



Does cross-cultural communication training for physicians improve pediatric asthma outcomes? A randomized trial

Minal R. Patel, Peter X. K. Song, Jean-Marie Bruzzese, Wei Hao, David Evans, Lara J. Thomas, Marcia Pinkett-Heller, Karen Meyerson & Randall W. Brown

To cite this article: Minal R. Patel, Peter X. K. Song, Jean-Marie Bruzzese, Wei Hao, David Evans, Lara J. Thomas, Marcia Pinkett-Heller, Karen Meyerson & Randall W. Brown (2018): Does cross-cultural communication training for physicians improve pediatric asthma outcomes? A randomized trial, *Journal of Asthma*, DOI: [10.1080/02770903.2018.1455856](https://doi.org/10.1080/02770903.2018.1455856)

To link to this article: <https://doi.org/10.1080/02770903.2018.1455856>



Published online: 11 Apr 2018.



Submit your article to this journal [↗](#)



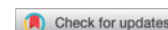
Article views: 34



View related articles [↗](#)



View Crossmark data [↗](#)



Does cross-cultural communication training for physicians improve pediatric asthma outcomes? A randomized trial

Minal R. Patel, PhD, MPH^a, Peter X. K. Song, PhD^b, Jean-Marie Bruzzese, PhD^c, Wei Hao, MA^b, David Evans, PhD^d, Lara J. Thomas, MPH^a, Marcia Pinkett-Heller, MPH^e, Karen Meyerson, NP-C, AE-C^f, and Randall W. Brown, MD, MPH^a

^aDepartment of Health Behavior and Health Education, University of Michigan School of Public Health Ann Arbor, MI, USA; ^bDepartment of Biostatistics, University of Michigan School of Public Health, Ann Arbor, MI, USA; ^cSchool of Nursing, Columbia University, New York, NY, USA; ^dPediatric Pulmonary Division, Columbia University, New York, NY, USA; ^eHealth Science Department, New Jersey City University, Jersey City, NJ, USA; ^fPriority Health, East Beltline Ave. NE, Grand Rapids, MI, USA

ABSTRACT

Objective: Adverse cross-cultural interactions are a persistent problem within medicine impacting minority patients' use of services and health outcomes. To test whether 1) enhancing the evidence-based Physician Asthma Care Education (PACE), a continuing medical education program, with cross cultural communication training (PACE Plus) would improve the asthma outcomes of African American and Latino/Hispanic children; and 2) whether PACE is effective in diverse groups of children.

Methods: A three-arm randomized control trial was used to compare PACE Plus, PACE, and usual care. Participants were primary care physicians ($n = 112$) and their African American or Latino/Hispanic pediatric patients with persistent asthma ($n = 867$). The primary outcome of interest included changes in emergency department visits for asthma overtime, measured at baseline, and 9 and 21 months following the intervention. Other outcomes included hospitalizations, asthma symptom experience, caregiver asthma-related quality of life, and patient-provider communication measures.

Results: Over the long term, PACE Plus physicians reported significant improvements in confidence and use of patient-centered communication and counseling techniques ($p < 0.01$) compared to PACE physicians. No other significant benefit in primary and secondary outcomes was observed in this trial.

Conclusion: PACE Plus did not show significant benefit in asthma-specific clinical outcomes. More trials and multi-component strategies continue to be needed to address complex risk factors and reduce disparities in asthma care.

Trial registration: ClinicalTrials.gov: NCT01251523 December 1, 2010.

ARTICLE HISTORY

Received 5 December 2017
Revised 10 March 2018
Accepted 19 March 2018

KEYWORDS

Pediatrics; education; control/management; treatment; guidelines

Introduction

Many factors from both patient and clinician perspectives impact the quality of communication in clinical encounters (1). A large body of evidence documents poor health outcomes and health disparities that manifest from differential interactions, treatment, and care in healthcare settings (2). To address this, healthcare institutions are augmenting their quality improvement and performance expectations of providers and healthcare delivery to account for social and cultural diversity. Significant time and resources are expended every year on cultural competence training for practicing physicians and trainees in US medical schools. However, there is limited, high-quality research documenting that cultural competency training for providers results in improved patient outcomes (3,4). Further, negative provider interactions as perceived by patients of color, implicit bias in care delivery, and

disparities in health outcomes all continue to persist (5–8). There is a significant need for optimal approaches for clinicians to better connect with diverse patients and families, given that our society is increasingly multi-cultural.

Effective interpersonal communication between clinicians and patients offers what cannot easily be communicated in medical records, including social context, values, preferences, and issues specific to complex disease management. High-quality communication has also demonstrated improvements in patient outcomes including health indicators from a wide range of chronic conditions, patient satisfaction, and psychosocial functioning (9).

There has been wide variation in the goals of cultural competency training initiatives (4). More recently, cultural competency training initiatives have become more skills-based, focusing more on advanced communication, negotiation, and collaboration, with the

intent of modifying provider behavior and maximizing patient engagement. Further, recent approaches have also focused on training providers to be aware of certain cross-cutting cultural and social issues and health beliefs present in all cultures (10). Ultimately, when cultural and linguistic barriers negatively impact communication and trust between provider and patient, this leads to patient dissatisfaction, poor adherence and adoption of health promoting behaviors (10).

We developed the Physician Asthma Care Education Program (PACE) Plus, a theory-driven, behavior change program based off the proven PACE program (11–13) that enhances communication, therapeutic practice, and the ability of physicians to foster effective management of asthma by their patients, without expanding visit time. PACE Plus is enhanced with skills and concepts considered essential to culturally competent practice. Prior evaluations of PACE enrolled too few racial/ethnic minority patients and caregivers to draw conclusions on the effectiveness of provider training for these groups (13). This article describes the results of a randomized clinical trial comparing two interventions: PACE Plus and PACE. This study focused on African American and Latino/Hispanic children with asthma, populations that continue to have remarkably high urgent care use and death rates attributable to asthma (7,8,14), to answer two questions. First, does cross-cultural communication training (PACE Plus) produce outcomes above and beyond a proven general communication training program (PACE)? Second, does PACE alone, already shown effective in a general population (11–13), remain effective compared with usual care when used primarily with African American and Latino/Hispanic children with asthma? This article describes results over a nine and 21-month follow-up period on our primary outcome of interest: children's emergency department (ED) visits for asthma, as well as other asthma outcomes and perception of physician communication and counseling. We hypothesized that Latino/Hispanic and African American patients whose providers are trained in PACE will demonstrate improved outcomes compared to standard of care. Further, we hypothesize that patients whose providers trained in PACE Plus will demonstrate improved outcomes compared to PACE, and the most improved outcomes between both interventions.

Methods

Study design and sample

A three group randomized controlled trial was employed with primary care physicians (PCP) who were racially different from their African American and Latino/Hispanic

pediatric patients with asthma in nine Michigan (MI) rural and urban cities, Bronx, New York (NY), and in Atlanta, Georgia (GA). All study procedures were reviewed and approved by the University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board (IRB-HSBS HUM#00030087). A study protocol of this study is available elsewhere and describes inclusion criteria, recruitment, and enrollment consent procedures (15).

