reductions in abdominal pain. Yoga responders reported benefits early in the treatment course; their parents were committed to and supportive of the intervention. Both groups felt that home practice was important to achieve benefit.
Stern et al. (2014)	IBS and FAP	HRV biofeedback	Self-report symptom frequency and severity	Full remission, defined as 2 weeks symptom-free, was achieved by 69.2% and partial remission was achieved by 30.8% of participants with IBS. Full remission was achieved by 63.6% and partial remission was achieved by 36.4% of patients with FAP. All patients in either group improved to a >50% satisfaction level.
Weigensberg et al. (2014)	Metabolic syndrome	Interactive guided imagery and DS	3-Day Physical Activity Recall, Hawks' Intuitive Eating Scale; Perceived Stress Scale; insulin resistance, eating and physical activity behaviors, salivary cortisol	The didactic and experiential intervention was highly acceptable to the study population. GI group demonstrated significant decrease in sedentary activity, increase in moderate physical activity, a trend toward reduced caloric intake, and greater improvement in intuitive eating and decreased salivary cortisol as compared with the DS group.
Wang et al. (2013)	Chronic prostatitis	Biofeedback training	NIH-CPSI scores, maximum urinary flow rate, postvoid residual volume	Group 1 experienced a gradual and significant decrease in total NIH-CPSI and subdomain scores, while group 2 experienced a significant increase in total NIH-CPSI as well as pain, urination, and life-impact scores at 30 and 36 months (after biofeedback training stopped). There was a significant difference between the two groups' total and subdomain scores at these times. Group 2 also experienced a decrease in Q_{max} at 30 and 36 months.

ABP, ambulatory blood pressure; ACMI, adolescent version of the Cook-Medley Hostility Inventory; APSA, Additional Pain Symptoms Assessment; BSI-18, Brief Symptom Inventory-18; CSI, Children's Somatization Inventory; DVSS, Dysfunctional Voiding Symptom Score; EMG, electromyography; ET-1 SNP, endothelin-1 single nucleotide polymorphism; FACIT-Fatigue, Functional Assessment of Chronic Illness Therapy Fatigue Subscale; FeNO, fractional exhaled nitric oxide; FEV1, forced expiratory volume in 1 second; FVC, forced vital capacity; HRV, heart rate variability; MSAS, Memorial Symptom Assessment Scale; NIH-CPSI, National Institute of Health Chronic Pain Symptom Index; NRS, abdominal pain numeric rating scale; PAQLQ, Pediatric Asthma Quality of Life Questionnaire; PEFR, peak expiratory flow rate; STAIC, State-Trait Anxiety Inventory for Children; UTI, urinary tract infection.

hypertension.[27,37] Gregoski et al. categorized participants using endothelin genotyping and quantified allostatic stress by measuring discrimination-based stress exposure. Both BAM and LST interventions were effective in reducing ambulatory blood pressure, although the BAM group displayed effects faster; however, in Gregoski et al., only BAM reduced blood pressure in gene noncarriers with high stress exposure.

In addition, Wright et al. found significant decreases in systolic blood pressure and hostility after BAM intervention, as measured by the Cook–Medley Hostility Inventory. Notably, there were significant increases in hostility post-LST.

IBS. For youth with IBS, the results of two Iyengar yoga interventions were correlated with significant improvements in symptoms, sleep, and pain as compared with controls[35,36]; one study also reported significantly improved psychological distress and fatigue as compared with control.[35] HRVB led to significant improvements in IBS per patient self-report[34]; 69.2% of participants achieved full remission, that is, 2 weeks symptom-free, while 30.4% of participants achieved partial remission. Similar improvements were observed in the same study for children with functional abdominal pain (FAP); controls were not included in this study.

Metabolic syndrome. One study assessed the impact of education on leading a heart-healthy lifestyle plus either guided imagery or digital storytelling in a cohort of Latino youth with obesity Latino children.[26] Both interventions were deemed acceptable to the study population. Guided imagery yielded increased physical activity alongside improvements in intuitive eating (described as a nondieting philosophy emphasizing permission to eat, relying on internal satiety cues, and engaging in physical activity for well-being) and salivary cortisol; these changes were not observed in the digital storytelling group.

