Clinical and health promotion asthma management: an intervention for children and adolescents

Sebastiano Guarnaccia, M.D.,[1] Charvonne N. Holliday, Ph.D., M.P.H.,[2] Emanuele D'Agata, RN,[1] Ada Pluda, RN,[1] Gaia Pecorelli, MSc,[1] Valeria Gretter, M.D.,[1] Susanna Facchetti, M.D.,[1] Richard A. Bilonick, Ph.D.,[3] Matthew G. Masiello, M.D., M.P.H.,[4] and Edmund Ricci, Ph.D., M.Litt.[5]

ABSTRACT

Background: *Asthma is the leading chronic condition among children. Given this international burden, clinicians and public health professionals applied the Expanded Chronic Care Model to address health adversities of pediatric patients with asthma.*

Objective: *This study examined the influence of a clinical health promotion initiative on asthma control and appropriate medication management among pediatric patients.*

Methods: *Patients ($n = 304$) were recruited and screened for participation in this study. All the patients participated in a motivational interview, received clinical care, and were monitored longitudinally. Eligible patients ($n = 53$) were referred to one or more intervention pathways regarding physical activity, nutrition, smoking cessation, and psychosocial wellness. A comparison group ($n = 90$) was eligible for an intervention but chose not to participate. This analysis focused on patients who were identified as needing a health intervention beyond asthma clinical care.*

Results: *Among patients who were invited to participate in the health promotion pathways, significant decreases in asthma exacerbation were achieved by the patients who participated in the intervention compared with those who did not participate ($p = 0.018$). Significant improvements in asthma exacerbation, activity limitations, and asthma control were attributed to the time in clinical care ($p < 0.001$). In this group, asthma control significantly improved with medication ($p = 0.002$), and age was associated with a significant decrease in asthma exacerbation ($p = 0.011$).*

Conclusions: *This pilot study demonstrated preliminary benefits in a child asthma population. In addition, this experience addressed the chronicity of pediatric asthma through patient-centered care.*

(Allergy Asthma Proc 37:e70–e76, 2016; doi: 10.2500/aap.2016.37.3967)

Asthma is the leading chronic condition among children. In Italy, the prevalence of asthma diagnoses is 9.5% among adolescents and 10.4% among children.[1] These estimates are comparable with other developed countries, which highlights the need for a more holistic approach to asthma prevention.[2,3] In addition to the economic burden of asthma-related health costs, children with asthma are often restricted from daily childhood activities and display higher school absenteeism rates relative to students without asthma.[2,4]

To date, most published reports are directed to studies that evaluated the benefit of pharmacologic treatment and avoidance of allergens and triggers by using optimal educational strategies designed to maximize this outcome. Kuo *et al.*[4] emphasize the need to identify, monitor, and study other health indicators that may directly affect the quality of life and management of a child with asthma.[4] Several studies comment on the potential benefit of behavioral interventions provided by a multidisciplinary team as a means to enhance adherence to treatment.[4–8] (Fig. 1)

However, these health promotion behavioral health interventions are often not components of a comprehensive clinical and educational program focused on the care of children with asthma, especially those children with uncontrolled asthma.[9] The overall effectiveness of clinics dedicated to the care of children with asthma, needs further study and evaluation.

HEALTH SIGNIFICANCE OF PEDIATRIC ASTHMA

Psychosocial Influence

Children who are diagnosed with asthma have a reduced quality of life,[3,10] with a limited ability to run and participate in sports, and a greater risk for being bullied.[11,12] Other behavioral challenges experienced

From the [1]Centro Io e l'Asma, Ospedale dei Bambini, Spedali Civili, Brescia, Italy, [2]Center for Health Promotion and Disease Prevention, Windber Research Institute, Windber, Pennsylvania, [3]Department of Ophthalmology, School of Medicine, University of Pittsburgh, Pittsburgh, Pennsylvania, [4]Care Coordination, The Children's Institute, Pittsburgh, Pennsylvania, and [5]Department of Behavioral and Community Health Sciences, UPMC/University of Pittsburgh Institute on Aging, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, Pennsylvania
Supported by Associazione Laboratorio Clinico Pedagogico e Ricerca Biomedica Onlus
The authors have no conflicts of interest to declare pertaining to this article
Address correspondence to Sebastiano Guarnaccia, M.D., Centro "Io e l'Asma", Ospedale dei Bambini, ASST Spedali Civili, Via del Medolo 2, 25100 Brescia, Italy
E-mail address: sebastiano.guarnaccia@asst-spedalicivili.it
Copyright © 2016, OceanSide Publications, Inc., U.S.A.