Recruitment

PCPs eligibility criteria were: 1) being board certified in pediatrics or family medicine; 2) treating children with asthma; 3) practicing full-time in either MI, NY, GA; 4) not self-reporting Hispanic/Latino or African American racial identity; and 5) willing to generate a roster of pediatric asthma patients. Interested physicians completed consent online prior to baseline.

Enrolled physicians provided the study team with rosters of their pediatric asthma patients. Inclusion criteria for children included: 1) currently being treated by the participating physician; 2) 1–16 years in age; 3) had a physician diagnosis of persistent asthma; 4) did not have other chronic disorders that cause pulmonary complications; and 5) were identified by caregivers as African American or Hispanic/Latino. Caregivers also needed to meet the following criteria: 1) had primary responsibility for the child's care, 2) self-identify as African American or Hispanic/Latino, and 3) had access to a telephone. Potentially eligible children/caregivers were mailed a recruitment packet by the research staff, followed by a phone call, and completed consent prior to their baseline interview. Interviews were conducted in either English or Spanish.

Randomization

Following consent, PCPs were randomly assigned to either the control group, the original PACE intervention, or the PACE Plus intervention. The control group consisted of usual care, defined as treatment and education within healthcare settings at the time of clinic visits by PCPs who did not receive either PACE Plus or PACE. A permuted block randomization schedule was created to generate blocks of three for random assignment of physicians. Randomization was balanced according to two factors: geographic area (three levels) and size of practice (two levels, solo practice and multiple-physician practices). One physician was enrolled per practice. Children/caregivers subsequently followed their PCPs into one of the three study arms as randomized.

Over the three-year recruitment period (2011–2014), a total of 160 PCPs were identified, sent recruitment

materials, and assessed for eligibility. Of those, 112 were successfully contacted, consented to participate, and provided baseline data. PCPs were excluded due to not meeting inclusion criteria ($n = 29$), declining to participate ($n = 8$), not completing baseline ($n = 3$), and being unreachable ($n = 8$). To enhance recruitment and retention of participants, a number of strategies were employed including utilizing a physician peer for contact, providing modest monetary incentives, and utilizing assistance of clinic staff. Of the PCPs' patients who were approached ($n = 3372$), 847 did not meet inclusion criteria, 394 declined to participate, and 1067 were unreachable. Ultimately, 1064 eligible families of children with asthma consented and followed their physicians into randomization. Of those, 869 provided baseline data.

Intervention conditions

We examined two interventions: PACE, and a culturally enhanced version of PACE: PACE Plus. Two teams consisting of a pediatric pulmonologist and behavioral scientist delivered the interventions, with one team assigned to each arm. Details of the intervention are described in the study protocol article (15).

PACE consists of two, 2-hour sessions offered to groups of 4–6 PCPs 2 weeks apart in an interactive group format. PACE is delivered via mini-lectures, case studies, videos, and interactive discussion, covering clinical management of asthma, patient education and communication practices, and billing and coding for asthma management (15).

PACE Plus is the same length and intensity as PACE, but integrates cross-cultural communication training within intervention activities, with a specific focus on working with African American and Latino/Hispanic families. Topics include patient perceptions, beliefs, fears, and preferences. Discussion was facilitated by video clips that depicted good and poor examples of clinical interactions. Case studies included cultural elements to consider in the diagnosis and management of asthma. Initial preliminary data on PACE Plus showed perceived usefulness and relevance of the training from physician participants (Unpublished data).

Outcome assessments

Self-reported data were collected using the measures below. We surveyed physician participants and caregivers of children with asthma by telephone interview at baseline (prior to randomization), at 9 and 21 months after physicians completed their intervention. Follow-up data collection was changed from 12 and 24 months to 9 and 21 months at the suggestion of the funder due to delays in commencing the evaluation portion of the trial. Participating physicians and caregivers of children with

asthma received modest monetary compensation for completing baseline and follow-up assessments.

Children's healthcare use for asthma

The primary outcome was changes in patients' asthma-related healthcare utilization (ED visits). This was measured through a series of caregiver-reported items verified with participants' medical records. Change was examined by reports at 9 and 12 months compared with baseline assessments.

Symptoms and asthma control

Caregivers were asked how many days per week their child experienced daytime symptoms. Self-reported responses were classified based on National Asthma Education and Prevention Program (NAEPP) guidelines (16). Asthma control was measured using the 5-item, validated Asthma Control Test (ACT) for children 12 years of age and older (17), and the children's 7-item ACT, for children 1–11 years of age, with responses measured on Likert Scales (17). Higher ACT scores indicated better asthma control. Responses ranged from 5 (poor control of asthma) to 25 (complete control of asthma).

Caregiver satisfaction with care

Caregiver satisfaction with the PCP's care was measured by asking participants on a 4-point Likert scale the degree to which they agree with the following statement: "I am very satisfied with the medical care my child receives from their doctor for their asthma" (strongly disagree to strongly agree). Higher scores indicated greater satisfaction.

Caregiver asthma-related quality of life

The validated, 13-item Pediatric Asthma Caregiver's Quality of Life scale assessed limitations and fears caregivers experienced as a result of their child's asthma (18). Higher scores indicated a better quality of life.

Physician self-efficacy and use of communication and counseling practices

Physician self-efficacy in communication practices with patients and asthma counseling behavior were measured by asking physicians to rate their confidence in his or her ability to perform specific communication and counseling behaviors on a 6-point scale (1, not at all confident; 6, extremely confident). Items were summed to create a score, with higher scores indicating higher levels of self-efficacy. This approach has been used in previous work (19). Scores ranged from 5 to 30 for communication and 8 to 48 for asthma counseling practices.

Physicians were also asked to rate their clinical skills working across cultures using 13 items (e.g. negotiating

culturally sensitive treatment plans, eliciting information about folk remedies) (1 – not at all skilled; 5 – very skilled), and their cultural communication practices using 11 items (e.g. asking about beliefs in non-traditional cures, who in the family should be involved in treatment decisions) (1, never; 5, always) (20). Items were summed to create a score, with higher scores indicating higher perception of clinical skill in working across cultures (score range: 13–65) and higher perceived use of culturally sensitive communication practices (score range: 11–55).

Caregiver perception of physician communication and counseling practices

To assess changes in physician communication and counseling behavior, parents were asked to rate their physician's performance of 6 PACE communication skills (e.g. finding out biggest concern, providing information to alleviate worries) (1, strongly disagree; 4, strongly agree), 17 asthma-specific counseling behaviors (e.g. providing written instructions, discussing the treatment plan) (1, strongly disagree; 4, strongly agree (6 items); 1, yes, 0, no (11 items)), and 11 culturally sensitive communication practices (e.g. include beliefs about asthma in treatment plan, discuss home remedies) (1, strongly disagree; 4, strongly agree). Items were summed to create a score, with higher scores indicating higher levels of general communication (score range: 6–24), cross-cultural communication (score range: 11–44), and counseling behaviors of physicians perceived by caregivers (score range: 0–17).

Demographic, clinical, and practice data were also collected from both physicians and patients and caregivers, including physician recall of the average time spent for urgent, non-urgent, and well child visits.

Data analysis

At completion of data collection, a sample size of 472 children and their caregivers (corresponding to a 59% retention rate), who completed all data collection sessions, was available for analysis at 21 months post-baseline. The high attrition rate was due to time constraints that resulted from delays in launching the study and lack of resource at the end of the study to adequately follow-up with participants. Our available data at follow-up provided us with 80% power to detect a 15.6% clinically significant improvement in ED visits from baseline.