Chronic prostatitis. Among pubertal patients with CP, those who received biofeedback training for 24 or more months after a 12-week intensive training experienced significant improvements in CP symptoms.[28] In comparison, those who received follow-up biofeedback training for less than 24 months postintensive training, paradoxically, experienced significant increases in CP symptoms and pain and decreased maximum urinary flow rate.

Instruments

Outcome measurement tools examined in this review were highly heterogeneous, owing to the variety of intervention types delivered and medical conditions treated. Details of the outcome measurements used in each study can be found in Table 1.

Intervention feasibility and acceptability

Thirteen of the 15 reviewed studies reported some measurement of feasibility and acceptability, including tracking of attendance, home practice (if required or encouraged during intervention), ratings or surveys of program, and/or qualitative interview data pertaining to satisfaction with the intervention; only two studies did not report attendance data. MBIs were overall deemed feasible and acceptable by participants, although one study (Wright et al.[37]) noted overall loss of 29% of cohort and attendance rate of <70% attributable to school attendance. Details of intervention feasibility and acceptability for each included study can be found in Table 4.

Study quality assessment

The Modified Newcastle-Ottawa Scale (NOS) criteria are described in Table 5. The NOS (Table 6) has a maximum, highest quality score of 8 points. Points were given based on sample representativeness, presence of a matched control group, subjective versus objective outcome measurement, and extent of statistical tests performed. Scores for the included studies ranged from 3 to 7, with a mean score of 4.9, such that higher scores reflected greater methodological quality.

Discussion

Overview

Based on the search performed, this appears to be the first scoping review of studies analyzing MBIs in youth under 18 years of age with various chronic, nonpain, noncancer, and nonpsychiatric predominant medical conditions. This review highlights encouraging preliminary findings for MBI feasibility, acceptability, and effectiveness, while underscoring the need for significantly more high-quality trials in this underserved population. Specific considerations regarding intervention design (including improved controls), participant needs, strengths, limitations, and future guidance are discussed in sections ''Study types'' to ''Future considerations.''

Study types

The most frequently observed MBIs in this review included yoga, followed by Tai Chi, guided imagery, and digital storytelling, which were most frequently utilized in populations with asthma and IBS. Study heterogeneity made meta-analysis practically impossible, and the wide range of study designs included in this review elucidates the need for further efforts toward determining optimal formats for research and care delivery. Most studies were prospective trials, and only three were RCTs, which had small sample sizes ranging from 35 to 162 participants. More high-quality large-scale RCTs are warranted to better characterize intervention effectiveness for these conditions.

Population

Demographics. This review also elucidates certain trends in participant demographics among YOUTH receiving MBIs for chronic conditions. All (except for the study involving prostatitis) included more females than males, with the lowest proportion of female participants being 52%. No study explicitly explained this distribution, and only one acknowledged this skewed distribution. Possible explanations for this observation may reflect a broader trend of chronic medical conditions affecting more females than