Delivered by Ingenta to: JAB Bellanti IP: 216.15.28.65 On: Sat, 09 Jul 2016 17:50:05
Copyright (c) Oceanside Publications, Inc. All rights reserved.
For permission to copy go to https://www.oceansidepubl.com/permission.htm

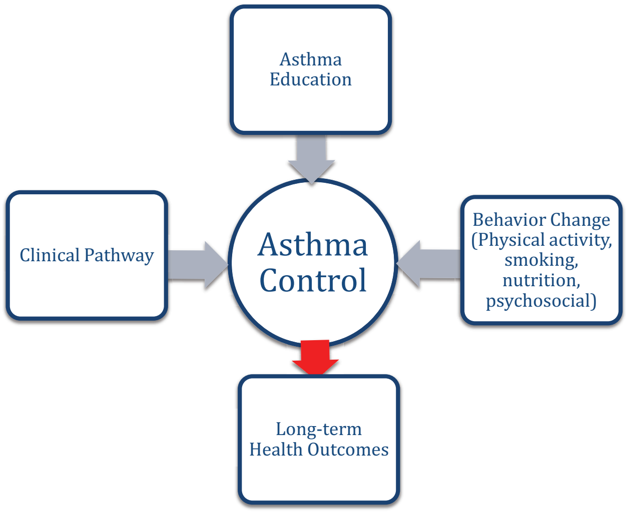

Figure 1. *Conceptual framework outlining the theoretical influence of clinical-based health promotion on pediatric patients with asthma.*

by children with asthma include an increased likelihood of attention-deficit/hyperactivity disorder, depression, anxiety, and difficulty learning.[3]

Tobacco Exposure

In utero exposure to tobacco smoke, *e.g.*, increases the likelihood of asthma in children, whereas exposure to postnatal tobacco smoke or second-hand smoke is associated with wheezing, bronchitis, pneumonia, and other pulmonary impairments. The relationship of smoking and asthma has been demonstrated at multiple levels, mainly stemming from familial exposure to smoke.[13,14]

Obesity and Nutrition

Results of a recent study also demonstrated a relationship between obesity, television viewing, exercise, and newly diagnosed asthma in school-age children.[1] The relationship between asthma and obesity is well established a recent study, although the pathophysiologic mechanisms that link both diseases remain unknown. Results a recent study demonstrated the role of proinflammatory cytokines in the theory of pathogenesis of obesity-related asthma as improper control of pulmonary function.[15] In addition, individuals who are obese have low vitamin D status, and there is emerging evidence that vitamin D affects the risk of acute inflammatory infections and corticosteroid responsiveness in individuals with asthma.

In this review, we summarized the association between obesity and asthma severity and/or control in children and discuss acute inflammatory infections and corticosteroid responsiveness as potential mediators in the obesity-asthma pathway.[16] As individuals move from childhood to adolescence, less time is spent being active and more time is spent participating in sedentary behaviors (*e.g.,* television viewing, playing video games),[17] which increases one's likelihood to become obese. Gilliland *et al.*[17] found that being overweight or obese increased a child's risk for new-onset asthma by >50%; children who were overweight and obese also have a higher use of asthma medications.

The aim of this study was to enhance the educational component of the intervention to specifically address health adversities that may hinder and exacerbate pediatric patients with asthma. We hypothesized that clinical care and education for proper asthma management, medication usage, and behavioral interventions, when appropriate, will increase asthma control in pediatric patients.