All analyses were conducted using SAS 9.4 (Cary, NC). Descriptive and bivariate analyses were conducted to examine the baseline sample of both physicians and patients and caregivers by randomization status. Mixed effect models compared the intervention effects for patients (PACE Plus versus PACE, PACE versus Control) on longitudinal outcomes at baseline and follow-up visits at both 9 months and 21 months post-intervention.

Since the intervention is at the level of the physician, and patients were randomized to receive the treatments from the physician, the adjusted mixed effect model with random intercept was utilized to account for the clustering effect of the physician. To directly test the study hypothesis concerning the improvement of PACE Plus over PACE in our analysis, the alternative hypothesis was formed as one-tailed: the effect of PACE Plus is above and beyond that of PACE. A one-tailed test was used because we concluded that PACE Plus could not be worse than PACE by design. When the test statistic is positive due to the positive parameter estimate for the difference between PACE Plus and PACE, the one-sided significance level is 0.05 or less. To test the hypothesis that PACE is greater than the control group, a two-tailed test was used.

Similar adjusted models were computed for assessing differences in visit time (two-sided significance level), and physician confidence and use of communication and asthma counseling practices (summary score of items), and patient perception of physicians' communication and asthma counseling practices (summary score of items).

Results

Sample characteristics

Table 1 describes the patient/caregiver sample ($n = 867$ families). Mean age of children was 8.2 (SD = 4.0) years, 61.1% were male, 70.5% were African American, and 23.5% were Latino/Hispanic. Forty-three percent of children had moderate-severe asthma, and their mean ACT score was 18.6 (SD = 4.8). Significant differences at baseline between treatment and control group participants were only evident for time under the physicians care, with the control group reporting longer duration of time under the physician's care (mean 76.9 months (control) vs. 60.7 months (PACE) and 68.8 months (PACE Plus), $p < 0.01$).

No differences between those who completed the study and those lost to follow-up were observed in terms of child sex, race/ethnicity of child, asthma severity, having an asthma subspecialist involved in the child's care, baseline hospitalizations and urgent office visits, type of health insurance, baseline asthma control, baseline asthma-related caregiver quality of life, or satisfaction with care. Children lost to follow-up were more likely to be younger (7.8 vs. 8.5 years, $p < 0.05$), under the physician's care for a shorter period of time (63 vs. 71.8 months, $p < 0.01$), or have more annual ED visits for asthma (mean 1.7 vs. 1.1, $p < 0.01$). African American caregivers were also less likely to drop out compared to Latino/Hispanic or White caregivers ($p < 0.05$).

Table 1. Baseline characteristics of patients by treatment group.

Factor	Control (n = 172) % (n)	PACE (n = 282) % (n)	PACE Plus (n = 413) % (n)	P-value*
Child sex (% male)	64.5 (111)	59.2 (167)	61.0 (252)	0.53
Age of child (mean, SD)	8.6 (4.0)	8.0 (4.0)	8.2 (4.0)	0.16
Race/ethnicity of child				
African American	66.9 (115)	68.0 (189)	73.7 (303)	0.14
Latino/Hispanic	21.5 (37)	25.2 (71)	23.2 (96)	0.66
Race/ethnicity of caregiver				
Latino/Hispanic	20.9 (36)	24.8 (70)	23.5 (97)	0.64
African American	68.6 (118)	70.5 (196)	72.9 (298)	0.16
White	6.4 (11)	5.0 (14)	5.4 (22)	
Asian	3.5 (6)	2.9 (8)	2.7 (11)	
American Indian	0.58 (1)	0.36 (1)	0.98 (4)	
More than one race/ethnicity	14.5 (25)	9.0 (25)	5.4 (22)	
Asthma severity				
Intermittent	32.9 (56)	27.0 (76)	33.9 (140)	0.27
Mild	24.1 (41)	28.4 (80)	24.7 (102)	
Moderate	20.6 (35)	27.3 (77)	23.0 (95)	
Severe	22.4 (38)	17.4 (49)	18.4 (76)	
Asthma subspecialist involved in care	29.1 (50)	30.5 (86)	30.4 (125)	0.94
Time under physician care (mons)	76.9 (48.5)	60.7 (44.4)	68.8 (51.6)	0.0025
Asthma-related healthcare utilization (mean, SD)				
Hospitalizations	0.1 (0.3)	0.1 (0.4)	0.1 (0.5)	0.69
Emergency department visits	1.3 (2.4)	1.4 (2.8)	1.3 (2.0)	0.78
Urgent office visits	2.1 (3.9)	1.7 (4.0)	1.8 (2.8)	0.54
Caregiver Relationship to child				
Mother	86.1 (148)	89.0 (251)	90.6 (374)	0.16
Father	7.0 (12)	8.2 (23)	5.8 (24)	
Other	7.0 (12)	2.8 (8)	3.6 (15)	
Insurance type				0.25
Private	28.7 (48)	30.2 (82)	30.9 (124)	
Medicaid	46.1 (77)	50.4 (137)	49.0 (197)	
Government	16.8 (28)	11.0 (30)	10.7 (43)	
Self-pay	0.0 (0)	0.0 (2)	0.5 (2)	
Other	5.4 (9)	8.1 (22)	7.0 (28)	
No insurance	3.0 (5)	0.4 (1)	2.0 (8)	
Asthma control (mean (SD))	18.6 (4.8)	18.5 (4.9)	18.7 (4.7)	0.81
Asthma-related QOL	5.8 (1.1)	5.6 (1.1)	5.7 (1.2)	0.53
Caregiver satisfaction with care (% agree)	91.8 (156)	93.5 (259)	90.4 (368)	0.36

Note: Definition of abbreviations: NAEPP = National Asthma Education and Prevention Program, QOL = quality of life.

* = P-values are two-sided.

Table 2 describes physician and practice characteristics. Forty-three percent of physicians were male, and, 80.9% self-identified as White. On average, their mean years since medical school graduation were 22.3 (SD = 11.5) years, and the mean number of asthma patients seen in their practice was 552 (SD = 1182). Significant differences at baseline between the combined treatment groups and the control group participants were only evident for type of practice setting ($p < 0.04$), with control group participants more heavily concentrated in solo or small group practice, and intervention participants concentrated in larger group practice.

Symptom and asthma healthcare utilization, quality of life and satisfaction at short (9 months) and long-term follow-up (21 months) between treatment and control groups

Table 3 shows changes in asthma outcomes (see Table E3 in the online data supplement for mean changes).

Compared to patients whose physicians completed the PACE program, patients whose physicians completed PACE Plus showed significant reductions in asthma-related hospitalizations (Estimate -0.09 , 95% CI: -0.18 to -0.0003 ; $p < 0.05$) over the short-term. No differences were observed for hospitalizations over the long-term, or other health outcomes of interest at either follow-up period including asthma symptoms and control, urgent office visits and ED visits, or caregiver asthma-related quality of life. Also, no differences in caregiver satisfaction were observed.

Compared to patients whose physicians were in the control condition, patients whose physicians completed PACE did not show significant differences in asthma health outcomes of interest at either follow-up period including asthma symptoms and control, urgent office visits, hospitalizations, and ED visits, or caretaker asthma-related quality of life. No differences in caregiver satisfaction were observed.