Table 4. Feasibility and Acceptability Reported in Reviewed Studies

Study	*Assessment of feasibility/acceptability*	*Results*
Bingham et al. (2010)	Structured interviews of perceptions of game	Patients showed pride in getting better at game.
Wright et al. (2011)	Attendance in each cohort	Attendance of 91%–95% during in school sessions.
	Likert-type scale ratings of program from 0 to 4 of thoroughness, attentiveness, enthusiasm.	Likert-type scale ratings not reported.
		Overall loss of 29% of cohort. Attendance rate of <70%.
Chadi et al. (2018)	Qualitative assessment of home practice and intervention acceptability	Both in-person and e-health groups practiced at home 6.1 times/week.
Evans et al. (2014)	Attendance	Average session attendance of 75%
	Self-reported home practice	43 Participants reported practicing at home for an average of 4 min/week
Evans et al. (2018)	Semistructured interviews after intervention	Yoga responders noted consistent multiple benefits of practice.
Gregoski et al. (2011)	Likert-type ratings from 0 to 4 of program implementation for aspects of thoroughness, attentiveness, and enthusiasm.	Thoroughness: 3.34 ± 0.26
		Attentiveness: 3.28 ± 0.32
		Enthusiasm: 3.31 ± 0.27
Kajbafzadeh et al. (2011)	Attendance (number of biofeedback sessions attended and follow-up visits completed).	Mean number of biofeedback sessions was 9.6 ± 1.3
		All participants completed follow-up visits, all subjects in intervention group attended monthly visits.
Kapoor et al. (2010)	Follow-up data, consumer satisfaction index with 0–5 Likert-type scale.	Mean score of 5 for all three participants.
Lin et al. (2017)	Did not report.	N/A
McNamara et al. (2016)	Attendance	19 Subjects completed six sessions each; 1 subject completed five sessions due to illness.
Paniccia et al. (2019)	Attendance	Attendance ranged from 83% to 100% for 5 of the 8 sessions. Postintervention satisfaction surveys detailed that the MBI met most or all of participants' ($n = 6$) needs, all would recommend the MBI, that the MBI helped to some degree, and 5/6 would definitely do the MBI again.
	Postintervention satisfaction surveys	
Stern et al. (2014)	Qualitative assessment of patient experiences	Post-treatment, participants expressed satisfaction with clinical outcomes and intervention.
Tahan et al. (2014)	Attendance	Among 24 participants across a 3-month intervention, 4 did not complete any yoga training, 1 attended for 1.5 months, and 1 attended for 2 months.
Wang et al. (2013)	Not directly reported.	Text notes that follow-up training sessions for long-term follow-up group were suspended due to "poor therapeutic compliance."
Weigensberg et al. (2014)	Qualitative postintervention focus group responses, attendance, and subjective surveys administered during RCT.	Results showed 90%–100% attendance and high level of acceptability of all components of intervention as per postintervention focus group and self-reported evaluations. However, there was near universal nonadherence with home practice.

males,[41] gender-based differences in symptom reporting or diagnosis, and issues related to adherence, as well as relatively greater female participation in CIH modalities, such as MBIs, overall.[42]

Three studies intervened upon specific demographic groups: Gregoski et al. and Wright et al. assessed the impact of BAM upon blood pressure in Black high school students, who are at particular risk of hypertension,[27,37] while Weigensberg et al. explored the impact of guided imagery with health education upon Latino adolescents with obesity, at risk of metabolic syndrome.[26] These studies represent critically important endeavors for numerous reasons.

First, delivering MBIs to youth at high risk for specific chronic medical conditions should represent a priority within the CIH space. Concurrently, efforts to engage with demographic groups who have historically been less represented among patients receiving CIH reflects an important move toward equitable access to potentially high-value, low-cost, and preventative health care, especially in youth.

Developmental stages. Participants had a wide range of ages. This is important in studies in the pediatric population, as developmental ages/stages profoundly impact treatment adherence, comprehension, and

Table 5. Modified Newcastle-Ottawa Quality Assessment Scale Criteria for Studies of Mind-Body Interventions for Youth with Chronic Medical Conditions

Representativeness of the sample
0 No description of sampling strategy
1 Somewhat representative
2 Truly representative (database or epidemiologic study)
Comparability
0 No comparison groups
1 Comparison group, but no matching of subjects (not randomized)
2 Subjects of the groups were comparable, as determined by the matching of demographic or clinical factors
Outcome
How they measured the outcome (e.g., *quality of life, symptoms of primary condition, wellness ratings, and psychological improvements*)
0 Inadequate description of the outcome measured
1 Use of subjective (self-report) to measure patient outcomes (e.g., self-report scale)
2 Use of objective measure of patient outcomes (e.g., laboratory values)
Statistical test
0 The statistical test is not appropriate, not described, or incomplete
1 The statistical test is appropriate, completed, and described in a comprehensive manner, with measures of association (e.g., probability value) presented
2 The statistical test includes one of the following: controlled for confounding variables, conducted multiple comparisons, and/or effect size.

efficacy. This feature of the review proved valuable in demonstrating feasibility for multiple ages; however, this also made it difficult to generalize findings across age groups. Effective MBI delivery considers the unique psychosocial needs of youth in each age group.

Study locations

Most studies took place at or in association with large urban medical centers in cities worldwide. Most MBIs were delivered in the outpatient or clinical research setting ($n = 10$; one offered a virtual option for attendance), four were delivered in schools, and one was delivered inpatient. Future efforts will ideally include MBIs delivered to rural or underserved populations, or otherwise include efforts to ameliorate issues related to distance and transportation to increase access.