METHODS

Allergy/pulmonology specialist (S.G.) and a public health nurse (A.P.) provided care and recruited patients and parents from Centro Io e l'Asma (Centro), Spedali Civili Hospital, in Brescia, Italy, for this study during clinical visits (Fig. 2). All patients ages 5–18 years were considered eligible to participate in at least one portion of the study (clinical care only versus clinical care and health promotion). The Centro, a network member of the Health Promoting Hospitals, provides pediatric patients with asthma with specialty allergy and pulmonology care.[18]

All the patients, regardless of eligibility, received at least three clinical evaluations (baseline, 8 weeks, and 16 weeks) and two follow-up visits, at 6 months and 1 year. The patients were evaluated and treated based on the Global Initiative for Asthma guidelines.[19] During each evaluation, the patients and parents were asked up to 150 asthma-related questions by using a dedicated data base, which allowed for longitudinal tracking of patients' health. Furthermore, all the patients and their families were recruited for a motivational interview to discuss asthma management and asthma-related health adversities.

Patients and their parents who consented to the study, were asked to complete a screening questionnaire to assess their need for targeted intervention about nutrition, physical activity, smoking exposure, and psychosocial well-being by using an algorithm developed by the health promotion research team. Patients and parents who scored above the preset benchmark on the screening questionnaire were invited to participate in one or more of the four interventions. Patients diagnosed as being overweight or obese were automatically invited to receive the nutritional intervention. This study was reviewed and approved by the research ethics committee at Spedali Civili, Brescia, Italy (clinical trial registration no. 930, date of approval, December 14, 2011).

Delivered by Ingenta to: JAB Bellanti IP: 216.15.28.65 On: Sat, 09 Jul 2016 17:50:05
Copyright (c) Oceanside Publications, Inc. All rights reserved.
For permission to copy go to https://www.oceansidepubl.com/permission.htm