Table 2. Physician and practice characteristics at baseline by treatment group.

Factor	Control (n = 32) % (n)	PACE (n = 44) % (n)	PACE Plus (n = 36) % (n)	P-value
Male	61.3 (19)	34.9 (15)	38.9 (14)	0.06
Years since medical school graduation (mean (SD))	24.4 (10.2)	20.5 (11.0)	22.6 (13.0)	0.35
Race				0.26
White	83.9 (26)	86.1 (37)	72.2 (26)	
Other	16.1 (5)	14.0 (6)	27.8 (10)	
Private practice	71.0 (22)	50.0 (22)	55.6 (20)	0.19
Practice setting				0.04*
Solo physician	19.4 (6)	2.3 (1)	5.6 (2)	
Small group (2–5 physicians)	41.9 (13)	36.4 (16)	22.2 (8)	
Large group (>6 physicians)	35.5 (11)	43.2 (19)	58.3 (21)	
Hospital or government clinic	0 (0.0)	4.6 (2)	0.0 (0)	
Other	3.2 (1)	13.6 (6)	13.9 (5)	
# of asthma patients in practice (mean (SD))	643 (1864.8)	422.6 (660.7)	627.8 (865.8)	0.68

Note: *P < 0.05; P-values are two-sided.

Caregivers' perception of physicians' communication and counseling practices short- and long-term follow-up between treatment and control groups

Table 4 shows changes in caregivers' perception of physicians' communication and counseling practices (see Table E4 in the online data supplement for mean changes). No differences in caregiver perception of physicians' communication and counseling behaviors were observed between PACE Plus vs. PACE. Compared to patients whose physicians were in the control condition, patients whose physicians completed PACE reported significant improvement over the long-term in their

physicians' patient-centered communication practices (Estimate −0.92, 95% CI: −1.85–0.002; p < 0.05).

Physician's perception of communication and counseling practices at short- and long-term follow-up between treatment and control groups

Table 5 shows changes in physician's perception of communication and counseling practices (see Table E5 in the online data supplement for mean changes). Compared to physicians who completed the PACE program, physicians who completed PACE Plus reported significant

Table 3. Intervention effects on patient asthma-related outcomes and satisfaction.

Outcome	PACE vs. PACE Plus		PACE vs. Control	
	Estimate (95% CI)	P value*	Estimate (95% CI)	P value**
Short-term outcomes (9 months post-intervention)				
Urgent office visits	−0.20 (−0.60, 0.20)	0.16 [†]	−0.004 (−0.71, 0.71)	0.99 [†]
ED visits	−0.64 (−1.94, 0.67)	0.17	1.02 (−0.53, 2.56)	0.20
Hospitalizations	−0.09 (−0.18, −0.0003)	0.02***	0.01 (−0.06, 0.09)	0.73
No. days affected by daytime asthma symptoms [§]	0.11 (−0.04, 0.27)	0.92	0.05 (−0.13, 0.24)	0.58
Asthma control	−0.74 (−1.52, 0.04)	0.97	0.80 (−0.20, 1.79)	0.11
Satisfaction with care	−0.01 (−0.15, 0.12)	0.58	−0.05 (−0.22, 0.12)	0.60
Asthma-related QOL	−0.03 (−0.18, 0.13)	0.64 [†]	0.16 (−0.06, 0.38)	0.15
Long term outcomes (21 months post-intervention)				
Urgent office visits	0.31 (−0.14, 0.77)	0.91 [†]	−0.83 (−1.60, −0.06)	0.04 ^{†***}
ED visits	−0.66 (−1.98, 0.67)	0.17	0.80 (−0.78, 2.37)	0.32
Hospitalizations	−0.05 (−0.14, 0.04)	0.16	0.01 (−0.07, 0.08)	0.89
No. days affected by daytime asthma symptoms [§]	0.08 (−0.09, 0.26)	0.83	−0.04 (−0.25, 0.16)	0.68
Asthma control	−0.59 (−1.45, 0.28)	0.91	0.45 (−0.62, 1.51)	0.41
Satisfaction with care	0.02 (−0.13, 0.17)	0.40	−0.09 (−0.27, 0.09)	0.33
Asthma-related QOL	−0.12 (−0.30, 0.05)	0.92 [†]	0.17 (−0.07, 0.41)	0.16

Note: Definition of abbreviations: ED = emergency department; CI = confidence interval; QOL = quality of life.

[§]Two or less days per week = 1; three or more days per week but not daily = 2; daily = 3; throughout the day = 4.

*P-value generated through a one-sided test.

**P-value generated through a two-sided test.

***P < 0.05

Models adjusted for fixed effects of baseline outcome, age, gender, insurance type, baseline asthma severity, household smoking, site, practice setting, and random effect of physician in the mixed effect models. P-values for the differential effect between PACE and PACE Plus, and PACE and control are obtained from two separate models.

[†]P-values are unstable due to sparse data and should be interpreted with caution.

Table E3. Changes in symptom and asthma health care utilization, quality of life and satisfaction measured at baseline, 9 months, and 21 months.

Short-term outcomes (9 months post-intervention)					
Outcome	Baseline mean (SD)	Follow-up 1 visit mean (SD)	Changes in outcomes between follow-up 1 and baseline (mean (SD))		
			Control	PACE	PACE Plus
Urgent office visits	1.72 (3.64)	1.08 (3.28)	− 0.50 (3.23)	− 0.61 (2.55)	− 0.70 (1.99)
ED visits	1.24 (2.29)	0.79 (2.86)	− 0.56 (2.07)	− 0.23 (3.29)	− 0.51 (1.97)
Hospitalizations	0.15 (0.45)	0.04 (0.23)	− 0.03 (0.29)	− 0.08 (0.46)	− 0.10 (0.48)
No. days affected by daytime asthma symptoms*	1.49 (0.83)	1.42 (0.82)	− 0.19 (0.97)	− 0.08 (0.96)	0.00 (1.05)
Asthma control	18.77 (5.00)	19.95 (4.65)	0.69 (4.35)	1.58 (4.47)	1.10 (4.69)
Satisfaction with care	3.41 (0.67)	3.46 (0.65)	0.06 (0.65)	0.01 (0.67)	0.06 (0.60)
Asthma-related QOL	5.71 (1.17)	6.09 (1.05)	0.22 (0.92)	0.42 (1.03)	0.40 (1.02)
Long-term outcomes (21 months post-intervention)					
Outcome	Baseline mean (SD)	Follow-up 2 visit mean (SD)	Changes in outcomes between follow-up 2 and baseline (mean (SD))		
			Control	PACE	PACE Plus
Urgent office visits	1.72 (3.64)	0.97 (2.37)	− 0.27 (4.45)	− 1.19 (4.71)	− 0.77 (2.54)
ED visits	1.24 (2.29)	0.66 (3.07)	− 0.36 (1.49)	− 0.18 (3.64)	− 0.59 (1.80)
Hospitalizations	0.15 (0.45)	0.04 (0.32)	− 0.01 (0.35)	− 0.05 (0.37)	− 0.08 (0.55)
No. days affected by daytime asthma symptoms*	1.49 (0.83)	1.39 (0.82)	− 0.17 (1.00)	− 0.15 (0.94)	− 0.05 (0.99)
Asthma control	18.77(5.00)	20.54 (4.26)	1.51 (4.72)	2.23 (4.78)	1.80 (4.67)
Satisfaction with care	3.41 (0.67)	3.41 (0.70)	0.02 (0.81)	− 0.07 (0.75)	0.04 (0.65)
Asthma-related QOL	5.71 (1.17)	6.26 (0.93)	0.39 (1.15)	0.62 (1.00)	0.57 (1.04)

Note: Definition of abbreviations: ED = emergency department; SD = standard deviation; QOL = quality of life.