Weigensberg et al.[26] described reimbursing participants for transportation as a means of improving engagement. Virtually delivered MBIs may also help to bridge this chasm of accessibility: Chadi et al.[38] demonstrated that electronic delivery of mindfulness meditation was equally as efficacious as in-person delivery for a variety of chronic medical conditions, including epilepsy and rheumatologic conditions.

Interventions

Of the six MBIs delivered one-on-one, four were biofeedback interventions. It was posited that the nature of biofeedback lends itself better to individual delivery rather than to a group setting. In addition, these studies assessed individuals with cystic fibrosis, DES, IBS/FAP, and CP—conditions for which biofeedback therapy may involve sensitive parts of the body, particularly in the latter three, and are thus perhaps ideally delivered individually.

In contrast, the nine MBIs delivered in group settings included modalities such as yoga, Tai Chi, guided imagery, and BAM, and the latter two included didactic components. These modalities likely lend themselves better to group delivery: qualitative comments from participants with concussion who received yoga revealed that youth appreciated knowing that they were not alone in managing their chronic condition and its associated challenges.[25] The multifactorial beneficial effects of group practice may come from the unstructured social element of being together in the waiting room, time immediately before/after session, and so on.

Most studies either required or encouraged a home practice element as part of the MBI. In those where home practice was encouraged (but not required), researchers noted that making this a required element would be advisable. In contrast, Paniccia et al. discouraged home practice

Table 6. Scoring of Modified Newcastle-Ottawa Quality Assessment Scale for Studies of Mind-Body Interventions for Youth with Chronic Medical Conditions

Study	*Representativeness*	*Comparability*	*Outcome*	*Statistical test*	*Total*
Bingham et al. (2010)	1	0	2	1	4
Wright et al. (2011)	1	2	2	2	7
Chadi et al. (2018)	0	0	2	1	3
Evans et al. (2014)	1	2	2	2	7
Evans et al. (2018)	1	2	2	2	7
Gregoski et al. (2011)	1	1	2	2	6
Kajbafzadeh et al. (2011)	1	2	2	1	6
Kapoor et al. (2010)	0	0	2	1	3
Lin et al. (2017)	1	1	2	2	6
McNamara et al. (2016)	1	0	1	2	4
Paniccia et al. (2019)	1	0	2	0	3
Stern et al. (2014)	1	0	1	0	2
Tahan et al. (2014)	1	0	2	1	4
Wang et al. (2013)	1	0	2	1	4
Weigensberg et al. (2014)	1	2	2	2	7

for safety reasons in efforts to ensure that participants with concussions carefully implemented calculated increases in physical activity.[25] This suggests that home practice may be an important feature of MBI design, but only after extra consideration for participants' developmental stages and unique safety issues.

Strengths

This scoping review provides an overview of the findings of an otherwise under-discussed realm of research. There is a paucity of literature exploring MBIs in any single or group of related nonpain, noncancer, and nonpsychiatric predominant medical conditions in pediatric patients. However, despite the lack of depth in any one condition, the broad scope of this review translates to coverage of a great breadth of different conditions and interventions, allowing for a broad understanding of the types of interventions that can be delivered and a snapshot of conditions that might benefit.

Furthermore, the included studies were conducted in a variety of locations worldwide. This heterogeneity and diversity potentiate the generalizability of the findings across populations, geographic locations, and intervention locations. This review also highlights the importance of both condition-specific and biopsychosocial considerations in study design and delivery to optimize feasibility and acceptability among diverse ages and ethnicities.

Limitations

This scoping review included data from a wide variety of chronic medical conditions and means of delivering MBIs. This heterogeneity does not allow for meta-analysis or in-depth analysis of a singular condition or method of intervention. Ultimately, these observations underscore the need for further research in this specific realm; as the body of available data grows, so too would the potential to conduct systematic reviews with meta-analyses for definitive guidance regarding clinical decision-making.

This review is further limited by the overall small participant pool: among 15 articles, there were only 641 participants, and individual studies had very small sample sizes, averaging 43 participants per study. The smallest study was conducted on only 3 individuals, whereas the largest study involved 162 participants. Thus, it was not possible to draw definitive conclusions regarding the impact of specific interventions upon specific conditions; future research in this area will ideally include larger sample sizes.