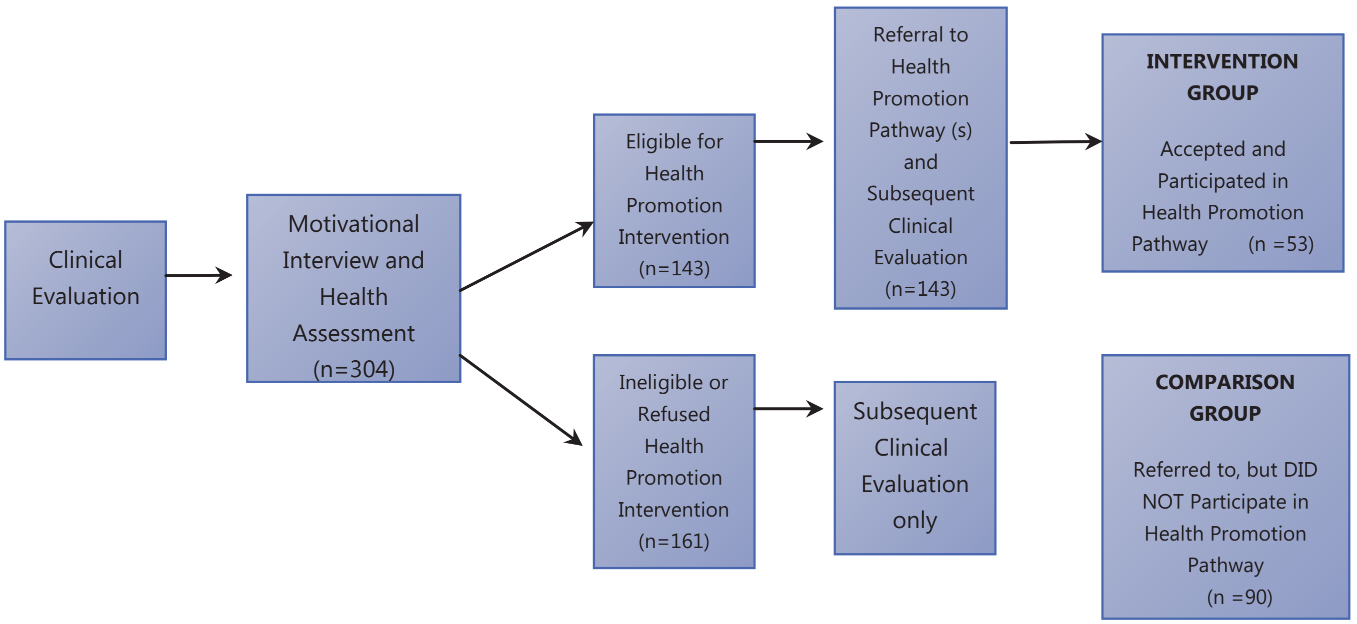

Figure 2. *The study approach.*

Data Collection

Health Promotion Pathways. Four intervention pathways were developed to address underlying health adversities associated with pediatric asthma. Consenting patients were referred to one or more intervention pathways based on the screening questionnaire that they and their parents completed during the first clinical visit. Pre- and postquestionnaires were given to the patients to capture any changes that may have occurred during the course of the intervention.

Psychosocial Pathway. Validated tools were used to assess the presence of anxiety, depression, and other psychosocial conditions.[3] This intervention was conducted by a neuropsychiatrist who determined the length of treatment based on clinical assessment. Initially, the physician gathered information from parents about the patient's family history. Parents of children <11 years old completed the Child Behavior Checklist/6–18 Diagnostic Statistical Manual–Oriented Scale on their child's behalf. Younger children also underwent a psychiatric evaluation in which they drew a picture based on a theme provided by the neuropsychiatrist. Similarly, patients who were ≥11 years of age completed the Youth Self-Report 6–18 Diagnostic Statistical Manual–Oriented Scale. The patients were asked to attend one 45-minute session each week for a total of four to six sessions. The patients were released from the pathway at the discretion of the neuropsychiatrist. However, some children were recommended to attend more than six sessions. Patients who needed long-term care were referred to a psychologist.

Physical Activity Pathway. This intervention pathway was designed by a physical activity specialist to encourage physical activity among inactive patients and to teach the importance of exercise and techniques to achieve quality breathing. The intervention took place in a group format for children ages 10–18 years by using PowerPoint and video presentations, printed materials, and exercise equipment. Due to challenges encountered in previous studies, children ages of 5–9 years were not included in the intervention. Instead, parents of children who fell within the younger age group attended the physical activity intervention if their child was identified as obese or having poor nutritional habits. The intervention consisted of three weekly sessions for 1.5 hours. During this time frame, the patients were asked to record their daily physical activity in a diary. The Borg Scale,[11] an objective measure, was used to assess the physical activity of the patients before and after the intervention. Pre- and postquestionnaires were also administered to assess the participants' perception of their physical activity level.

Nutrition Pathway. This pathway, developed and conducted by a nutritionist, was structured into two groups according to the age range (5–9 years and 10–14 years) and consisted of individual and group sessions. Three weekly meetings of 1.5 hours each were held, followed by two follow-up sessions of 30 minutes each at 1 month and at 3 months from the first follow-up session. A meeting for parents was held at the conclusion of the intervention. However, at the end of each meeting, the parents were briefed on what their child

Delivered by Ingenta to: JAB Bellanti IP: 216.15.28.65 On: Sat, 09 Jul 2016 17:50:05
Copyright (c) Oceanside Publications, Inc. All rights reserved.
For permission to copy go to https://www.oceansidepubl.com/permission.htm

Table 1 **Sex, age, and nationality for all participant groups**

	Participant Groups (N = 304)		
	Clinical Care Only, no. (%) (n = 161)	**Participated in Targeted Health Intervention–Exposed, no. (%) (n = 53)**	**Opted Out of Targeted Health Intervention–Comparison, no. (%) (n = 90)**
Boys	98 (61)	35 (66)	62 (69)
Age			
0–5 y	5 (3)	2 (4)	4 (4)
>5–10 y	93 (58)	26 (49)	56 (62)
>10–16 y	63 (39)	25 (47)	30 (33)
Nationality			
Italian	159 (99)	47 (89)	82 (91)
Other	1 (1)	6 (11)	8 (9)

had been taught and were given a corresponding educational brochure. The patients and their parents kept a weekly food diary, which were revised by the nutrition specialist. Food props were used to increase understanding, particularly among the younger children. Patients identified as overweight or obese were referred to this pathway regardless of their reported nutrition habits.