*Two or less days per week=1; three or more days per week but not daily=2; daily=3; throughout the day=4.

improvements over the short term on their use of patient-centered communication practices (Estimate 1.60, 95% CI: −0.07 – 3.26; $p < 0.05$), culturally sensitive communication practices (Estimate 2.54, 95% CI: 0.27 – 4.82; $p < 0.05$), their perception of clinical skills working across cultures (Estimate 2.65, 95% CI: −0.22 – 5.52; $p < 0.05$), and patient-centered counseling around asthma (Estimate 3.03, 95% CI: −0.11 – 6.17; $p < 0.05$). Over the short-term, PACE

Plus physicians also reported greater confidence in communication practices (Estimate 1.09, 95% CI: −0.06 – 2.25; $p < 0.05$), and asthma counseling practices (Estimate 1.58, 95% CI: −0.19 – 3.34; $p < 0.05$) compared to PACE physicians. Over the long-term, these differences sustained for use of patient-centered communication practices (Estimate 2.38, 95% CI: 0.67 – 4.09; $p < 0.01$), culturally sensitive communication practices (Estimate 2.51, 95% CI: 0.16 – 4.85; $p < 0.05$), physicians perception

Table 4. Intervention effects on caregiver perception in provider's communication and counseling practice.

Outcome	PACE vs. PACE Plus		PACE vs. Control	
	Estimate (95% CI)	P-value*	Estimate (95% CI)	P-value**
Short term outcomes (9 months post-intervention)				
Patient-centered communication practices	0.27 (−0.42, 0.96)	0.22	− 0.43 (−1.30, 0.44)	0.33
Patient-centered counseling around asthma	0.64 (−1.40, 2.69)	0.28	− 0.77 (−3.42, 1.88)	0.57
Culturally sensitive communication practices	− 0.11 (−1.13, 0.90)	0.59	0.51 (−0.98, 2.00)	0.50
Patient's perception about medical care received	0.10 (−0.69, 0.90)	0.40	− 0.40 (−1.42, 0.61)	0.44
Long term outcomes (21 months post-intervention)				
Patient-centered communication practices	0.56 (−0.18, 1.30)	0.07	− 0.92 (−1.85, −0.002)	0.05***
Patient-centered counseling around asthma	− 0.75 (−3.01, 1.51)	0.74	− 1.44 (−4.28, 1.40)	0.32
Culturally sensitive communication practices	− 0.42 (−1.54, 0.70)	0.77	− 0.62 (−2.20, 0.96)	0.44
Patient's perception about medical care received	0.09 (−0.77, 0.94)	0.42	− 0.56 (−1.63, 0.51)	0.31

Note: Definition of abbreviations: CI = confidence interval;

*P-value generated through a one-sided test.

**P-value generated through a two-sided test.

*** $p < 0.05$

Models adjusted for fixed effect of baseline outcome, age, gender, insurance type, baseline asthma severity, household smoking, study site, practice setting, and random effect of physician in the mixed effect models. P-values for the differential effect between PACE and PACE Plus, and PACE and control are obtained from two separate models.

Table E4. Changes in patient perception in provider's communication and counseling practice over the short and long term, measured at baseline, 9 months, and 21 months.

Short-term outcomes (9 months post-intervention)					
Outcome	Baseline mean (SD)	Follow-up 1 visit mean (SD)	Changes in outcomes between follow-up 1 and baseline (mean (SD))		
			Control	PACE	PACE Plus
Patient-centered communication practices	20.87 (3.15)	20.91 (3.05)	0.16 (2.66)	− 0.28 (3.27)	0.13 (2.84)
Patient-centered counseling around asthma	29.89 (8.80)	31.69 (9.79)	1.47 (9.34)	1.02(11.09)	2.44 (11.60)
Culturally sensitive communication practices	36.63 (5.43)	36.88 (5.29)	− 0.68 (6.38)	0.31 (5.69)	0.56 (5.64)
Patient's perception about medical care received	23.25 (3.97)	23.45 (3.87)	0.38 (2.95)	− 0.16 (3.66)	0.35 (3.09)
Long-term outcomes (21 months post-intervention)					
Outcome	Baseline mean (SD)	Follow-up 2 visit mean (SD)	Changes in outcomes between follow-up 2 and baseline (mean (SD))		
			Control	PACE	PACE Plus
Patient-centered communication practices	20.85 (3.19)	20.77 (3.36)	0.30 (2.51)	− 0.69 (3.50)	0.16 (2.85)
Patient-centered counseling around asthma	29.47 (8.62)	32.65 (10.65)	4.04 (11.62)	2.83 (12.22)	3.02 (11.27)
Culturally sensitive communication practices	36.60 (5.44)	36.70 (5.35)	0.14 (5.57)	− 0.03 (5.85)	0.16 (5.59)
Patient's perception about medical care received	23.11 (4.02)	23.31 (4.14)	0.39 (3.57)	− 0.20 (4.05)	0.40 (3.55)

Note: Definition of abbreviations: SD= standard deviation.

of clinical skills working across cultures (Estimate 4.01, 95% CI: 1.05 – 6.98; $p < 0.01$), and physician confidence in communication practices (Estimate 1.59, 95% CI: 0.41–2.77; $p < 0.01$). Long-term changes in confidence and use of patient-centered counseling around asthma were not observed.

Compared to physicians in the control condition, physicians who completed PACE reported significant

improvement over the long-term in culturally sensitive communication practices (Estimate 3.43, 95% CI: 0.58–6.27; $p < 0.05$). No short-term changes were observed on physician's perception of communication and counseling practices, or long-term changes in general communication practices communication and counseling practices or physician perception of clinical skills in working across cultures.

Table 5. Intervention effects on physician perception of communication and asthma counseling practices.

Outcome	PACE vs. PACE Plus		PACE vs. Control	
	Estimate (95% CI)	P-value*	Estimate (95% CI)	P-value**
Short-term outcomes (9 months post-intervention)				
Patient-centered communication practices	1.60 (−0.07, 3.26)	0.03***	− 0.39 (−2.34, 1.57)	0.70
Culturally sensitive communication practices	2.54 (0.27, 4.82)	0.02***	1.06 (−1.62, 3.75)	0.44
Physician perceptions of clinical skills working across cultures	2.65 (−0.22, 5.52)	0.04***	0.35 (−3.62, 4.33)	0.86
Patient-centered counseling around asthma	3.03 (−0.11, 6.17)	0.03***	− 1.63 (5.14, 1.88)	0.37
Confidence in communication practices	1.09 (−0.06, 2.25)	0.03***	0.005 (−1.29, 1.30)	0.99
Confidence in asthma counseling practices	1.58 (−0.19, 3.34)	0.04***	0.92 (−0.98, 2.82)	0.35
Long-term outcomes (21 months post-intervention)				
Patient-centered communication practices	2.38 (0.67, 4.09)	0.004***	− 0.79 (−2.86, 1.28)	0.46
Culturally sensitive communication practices	2.51 (0.16, 4.85)	0.02***	3.43 (0.58, 6.27)	0.02***
Physician perceptions of clinical skills working across cultures	4.01 (1.05, 6.98)	0.005***	3.41 (−0.80, 7.61)	0.12
Patient-centered counseling around asthma	2.40 (−0.84, 5.64)	0.08	− 1.12 (−4.82, 2.60)	0.56
Confidence in communication practices	1.59 (0.41, 2.77)	0.005***	0.26 (−1.11, 1.63)	0.71
Confidence in asthma counseling practices	0.80 (−1.03, 2.63)	0.20	1.97 (−0.04, 3.98)	0.06

Note: Definition of abbreviations: CI = confidence interval;

*P-value generated through a one-sided test.