Another limitation of this review is variable study quality, as detailed in Table 6. In addition to the small sample sizes, many of the reviewed studies were not designed as RCTs and lacked a control group to comparatively analyze therapeutic impact. In addition, some studies explored objective measures of improvement alone, making it difficult to compare results with studies that specifically explored patient-reported symptomatic improvement, or vice versa.

Most studies did not report the results of long-term follow-up, presenting limitations in understanding the impact of treatment on symptomatology, adherence, and other outcomes along the course of age-related transitions and changes. Long-term follow-up with study participants would yield interesting findings as to the lifelong impact of exposure to MBIs, even beyond the specific condition targeted.

Future considerations

In addition to the essential need for more research in this field, future research should consider assessing numerous other domains particularly relevant to childhood chronic medical conditions. One such domain is quality of life, which is commonly impacted by chronic illness, and for which MBIs have previously shown promise[10]; others include psychosocial, social, and economic determinants of health to explore barriers to MBI accessibility in this vulnerable patient population. Determining optimal controls for these studies presents challenges and will demand creativity. Interventions that are, by nature, founded on the assumption that participants be actively engaged and put forth effort, generally get better results with greater effort.

Furthermore, these interventions, when enthusiastically engaged, generally hypothesize added gains over time. Thus, there is additional complexity in generating generalizable outcomes. Within the active group alone, one would expect considerable variation in outcomes based on interest, effort, prior experience, general aptitude, and resonance with a given modality. These factors may be even more pronounced when working with children and teens than in an adult population.

Studies comparing outcomes of yoga versus Tai Chi, for example, would need to account for, first, ''type of yoga'' and ''type of tai chi,'' as well as consider that some participants may enjoy seated yoga and dislike movement-based Tai Chi, and vice versa. It may be that yoga is very powerful for some people, while Tai Chi is the preferred choice for others. This would dictate, then, that yoga may not be an inherently effective or ineffective intervention, but rather be inherently effective for some and inherently ineffective for others. Given this, research looking at for whom yoga is likely to be most valuable would be compelling, rather than only *if* yoga can affect a disease state in an undifferentiated population.

Rather than analyzing data collectively from the group (e.g., mean change in outcome measures for the whole active cohort), it may also be revealing to seek subsets of the active cohort for whom the intervention is particularly powerful, and then work to amplify their engagement and study changes in their specific disease and quality of life measures. Studies of MBIs must consider that the work is being done ''with'' participants rather than ''to'' participants and must recognize subject individuality in a more pronounced manner than may be needed for a study of a surgical procedural technique or drug trial.

Conclusions

MBIs have been successfully and feasibly delivered in the service of many chronic medical conditions in youth across diverse populations and age groups. These interventions, which address the critical need to support coping in children with chronic conditions, show promise in benefiting symptoms and psychosocial outcomes. Tailoring interventions to condition-specific needs and developmental stages of patients, as well as addressing unique socioeconomic

factors faced by each population, contributes to better treatment adherence and satisfaction.

Greater consideration of individual effort, aptitude, and interest by participants is also needed to best determine how to optimize intervention-subject pairing. The high degree of heterogeneity across studies limits collated analysis, at present. However, the existing literature supports the feasibility and acceptability of MBI delivery for several modalities, delivery structures, and health conditions. More high-quality research and potentially innovative research designs are needed to explore the impact of MBIs on non-pain, noncancer, and nonpsychiatric predominant chronic medical conditions in pediatric populations.

Data Availability Statement

Data available within the article or its Supplementary Data.

Authors' Contributions

Study conception and design by D.W.M., J.A.D., M.K.D., and M.M.; background research and data organization by A.W., D.W.M., M.K.D., and R.S.; article procurement and search method director by M.N.; article screening by D.W.M., M.E.C., and M.M.; analysis and interpretation of results and draft article preparation by D.W.M. and R.S.; article review and editing by M.E.C., M.M., J.A.D., and R.S. All authors have accepted responsibility for the entire content of this article and approved its submission.

Author Disclosure Statement

The authors do not have any conflicts of interest to disclose.

Funding Information

This scoping review was generously supported by the Elisabeth Severance Prentiss Foundation. Sources of funding for included research can be found in their original articles as cited.

Supplementary Material

Supplementary Data S1

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(*Appendix follows* →)

Appendix A1.