Smoking Pathway. This pathway was based on the transtheoretical model to provide individual-based education and behavior changes for pediatric patients who smoke.[20] Two monthly meetings were held, with a follow-up meeting at 6 months. Sessions followed the stages-of-change approach, which provided the patients with appropriate cessation milestones and motivation. In between sessions, the specialist called patients and gauged their position within the theoretical model. Before and after the intervention, the patients were given a carbon dioxide test,[21] a biologic indicator of exposure to smoke or smoking activity, and their degree of physical dependence on nicotine was assessed *via* the Fagerstrom Nicotine Dependence Test.[22]

Statistical Analysis

A longitudinal cumulative link mixed-effects model[23] was used to determine the effect of the medication and health behavior modification on asthma control. A longitudinal random intercept Poisson regression model was fitted to exacerbations. A longitudinal random intercept logistic regression model was fitted to limitations. Analyses were conducted by using the R software for statistical computation and graphics (version 3.2.2).[24] The ordinal R package (version 2015.6–28)[25] was used to fit the longitudinal cumulative link mixed-effects models. For the purpose of this study, only patients who were identified as needing additional asthma-related intervention were included in this analysis. The treatment group completed the intervention, whereas the control group did not.

RESULTS

The participants in this study were drawn from the total population of pediatric patients with asthma (n = 304) who were all seeking specialized allergy and/or pulmonology care at our center. For the purpose of this analysis, only participants who scored high enough on a screening questionnaire that indicated eligibility for one or more of the health promotion pathways were included (n = 143). The participants who were not identified as being eligible for one of the four health promotion pathways (n = 161) were excluded from the current analysis (Fig. 2; Table 1). Of the patients who were invited to participate in the health promotion pathways (n = 143), 53 participated; the remaining (n = 90) did not participate and served as the comparison group (Table 1). Across the groups, the majority of the participants were boys, Italian, and within the >5–10 years age range (Table 1).

The results of exacerbations, limitations, and asthma control as a function of time in clinical care; participation in the health promotion pathway; daily medication; and age are described in Table 2. First we described the fixed effects. Note that the time in clinical care was a subject-specific effect (a longitudinal variable), whereas participation in the health promotion pathway, baseline age, and sex were cross-sectional variables. The subject-specific time in clinical care showed the effect on the individual child, whereas the cross-sectional variables only allowed us to compare different children. In addition, because daily medication often changed over time, we could estimate a subject-specific effect that allowed us to directly see how changing medication affected children individually.

Delivered by Ingenta to: JAB Bellanti IP: 216.15.28.65 On: Sat, 09 Jul 2016 17:50:05
Copyright (c) Oceanside Publications, Inc. All rights reserved.
For permission to copy go to https://www.oceansidepubl.com/permission.htm

Table 2 **Fixed and random effects of exacerbations, limitations, and asthma control***

	Exacerbations		Activity Limitations		Asthma Control	
	PC	*p*	OR	*p*	OR	*p*
Fixed effects						
Intercept (baseline)	1.220	0.573	1.441	0.502		
Uncontrolled or partially controlled					0.551	0.161
Partially or well controlled					0.959	0.930
Time (days) in clinical care	0.996	<0.001#	0.992	<0.001#	1.005	<0.001#
Participation in health promotion pathway	0.586	0.018#	0.686	0.222	1.132	0.647
Daily medication	0.862	0.441	0.663	0.148	2.389	0.002#
Age (years)	0.912	0.011#	0.966	0.498	1.023	0.612
Girls	1.463	0.068	1.343	0.362	0.687	0.182
Exponentiated estimated SD for the random intercept	±1.598		±2.260		±1.664	

PC = proportional change; OR = odds ratio; SD = standard deviation.
**Fixed effect estimated PC in asthma-related exacerbations and fixed effect estimated ORs for asthma-related limitations and asthma control (uncontrolled, partially controlled, well controlled) based on predictors of asthma symptoms among patients who were referred to participate in the health promotion program.*
#Indicates statistically significant coefficient ($p < 0.05$).