**P-value generated through a two-sided test

*** $p < 0.05$

Models adjusted for fixed effect of baseline outcome, and physician's gender, site, and practice setting in the mixed effect models. P-values for the differential effect between PACE and PACE Plus, and PACE and Control are obtained from two separate models.

Table E5. Changes in physician perception of communication and asthma counseling practices over the short and long term, measured at baseline, 9 months, and 21 months.

Short-term outcomes (9 months post-intervention)					
Outcome	Baseline mean (SD)	Follow-up 1 visit mean (SD)	Changes in outcomes between follow-up 1 and baseline (mean (SD))		
			Control	PACE	PACE Plus
Patient-centered communication practices	33.96 (5.04)	36.48 (4.21)	2.20 (4.51)	1.62 (4.73)	3.97 (3.93)
Culturally sensitive communication practices	46.18 (6.78)	49.65 (6.56)	2.27 (7.69)	2.92 (5.12)	5.37 (6.92)
Physician perceptions of clinical skills working across cultures	37.02 (9.48)	42.29 (9.03)	4.47 (10.05)	4.38 (7.14)	7.17 (7.96)
Patient-centered counseling around asthma	57.38 (9.90)	61.42 (8.95)	3.20 (8.16)	3.14 (7.92)	6.00 (5.70)
Confidence in communication practices	23.82 (3.23)	25.33 (2.88)	1.00 (2.79)	0.89 (3.03)	2.77 (3.17)
Confidence in asthma counseling practices	35.08 (6.13)	37.94 (5.20)	1.50 (4.69)	2.76 (4.94)	4.33 (4.51)
Long-term outcomes (21 months post-intervention)					
Outcome	Baseline mean (SD)	Follow-up 2 visit mean (SD)	Changes in outcomes between follow-up 2 and baseline (mean (SD))		
			Control	PACE	PACE Plus
Patient-centered communication practices	33.90 (5.29)	36.81 (4.63)	2.52 (4.28)	1.78 (5.29)	4.42 (4.19)
Culturally sensitive communication practices	46.21 (6.73)	50.52 (6.30)	1.37 (7.04)	4.53 (5.23)	6.65 (7.20)
Physician perceptions of clinical skills working across cultures	36.81 (9.69)	43.39 (9.63)	3.22(11.13)	6.19 (6.60)	9.90 (8.78)
Patient-centered counseling around asthma	57.37 (9.99)	63.50(10.04)	4.81 (7.13)	5.66 (8.16)	7.77 (6.92)
Confidence in communication practices	23.72 (3.35)	25.34 (2.97)	0.74 (3.08)	1.09 (3.28)	2.94 (3.60)
Confidence in asthma counseling practices	35.20 (6.43)	38.49 (5.08)	1.44 (5.18)	3.81 (4.08)	4.35 (5.71)

Note: Definition of abbreviations: SD= standard deviation

Visit time short- and long-term follow-up between treatment and control groups

Table 6 shows physician recall of visit time at short and long-term follow-up (see Table E6 in the online data supplement for mean changes). In the short term, PACE Plus took more visit time than PACE for non-urgent visits with a diagnosis of one or more years (Estimate -2.27 , 95% CI: -4.46 to -0.07 ; $p < 0.05$), and with a diagnosis within the last year (Estimate -2.60 , 95% CI: -4.82 to -0.37 ; $p < 0.03$). Compared to physicians who participated in PACE, control physicians spent more time with their patients for urgent visits in the long-term for patients diagnosed within the last year (Estimate -7.76 , 95% CI: -13.65 to 1.87 ; $p < 0.01$), and diagnosed for one or more years with asthma (Estimate -6.31 , 95% CI: -12.40 to -0.23 ; $p < 0.05$).

Discussion

The US continues to expand rapidly as a multicultural society, yet long-standing disparities in health status persist for historically marginalized groups (7,8). Reducing disparities aligns with national public health goals (21), yet we continue to lack sufficient evidence

on the best ways that cultural competence training in healthcare settings can actually improve outcomes and reduce disparities, despite growing investment in these investigations (3,4). We compared general communication training via a proven communications training program, PACE, versus cultural competency training (PACE enhanced with skills training in working across cultures (PACE Plus)) on patient outcomes using a randomized controlled design in a high-risk population of asthma patients.

This study showed no definitive benefit in healthcare utilization outcomes (ED visits or hospitalizations), nor any benefit in asthma control. Partial support for our hypothesis that PACE Plus improved patients' asthma-related hospitalizations in the short-term should be treated with caution given the attrition issues with the study. We faced many challenges getting this study off the ground at multiple sites with busy practices and physicians. The study launched when the Affordable Care Act just passed, making it especially challenging to recruit physicians devoting significant time and resources into restructuring their practices. In the middle of the study, leadership of the study changed unexpectedly. Transitions resulted in time delays and resource challenges that impacted follow-up.

Table 6. Intervention effects on visit time.

Visit time	PACE vs. PACE Plus		PACE vs. Control	
	Estimate (95% CI)	P-value	Estimate (95% CI)	P-value
Short-term outcomes (9 months post-intervention)				
Diagnosed within last year				
Urgent visit	0.89 (−3.74, 5.52)	0.71	− 4.36 (−9.89, 1.18)	0.13
Non-urgent visit	− 2.60 (−4.82, −0.37)	0.03*	0.59 (−1.92, 3.10)	0.65
Well-child visit	− 0.33 (−3.20, 2.53)	0.82	0.74 (−2.98, 4.47)	0.70
Diagnoses one or more years				
Urgent visit	0.37 (−4.10, 4.84)	0.87	− 3.50 (−9.21, 2.21)	0.23
Non-urgent visit	− 2.27 (−4.46, −0.07)	0.05*	1.45 (−0.91, 3.81)	0.23
Well-child visit	− 1.43 (−4.44, 1.59)	0.36	0.81 (−2.95, 4.56)	0.68
Long-term outcomes (21 months post-intervention)				
Diagnosed within last year				
Urgent visit	− 0.04 (−4.83, 4.76)	0.99	− 7.76 (−13.65, −1.87)	0.01*
Non-urgent visit	− 1.57 (−3.86, 0.71)	0.18	− 0.31 (−2.92, 2.31)	0.82
Well-child visit	− 2.45 (−5.39, 0.50)	0.11	1.13 (−2.75, 5.02)	0.57
Diagnoses one or more years				
Urgent visit	− 0.59 (−5.21, 4.03)	0.80	− 6.31 (−12.40, −0.23)	0.05*
Non-urgent visit	− 1.35 (−3.60, 0.90)	0.24	0.10 (−2.36, 2.57)	0.94
Well-child visit	− 1.96 (−5.09, 1.16)	0.22	1.23 (−2.70, 5.16)	0.54

Note: Definition of abbreviations: CI = confidence interval;

*P < 0.05. Models adjusted for fixed effect of baseline outcome, physician's gender, study site and practice setting in the mixed effect models. P-values for the differential effect between PACE and PACE Plus, and PACE and control are obtained from two separate models and are two-sided.