Search Methods

A search strategy was generated for the concepts of mind–body interventions in pediatric patients with chronic illnesses. Both controlled vocabulary and title and abstract fields were used for the search terminology. Search results were limited to the English language and the years of 2010–2020. Reviews, editorials, and commentary were removed before exporting results to the Covidence database for review.

Database(s): **Ovid MEDLINE** and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily 1946 to September 21, 2020
Search Strategy:

No.	Searches	Results
1	mind-body therapies/ or biofeedback, psychology/ or neurofeedback/ or breathing exercises/ or qigong/ or hypnosis/ or autogenic training/ or suggestion/ or autosuggestion/ or imagery, psychotherapy/ or tai ji/ or yoga/	29,633
2	Meditation/	2881
3	Acupuncture Therapy/	16,853
4	(mind adj2 body).ti,ab,kf.	4760
5	biofeedback.ti,ab,kf.	7007
6	(neurofeedback or neurotherapy).ti,ab,kf.	1648
7	(breathing adj2 exercise*).ti,ab,kf.	1734
8	qigong.ti,ab,kf.	735
9	qi gong.ti,ab,kf.	106
10	hypnosis.ti,ab,kf.	8142
11	autogenic.ti,ab,kf.	1477
12	autosuggestion.ti,ab,kf.	33
13	suggestion therap*.ti,ab,kf.	36
14	Psychotherapy Imagery.ti,ab,kf.	0
15	Guided Imagery.ti,ab,kf.	747
16	tai ji.ti,ab,kf. or tai Chi.ti,ab,kf.	54
17	meditation.ti,ab,kf.	5181
18	acupuncture.ti,ab,kf.	22,600
19	or/1–18	71,108
20	Chronic Disease/	263,643
21	exp Gastrointestinal Diseases/	959,474
22	respiratory tract diseases/ or lung diseases/ or respiration disorders/ or cardiovascular diseases/	243,920
23	autoimmune diseases/ or arthritis, juvenile/ or arthritis, rheumatoid/	158,373
24	exp Asthma/	128,487
25	(chronic adj2 disease*).ti,ab,kf.	200,791
26	(chronic adj2 illness*).ti,ab,kf.	19,829
27	(chronic adj2 condition*).ti,ab,kf.	35,008
28	(gastrointestinal adj2 disease*).ti,ab,kf.	12,898
29	(respiratory adj2 disease*).ti,ab,kf.	38,371
30	(lung adj2 disease*).ti,ab,kf.	62,582
31	(respiration adj2 disorder*).ti,ab,kf.	225
32	(cardiovascular adj2 disease*).ti,ab,kf.	185,224
33	autoimmune.ti,ab,kf.	154,099
34	arthritis.ti,ab,kf.	182,795
35	or/20–34	2,220,875
36	Pediatrics/	54,054
37	exp Child/	1,917,094
38	Adolescent/	2,036,114
39	pediatric*.ti,ab,kf.	307,875
40	child*.ti,ab,kf.	1,443,085
41	adolescent*.ti,ab,kf.	262,536
42	teen*.ti,ab,kf.	31,043
43	juvenile*.ti,ab,kw.	83,221
44	or/36–43	3,623,971
45	19 and 35 and 44	1351

(*Appendix continues* →)

46 limit 45 to (English language and last 10 years) 386
47 limit 46 to (case reports or editorial or letter or ''review'') 105
48 46 not 47 281