For exacerbations, the longitudinal random intercept Poisson regression model showed that, for every day a child was included in the study, there was a proportional change in exacerbations of 0.996 ($p < 0.001$). In other words, each day in the study was associated with a 0.4% decrease in exacerbations, which would be equivalent to approximately a 77% (100% $[1 - 0.996^{365}]$) decrease on a yearly basis. Participation in the health promotion pathway was associated with a proportional change of 0.586 ($p = 0.018$) in exacerbations, that is, a 41.4% decrease. When comparing children, the child's baseline age was associated with a proportional change in exacerbations of 0.912 ($p = 0.011$), that is, an 8.8% decrease for each additional year of age. Being female was associated with a proportional change of 1.463 ($p = 0.068$) or a 46.3% increase in exacerbations, but the result was just short of being statistically significant. Daily medication was associated with a proportional change of 0.862 ($p = 0.441$), but the effect was not statistically significant.

For activity limitations, the longitudinal random intercept logistic regression showed that, for every day the child was in clinical care, the odds of an activity limitation decreased by 0.8% (odds ratio 0.992; $p < 0.001$). Although the effect was not significant, participation in the health promotion pathway was associated with a decrease in odds of 31.4% (odds ratio 0.686; $p = 0.222$). The effect of medication was to decrease the odds for activity limitation by 33.7% (odds ratio 0.663; $p = 0.148$) but did not reach statistical significance. When comparing children, the child's baseline age was associated with a 3.4% decrease in the odds for an activity limitation (odds ratio 0.966; $p = 0.498$), but the result was not statistically significant. Being female increased the odds for an activity limitation by 34.3% (odds ratio 1.343; $p = 0.362$), although not statistically significant.

For asthma control, a longitudinal cumulative link random intercept model showed that the number of days in clinical care increased the odds for asthma control by 0.5% (odds ratio 1.005; $p < 0.001$) for each addition day in clinical care. Daily medication increased the odds for asthma control by 238.9% (odds ratio 2.389; $p = 0.002$). Being female decreased the odds for asthma control by 31.3% (odds ratio 0.687; $p = 0.182$), but the result was not statistically significant. When comparing children, each additional year of age increased the odds for asthma control by 2.3% (odds ratio 1.023; $p = 0.612$) but the result was not statistically significant. Participation in the health promotion pathway increased the odds for asthma control by 13.2% (odds ratio 1.132; $p = 0.647$) but the result was not statistically significant.

All three models were longitudinal models, which included a random intercept. The exponentiated standard deviation for the random intercept is shown in Table 2. In other words, these models allow each child to have his or her own intercept to account for heterogeneity of the response in which the cause(s) of the heterogeneity is unknown. The standard deviation for exacerbations was 1.598, which indicated that the risk associated with a one standard deviation difference

Delivered by Ingenta to: JAB Bellanti IP: 216.15.28.65 On: Sat, 09 Jul 2016 17:50:05
Copyright (c) Oceanside Publications, Inc. All rights reserved.
For permission to copy go to https://www.oceansidepubl.com/permission.htm

between two children differed by ~60%. Similarly for activity limitations, the risk differed by a factor of 2.26 (226%). For asthma control, the risk differed by ~66% (a factor of 1.66). Thus, even after accounting for the fixed effects, there was substantial heterogeneity among the children.

DISCUSSION

The purpose of this study was to assess the effects of an expanded Chronic Care Model on a sample of pediatric patients with asthma. The patients who took part in this analysis received enhanced clinical care, including medication when needed, and a targeted health promotion intervention on nutrition, physical activity, smoking, and psychosocial well-being. Consenting patients were selected to participate in one or more health promotion pathways. When comparing the two arms of the study (clinical care only versus clinical care and health promotion), which were similar in terms of asthma-related health, the patients in the health promotion portion showed greater decreases in their asthma-related limitations.