Physicians reported greater confidence and ability to implement education and counseling techniques that are especially sensitive to multicultural patients. Several physician-reported outcomes were sustained over the long-term. These findings align with review studies confirming that provider interventions in cross-cultural communication training improves their own knowledge, skill level, and attitudes in working with diverse patients (3). A prior review has shown that adults and

children from minority groups with asthma benefit from culturally specific programs aimed at bolstering asthma management (22).

Unexpectedly, we found that PACE physicians also reported improvement over the long-term in the use of culturally sensitive communication practices even though this was not a specific focus of their intervention. One potential explanation of this finding is social desirability to response options at follow-up data collection to the

Table E6. Changes in visit time over the short term and long term measured at baseline, 9 months, and 21 months.

Visit time	Baseline mean (SD)	Follow-up 1 visit mean (SD)	Changes in outcomes between follow-up 1 and baseline (mean (SD))		
			Control	PACE	PACE Plus
Short-term outcomes (9 months post-intervention)					
Diagnosed within last year					
Urgent visit	27.93 (16.13)	28.92 (11.62)	1.60(19.30)	− 1.25 (16.27)	3.27 (10.96)
Non-urgent visit	15.70 (5.47)	16.13 (5.46)	0.90 (6.25)	1.40 (4.88)	− 1.03 (4.58)
Well-child visit	22.02 (6.46)	22.89 (7.73)	0.26 (8.90)	1.18 (7.10)	1.60 (4.94)
Diagnoses one or more years					
Urgent visit	26.22 (16.20)	26.56 (11.33)	1.29(20.99)	− 1.25 (15.60)	2.50 (10.97)
Non-urgent visit	14.83 (5.26)	14.59 (5.17)	− 0.41 (5.60)	0.97 (4.56)	− 1.20 (4.71)
Well-child visit	21.53 (6.57)	21.65 (7.08)	− 0.24 (8.81)	0.71 (7.03)	0.27 (6.25)
Long-term outcomes (21 months post-intervention)					
	Baseline mean (SD)	Follow-up 2 visit mean (SD)	Changes in outcomes between follow-up 2 and baseline (mean (SD))		
			Control	PACE	PACE Plus
Diagnosed within last year					
Urgent visit	28.13 (16.61)	28.65 (11.59)	6.37(14.75)	− 2.10 (17.07)	1.42 (8.52)
Non-urgent visit	15.76 (5.50)	16.94 (5.98)	1.85 (6.21)	1.78 (5.61)	0.0 (5.29)
Well-child visit	22.29 (6.34)	24.51 (8.07)	1.80 (8.96)	3.52 (7.37)	1.26 (5.68)
Diagnoses one or more years					
Urgent visit	26.36 (16.69)	27.45 (11.41)	6.13(12.98)	− 0.55 (18.73)	1.81 (9.23)
Non-urgent visit	14.88 (5.31)	15.66 (5.81)	1.00 (6.35)	1.47 (4.68)	− 0.13 (6.00)
Well-child visit	21.74 (6.32)	23.74 (7.98)	1.33 (9.06)	3.06 (8.63)	1.55 (6.10)

Note: Definition of abbreviations: SD= standard deviation.

specific survey items that measured culturally sensitive communication. Another explanation could be that general communication training primed greater awareness of communication across all patients or prior exposure to training in cultural competence.

In a sample of African American and Latino/Hispanic children and their caregivers, caregiver perception of physicians' communication and counseling behavior did not change for the PACE Plus trained group. This finding may be attributable to the fact that caregiver perception of physician performance and communication was already rated high at baseline and remained high after their physicians went through training. Long-term changes were observed for PACE trained physicians in terms of patients rating their physicians' communication practices more favorably. This outcome provides support for our second hypothesis that PACE demonstrates partial effectiveness with Latino/Hispanic and African American patients.

Significant asthma disparities exist in racial/ethnic minority populations and factors contributing to these disparities are multifaceted and complex (23,24). Racial/ethnic minorities have greater exposures to structural racism that increase their environmental exposures to asthma triggers, and are more likely to be impacted by interpersonal discrimination in other forums outside of the clinical encounter (24). A recent study by Thakur and colleagues showed that any general perceived discrimination experience in schools, medical settings, and public settings by African American children was associated with increased odds of poor asthma control (25). Given that our intervention was only specific to communication, education, and counseling with the provider, multi-component interventions continue to be needed to thoroughly address factors that contribute to poor outcomes in racial/ethnic minority children with asthma. Use of novel study designs and evaluation methods to support adequate testing of multi-component interventions would be necessary for future studies. Further, qualitative inquiry to inform the development of multi-component interventions from social and ethnically diverse backgrounds has the potential to elevate the impact of such interventions.

There are several limitations to this study that should be noted. Some of the regression models examining changes in short- and long-term outcomes had sparse data on key outcomes of interest, therefore p-values should be interpreted with caution. The significant dropout that resulted from this study also impedes generalizability of the findings. Data were primarily self-report and may be subject to social desirability. Further, we recommend that future assessment tools to measure communication and patient-provider interaction focus on more robust, validated instruments. Healthcare use data were verified with medical records, however other

measures not verified may be prone to error in recall such as visit time. Given that this study aimed to measure key functional and behavioral clinical outcomes, specific physiologic parameters such as FEV1 assessment via spirometry were not measured, although this information would be useful for future studies. ACT scores reflect the state of asthma control over the previous 4 weeks and can be affected by many factors. We primarily relied on quantitative outcome measurement in this study. Future studies should consider mixed-methods evaluation approaches to better understand how provider training in communication and counseling translate or do not translate to improved patient outcomes. Further, we recommend systematic assessment of provider behavior as an integral part of assessing the effectiveness of a provider behavior change intervention, and modeling the whole process of influencing system, provider, patient and family behaviors, and ultimately health outcomes.

Conclusion

Medical education for healthcare providers enhanced with specific training in working across cultures increases both provider confidence and perceived skill in treating diverse patients, beyond training in general communication practices. Research is needed to establish more evidence on the long-term outcomes of patients whose healthcare providers are trained in culturally sensitive healthcare delivery. More trials are also needed to better establish the generalizability of the PACE program in racial/ethnic minority populations. Finally, because factors that contribute to poor outcomes in racial/ethnic minority populations are broad and complex, multi-component strategies are needed to address risk factors and reduce disparities.