EBSCO CINAHL
No. Query Limiters/Expanders Results
S58 S57 NOT S56 Limiters - Published Date: 20100101-20201231; English Language
Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 376
S57 S29 AND S49 AND S55 Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 761
S56 S29 AND S49 AND S55 Limiters - Publication Type: Book, Case Study, Commentary, Doctoral Dissertation, Editorial, Letter, Masters Thesis, Review
Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 175
S55 S50 OR S51 OR S52 OR S53 OR S54 Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 1,050,749
S54 TI child* OR AB child* OR TI adolescent* OR AB adolescent* OR TI teen* OR AB teen* OR TI juvenile* OR AB juvenile* Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 578,219
S53 (MH ''Adolescence'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 524,990
S52 (MH ''Child'') OR (MH ''Child, Preschool'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 518,445
S51 TI pediatric* OR AB pediatric* Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 112,548
S50 (MH ''Pediatrics'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 19,710
S49 S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48 Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 1,205,798
S48 TI arthritis OR AB arthritis Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 42,336
S47 TI autoimmune OR AB autoimmune Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 17,742
S46 TI cardiovascular N2 disease* OR AB cardiovascular N2 disease* Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 52,430
S45 TI respiration N2 disorder* OR AB respiration N2 disorder* Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 21
S44 TI lung N2 disease* OR AB lung N2 disease* Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 12,892
S43 TI respiratory N2 disease* OR AB respiratory N2 disease* Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 6840
S42 TI gastrointestinal N2 disease* OR AB gastrointestinal N2 disease* Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 2072
S41 TI chronic N1 condition* OR AB chronic N1 condition* Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 16,679
S40 TI chronic N1 illness* OR AB chronic N1 illness* Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 11,593
S39 TI chronic N2 disease* OR AB chronic N2 disease* Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 72,683
S38 (MH ''Asthma+'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 35,060
S37 (MH ''Arthritis, Juvenile Rheumatoid'') OR (MH ''Arthritis, Rheumatoid+'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 30,622
S36 (MH ''Autoimmune Diseases+'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 103,157
S35 (MH ''Cardiovascular Diseases+'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 587,602

(*Appendix continues* →)

S34 (MH ''Respiration Disorders+'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 61,713
S33 (MH ''Lung Diseases+'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 185,031
S32 (MH ''Respiratory Tract Diseases+'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 296,020
S31 (MH ''Gastrointestinal Diseases+'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 157,697
S30 (MH ''Chronic Disease'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 63,879
S29 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 53,354
S28 TI acupuncture OR AB acupuncture Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 13,379
S27 TI meditation OR AB meditation Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 3787
S26 TI Tai Chi OR AB Tai Chi Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 1686
S25 TI tai ji OR AB tai ji Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 32
S24 TI Guided Imagery OR AB Guided Imagery Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 697
S23 TI Psychotherapy Imagery OR AB Psychotherapy Imagery Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 0
S22 TI suggestion therap* OR AB suggestion therap* Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 7
S21 TI autosuggestion OR AB autosuggestion Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 7
S20 TI autogenic OR AB autogenic Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 229
S19 TI hypnosis OR AB hypnosis Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 2045
S18 TI qi gong OR AB qi gong Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 94
S17 TI qigong OR AB qigong Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 631
S16 TI breathing N2 exercise* OR AB breathing N2 exercise* Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 835
S15 TI biofeedback OR AB biofeedback Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 2483
S14 TI mind N1 body OR AB mind N1 body Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 4121
S13 (MH ''Acupuncture+'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 17,105
S12 (MH ''Meditation'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 5265
S11 (MH ''Yoga+'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 9441
S10 (MH ''Tai Chi'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 2127
S9 (MH ''Guided Imagery'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 2845
S8 (MH ''Posthypnotic Suggestion'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 11
S7 (MH ''Autogenic Training (Iowa NIC)'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 1
S6 (MH ''Hypnosis+'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 3048

(*Appendix continues* →)

S5 (MH ''Qigong'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 687
S4 (MH ''Breathing Exercises+'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 2434
S3 TI neurofeedback OR AB neurofeedback OR TI Neurotherapy OR AB Neurotherapy Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 582
S2 (MH ''Biofeedback'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 3690
S1 (MH ''Mind Body Techniques'') Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase 3279

Database(s): **Ovid APA PsycInfo** 1806 to September Week 2, 2020
Search Strategy:

No.	Searches	Results
1	''mind body therap*''.tw.	177
2	exp Biofeedback Training/ or exp Biofeedback/	6293
3	exp Neurotherapy/	1566
4	(breathing adj2 exercise*).tw.	409
5	qigong.tw.	280
6	exp Hypnosis/	9202
7	exp Autogenic Training/	630
8	exp Posthypnotic Suggestions/	284
9	autosuggestion.tw.	203
10	exp Guided Imagery/	746
11	(tai ji or tai chi).tw.	609
12	yoga/	1870
13	exp Meditation/	4693
14	exp Acupuncture/	1489
15	biofeedback.tw.	5722
16	(neurofeedback or neurotherapy).tw.	1746
17	(breathing adj2 exercise*).tw.	409
18	qigong.tw.	280
19	qi gong.tw.	55
20	hypnosis.tw.	14,403
21	autogenic.tw.	1022
22	autosuggestion.tw.	203
23	suggestion therap*.tw.	50
24	Psychotherapy Imagery.tw.	5
25	Guided Imagery.tw.	1291
26	meditation.tw.	8225
27	acupuncture.tw.	2003
28	or/1–27	38,838
29	exp Chronic Illness/	29,503
30	exp Gastrointestinal Disorders/	8518
31	exp Respiratory Tract Disorders/	14,875
32	exp Lung Disorders/	4453
33	respiration disorder*.tw.	8
34	exp Cardiovascular Disorders/	62,560
35	exp Immunologic Disorders/	47,639
36	autoimmune disease*.tw.	1669
37	exp Rheumatoid Arthritis/ or exp Arthritis/	4233
38	exp Asthma/	4743
39	(chronic adj2 disease*).tw.	15,522
40	(chronic adj2 illness*).tw.	13,182
41	(chronic adj2 condition*).tw.	10,370
42	(gastrointestinal adj2 disease*).tw.	308
43	(respiratory adj2 disease*).tw.	1094
44	(lung adj2 disease*).tw.	1029
45	(respiration adj2 disorder*).tw.	19

(*Appendix continues* →)

46 (cardiovascular adj2 disease*).tw. 11,889
47 autoimmune.tw. 5975
48 arthritis.tw. 5471
49 or/29–48 195,567
50 28 and 49 2605
51 limit 50 to (all journals and English language and last 10 years) 676
52 limit 51 to (100 childhood or 160 preschool age or 180 school age or 200 adolescence) 41
53 exp Pediatrics/ 29,613
54 pediatric*.tw. 37,016
55 adolescent*.tw. 228,547
56 teen*.tw. 23,153
57 juvenile*.tw. 27,677
58 child*.tw. 718,847
59 or/53–58 887,383
60 28 and 49 and 59 268
61 limit 60 to (all journals and English language and last 10 years) 55

Elsevier Scopus
(TITLE-ABS-KEY (chronic W/2 disease*) OR TITLE-ABS-KEY (gastrointestinal W/2 disease*) OR TITLE-ABS-KEY (respirat* W/2 disease*) OR TITLE-ABS-KEY (lung W/1 disease*) OR TITLE-ABS-KEY (cardiovascular W/1 disease*) OR TITLE-ABS-KEY (autoimmune) OR TITLE-ABS-KEY (arthritis) OR TITLE-ABS-KEY (chronic W/2 illness*)) AND (TITLE-ABS-KEY (mind W/2 body) OR TITLE-ABS-KEY (biofeedback) OR TITLE-ABS-KEY (neurofeedback) OR TITLE-ABS-KEY (breathing W/2 exercise*) OR TITLE-ABS-KEY (qigong) OR TITLE-ABS-KEY (tai AND w/1 chi) OR TITLE-ABS-KEY (tai W/1 chi) OR TITLE-ABS-KEY (hypnosis) OR TITLE-ABS-KEY (autogenic) OR TITLE-ABS-KEY (suggestion) OR TITLE-ABS-KEY (autosuggestion) OR TITLE-ABS-KEY (neurotherap*) OR TITLE-ABS-KEY (psychotherapy W/1 imagery) OR TITLE-ABS-KEY (guided W/1 imagery) OR TITLE-ABS-KEY (meditation) OR TITLE-ABS-KEY (acupuncture)) AND (TITLE-ABS-KEY (pediatric*) OR TITLE-ABS-KEY (child*) OR TITLE-ABS-KEY (adolescent*) OR TITLE-ABS-KEY (teen*) OR TITLE-ABS-KEY (juvenile*)) PUBYEAR >2009 AND (EXCLUDE (DOCTYPE, ''re'') OR EXCLUDE (DOCTYPE, ''cp'') OR EXCLUDE (DOCTYPE, ''ch'') OR EXCLUDE (DOCTYPE, ''le'') OR EXCLUDE (DOCTYPE, ''sh'') OR EXCLUDE (DOCTYPE, ''ed'') OR EXCLUDE (DOCTYPE, ''no'') OR EXCLUDE (DOCTYPE, ''bk'') OR EXCLUDE (DOCTYPE, ''cr'')) AND (LIMIT-TO (LANGUAGE, ''English'')) PUBYEAR AFT 2009 Results 561