Although only time in clinical care was statistically significant in the individual models for each of three responses, there were several important things to note. First, the effect of time in clinical care was positive for each response. That is, more time in clinical care resulted in fewer exacerbations, less-frequent activity limitation, and improved asthma control. The estimated effect of participation in the health promotion pathway was also always positive (even if only statistically significant for exacerbations). Daily medication, although only statistically significant for asthma control, always had an estimated effect that was positive. Daily medication tended to decrease the number of exacerbations, decreased the odds for an activity limitation, and increased the odds for asthma control.

Similarly, Guarnaccia *et al.*[26] documented a decrease in asthma exacerbation and medication use, and significant improvements in asthma severity ($p < 0.001$) and use of medication for exacerbations ($p < 0.001$) through interventions tailored to clinic-based education and medication management. In a more recent longitudinal study, 262 patients, ages 6–15 years, attended three clinical visits and participated in an educational asthma session. There was a significant decrease in the number of hospitalizations ($p < 0.001$) and school absenteeism ($p < 0.001$).[27]

CONCLUSION

This real-world study had some limitations. It was designed to test the feasibility of adding formal health promotion, data collection, analysis, and evaluation to a fully operating clinical practice. We strongly recommend additional research to include a larger sample of patients and longitudinal follow-up to allow more expanded statistical analysis with increased certainty in the findings. Little is known about the sustainability and long-term effects of clinic-based interventions. However, this research supported the effectiveness of health care provider–delivered interventions short term.[28]

Findings from this study support the need for a more comprehensive and coordinated level of care for pediatric patients with asthma. In addition to integrating health educational pathways into a clinical setting, analysis of the data in this study indicated a need for the identification and management of health-related behaviors. This new approach will allow the physician and his or her clinical care coordination team to follow up all aspects of the child's health, which, as demonstrated in this study, resulted in better asthma management and outcomes. To our knowledge, this is the first study to examine the incorporation of a comprehensive health promotion intervention into a clinical setting by using a multidisciplinary health care team and builds on the successes of other clinical asthma interventions.

ACKNOWLEDGMENTS

We thank Virginia Arietti, Alessandro Brioni, Denise Colombo, Maria Cristina De Leonardis, Anna Zanardini, Annalisa Gennari, Andrea Brivio, and Adriana Boldi of Spedali Civili di Brescia, Italy, Laboratorio Clinico Pedagogico e Ricerca Biomedica, Brescia Primary Care Ioeasma Team, and Jennifer Gray of the University of Pittsburgh. We thank Associazione Laboratorio Clinico Pedagogico e Ricerca Biomedica Onlus, for their generous support, which made this research possible.

REFERENCES

1. Corbo GM, Forastiere F, De Sario M, et al. Wheeze and asthma in children: Associations with body mass index, sports, television viewing, and diet. Epidemiology 19:747–755, 2008.
2. Akinbami LJ, Moorman JE, Garbe PL, and Sondik EJ. Status of childhood asthma in the United States, 1980–2007. Pediatrics 123(suppl. 3):S131–S145, 2009.
3. Blackman JA, and Gurka MJ. Developmental and behavioral comorbidities of asthma in children. J Dev Behav Pediatr 28:92–99, 2007
4. Kuo AA, Etzel RA, Chilton LA, et al. Primary care pediatrics and public health: Meeting the needs of today's children. Am J Public Health 102:e17–e23, 2012.
5. Szefler SJ. Monitoring and adherence in asthma management. Lancet Respir Med 3:175–176, 2015.
6. Szefler SJ. Advances in pediatric asthma in 2014: Moving toward a population health perspective. J Allergy Clin Immunol 135:644–652, 2015.
7. European Innovation Partnership on Active and Healthy Ageing, Action Plan B3; Mechanisms of the Development of Allergy, WP 10; Global Alliance against Chronic Respiratory Diseases et al. Integrated care pathways for airway diseases (AIRWAYS-ICPs). Eur Respir J 44:304–323, 2014.
8. Pijnenburg MW, Baraldi E, Brand PL, et al. Monitoring asthma in children. Eur Respir J 45:906–925, 2015.
9. Papadopoulos NG, Arakawa H, Carlsen KH, et al. International consensus on (ICON) pediatric asthma. Allergy 67:976–997, 2012.