Acknowledgements

This work was supported by the Lung Division of the National Heart, Lung, and Blood Institute of the National Institutes of Health (Brown- R01HL093386-01-A2). The authors would like to thank Matthew Shankin, Kausar Hafeez, Margaret Wilkin, Emily Salvette, Daniel Awad, Harim Yoo, and study participants for their contributions to this work. This work is dedicated to the loving memory of Dr. Noreen M. Clark, Director of the Center for Managing Chronic Disease at the University of Michigan School of Public Health.

Declaration of interest

The authors have no competing interests relevant to the proposed work. Dr. Brown reports personal fees from AstraZeneca, personal fees from Meda, personal fees from Teva, personal fees from ThermoFisher, non-financial support from Allergy and Asthma Network, non-financial support from National Asthma Educator Certification Board, outside the submitted work.

Dr. Meyerson reports personal fees from GlaxoSmithKline, personal fees from Teva Pharmaceuticals, personal fees from Medscape, outside the submitted work.

Funding

Lung Division of the National Heart, Lung, and Blood Institute of the National Institutes of Health R01HL093386-01-A2.

References

- Ha JF, Longnecker N. Doctor-patient communication: a review. *Ochsner J*. 2010;10(1):38–43. PMID:21603354.
- Bailey ZD, Krieger N, Agénor M, Graves J, et al. Structural racism and health inequities in the USA: evidence and interventions. *Lancet*. 2017;389(10077):1453–63. doi: 10.1016/S0140-6736(17)30569-X. PMID:28402827.
- Truong M, Paradies Y, Priest N. Interventions to improve cultural competency in healthcare: a systematic review of reviews. *BMC Health Serv Res*. 2014;14(1):1–17. doi: 10.1186/1472-6963-14-99.
- Horvat L, Horey D, Romios P, Kis-Rigo J. Cultural competence education for health professionals. *Cochrane Database Syst Rev*. 2014;5(5):CD009405.
- White AA, Stubblefield-Tave B. Some advice for physicians and other clinicians treating minorities, women, and other patients at risk of receiving healthcare disparities. *J Racial Ethn Health Disparities*. 2016;10:1–8.
- Hall WJ, Chapman MV, Lee KM, Merino YM, et al. Implicit racial/ethnic bias among healthcare professionals and its influence on healthcare outcomes: a systematic review. *Am J Public Health*. 2015;105(12):e60–76. doi: 10.2105/AJPH.2015.302903. PMID:26469668.
- Barr RG, Avilés-Santa L, Davis SM, Aldrich TK, et al. Pulmonary disease and age at immigration among hispanics. results from the hispanic community health study/study of latinos. *Am J Respir Crit Care Med*. 2016;193(4):386–95. doi: 10.1164/rccm.201506-1211OC. PMID:26451874.
- Rosser FJ, Forno E, Cooper PJ, Celedón JC. Asthma in hispanics: an 8-year update. *Am J Respir Crit Care Med*. 2014;189(11):1316–27. doi: 10.1164/rccm.201401-0186PP. PMID:24881937.
- Roter DL, Hall JA. Doctors talking with patients/patients talking with doctors: improving communication in medical visits. Westport (CT): Praeger; 2006.
- Betancourt JR, Green AR, Carrillo JE, Ananeh-Firempong O 2nd. Defining cultural competence: a practical framework for addressing racial/ethnic disparities in health and health care. *Public Health Rep*. 2003;118(4):293–302. doi: 10.1016/S0033-3549(04)50253-4. PMID:12815076.
- Clark NM, Gong M, Schork MA, Evans D, et al. Impact of education for physicians on patient outcomes. *Pediatrics*. 1998;101(5):831–6. doi: 10.1542/peds.101.5.831. PMID:9565410.
- Clark NM, Cabana M, Kaciroti N, Gong M, et al. Long-term outcomes of physician peer teaching. *Clin Pediatr*. 2008;47(9):883–90. doi: 10.1177/0009922808319964.
- Cabana MD, Slish KK, Evans D, Mellins RB, et al. Impact of physician asthma care education on patient outcomes. *Pediatrics*. 2006;117(6):2149–57. doi: 10.1542/peds.2005-1055. PMID:16740859.
- Centers for Disease Control and Prevention. Faststats Childhood asthma. 2017. Available from: <https://www.cdc.gov/nchs/faststats/asthma.htm> [last accessed 15 January 2017].
- Patel MR, Thomas LJ, Hafeez K, Shankin M, et al. Study protocol for improving asthma outcomes through cross-cultural communication training for physicians: a randomized trial of physician training. *BMC Med Educ*. 2014;14(1):1–8. doi: 10.1186/1472-6920-14-118.
- National Asthma Education and Prevention Program (NAEPP). Expert panel report 3: guidelines for the diagnosis and the management of asthma. Bethesda (MD): National Heart, Lung, and Blood Institute; 2007.
- Schatz M, Sorkness CA, Li JT, Marcus P, et al. Asthma Control Test: reliability, validity, and responsiveness in patients not previously followed by asthma specialists. *J Allergy Clin Immunol*. 2006;117(3):549–56. doi: 10.1016/j.jaci.2006.01.011. PMID:16522452.
- Juniper EF, Guyatt GH, Feeny DH, Ferrie PJ, et al. Measuring quality of life in the parents of children with asthma. *Qual Life Res*. 1996;5(1):27–3. doi: 10.1007/BF00435966. PMID:8901364.
- Elaro A, Bosnic-Anticevich S, Kraus K, Farris KB, Shah S, Armour C, Patel MR. Pharmacists' perspectives of the current status of pediatric asthma management in the U.S. community pharmacy setting. *Int J Clin Pharm*. 2017;39(4):935–44. doi: 10.1007/s11096-017-0471-1. PMID:28497209.
- Like RC. Clinical cultural competency questionnaire (pre-training version). Center for Healthy Families and Cultural Diversity, Department of Family Medicine, UMDNJ-Robert Wood Johnson Medical School ©2001. Available from: http://rwjms.umdj.edu/departments_institutes/family_medicine/chfcd/grants_projects/documents/Pretraining.pdf [last accessed 1 February 2018].
- Office of Disease Prevention and Health Promotion. Healthy People 2020- Health Disparities. 2017. Available from: <https://www.healthypeople.gov/2020/about/foundation-health-measures/Disparities> [last accessed 15 January 2017].
- Mosnaim GS, Akkoyun E, Eng J, Shalowitz MU. Behavioral interventions to improve asthma outcomes: a systematic review of recent publications. *Curr Opin Allergy Clin Immunol*. 2017;17(3):194–200. doi: 10.1097/ACI.0000000000000359. PMID:28362676.
- Neophytou AM, White MJ, Oh SS, Thakur N, et al. Air pollution and lung function in minority youth with asthma in the GALA II (Genes-environments and admixture in latinoamericans) and SAGE II (study of africanamericans, asthma, genes, and environments) studies. *Am J Respir Crit Care Med*. 2016;193(11):1271–80. doi: 10.1164/rccm.201508-1706OC. PMID:26734713.
- Kopel LS, Phipatanakul W, Gaffin JM. Social disadvantage and asthma control in children. *Paediatr Respir Rev*. 2014;15(3):256–62; quiz 262–3.
- Thakur N, Barcelo NE, Borrell LN, Singh S, et al. Perceived discrimination associated with asthma and related outcomes in minority youth: the GALA II and SAGE II studies. *Chest*. 2017;151(4):804–12. doi: 10.1016/j.chest.2016.11.027. PMID:27916618.