Delivered by Ingenta to: JAB Bellanti IP: 216.15.28.65 On: Sat, 09 Jul 2016 17:50:05
Copyright (c) Oceanside Publications, Inc. All rights reserved.
For permission to copy go to https://www.oceansidepubl.com/permission.htm

10. van den Bemt L, Kooijman S, Linssen V, et al. How does asthma influence the daily life of children? Results of focus groups interviews. Health Qual Life Outcomes 8:5, 2010.
11. Borg G, and Linderholm H. Perceived exertion and pulse rate during graded exercise in various age groups. Acta Med Scand 181:194–206, 1967.
12. Rhee H, Belyea MJ, and Brasch J. Family support and asthma outcomes in adolescents: Barriers to adherence as a mediator. J Adolesc Health 47:472–478, 2010
13. Akuete, K., Oh SS, Thyne S, et al. Ethnic variability in persistent asthma after in utero tobacco exposure. Pediatrics 128:e623–e630, 2011.
14. Siddiqi K, Huque R, Jackson C, et al. Children Learning About Secondhand Smoke (CLASS II): Protocol of a pilot cluster randomized controlled trial. BMJ Open 5:e008749, 2015.
15. Lu Y, Van Bever HP, Lim TK, et al. Obesity, asthma prevalence and IL-4: Roles of inflammatory cytokines, adiponectin and neuropeptide Y. Pediatr Allergy Immunol 26:530–536, 2015.
16. Frieri M. The role of vitamin D in asthmatic children. Curr Allergy Asthma Rep 11:1–3, 2011.
17. Gilliland FD, Berhane K, Islam T, et al. Obestiy and risk of newly diagnosed asthma in school-age children. Am J Epidemiol 158:406–415, 2003.
18. Masiello M. A health promoting hospital: a strategy in the re-design of the U.S. health care system. Commonwealth. J Polit Sci 14:125–137, 2008.
19. Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention, 2016. Available at www.ginasthma.org.
20. Prochaska JO, and DiClemente CC. Stages and processes of self-change of smoking: Toward an integrative model of change. J Consult Clin Psychol 51:390–395, 1983.
21. Scieszka J, and Kalina Z. Effect of cigarette smoking on the tidal carbon dioxide profile. Arch Environ Health 39:302–305, 1984.
22. Fagerström KO. Measuring degree of physical dependence to tobacco smoking with reference to individualization of treatment. Addict Behav 3:235–241, 1978.
23. Agresti A. Analysis of Ordinal Categorical Data. John Wiley & Sons Inc., Hoboken, New Jersey, Second Edition, 2010.
24. Development Core Team. R: A language and environment for statistical computing. Vienna, Austria, 2015.
25. Christensen RH. Ordinal-Regression Models for Ordinal Data R package 2013. Vienna: Foundation for Statistical Computing.
26. Guarnaccia S, Lombardi A, Gaffurini A, et al. Application and implementation of the GINA asthma guidelines by specialist and primary care physicians: a longitudinal follow-up study on 264 children. Prim Care Respir J 16:357–362, 2007.
27. Guarnaccia S, White M, D'Agata E, et al. Evaluating the effectiveness of a therapeutic-path educational in improving asthma control in children and adolescents. Medico e Bambino 15:1–9, 2012.
28. Wu YP, and Pai AL. Health care provider-delivered adherence promotion interventions: A meta-analysis. Pediatrics 133: e1698–e1707, 2014. □

Delivered by Ingenta to: JAB Bellanti IP: 216.15.28.65 On: Sat, 09 Jul 2016 17:50:05
Copyright (c) Oceanside Publications, Inc. All rights reserved.
For permission to copy go to https://www.oceansidepubl.com/permission.htm