The Asthma Multiverse Shared Decision Making in Pediatric Asthma Care

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Pediatric Pulmonology

June 15, 2023

Objectives

Discuss	• Discuss methods for shared decision making in Pediatric asthma
Review	• Review outcomes of shared decision making interventions for asthma
Understand	• Understand barriers to effective shared decision making in Pediatric asthma management
Review	• Review technology use with shared decision making

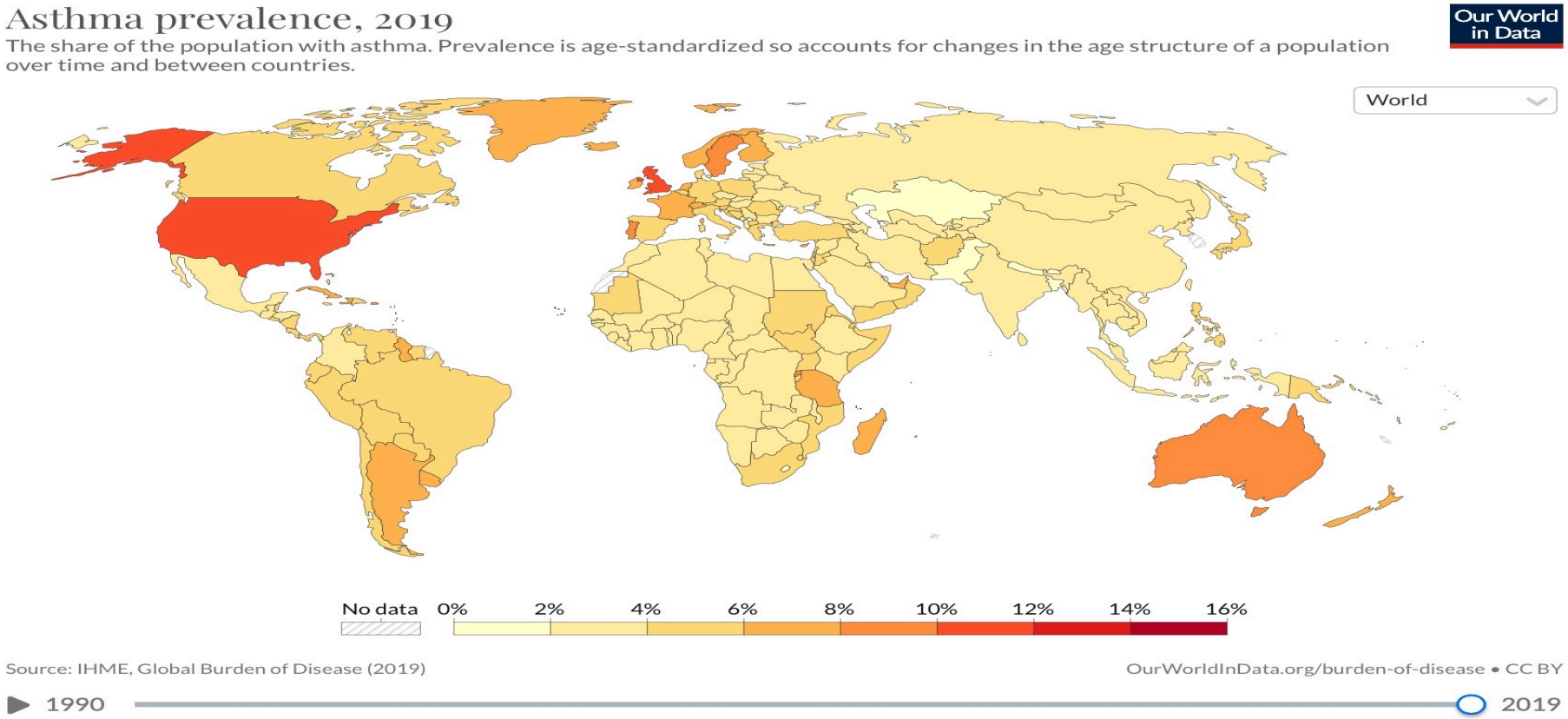
Asthma Healthcare Burden

Affects more than 25 million people in the United States, including approximately 7 million children

1.8 million emergency department visits

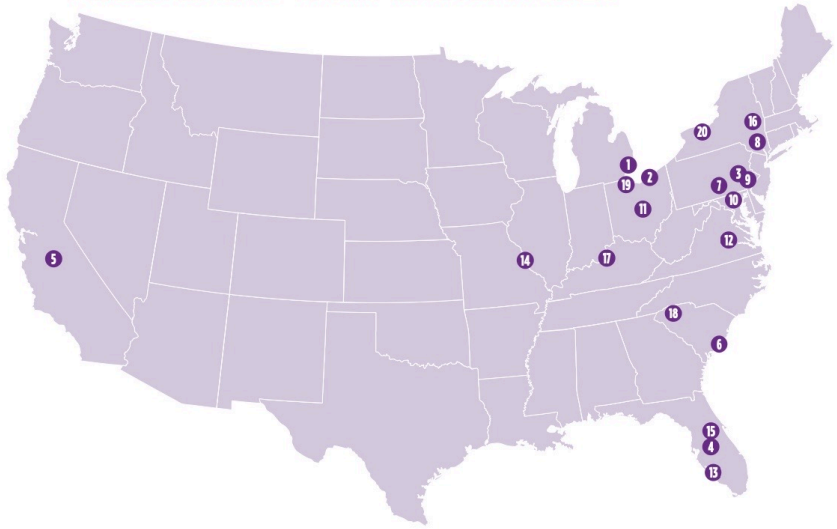
Over 3,500 deaths

Global Burden of Asthma



Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2021.

Map of the Top 20 Most Challenging Places to Live With Asthma in 2022



These are the top 20 Asthma Capitals based on estimated asthma prevalence, emergency department visits due to asthma, and asthma-related fatalities. The burden of asthma falls heavily on the eastern half of the country, including some cities in the Midwest. The full list of top 100 cities can be found on page 7 in this report.

1. Detroit, MI
2. Cleveland, OH
3. Allentown, PA
4. Lakeland, FL
5. Fresno, CA
6. Charleston, SC
7. Harrisburg, PA
8. Poughkeepsie, NY
9. Philadelphia, PA
10. Baltimore, MD
11. Columbus, OH
12. Richmond, VA
13. Cape Coral, FL
14. St. Louis, MO
15. Orlando, FL
16. Albany, NY
17. Louisville, KY
18. Greenville, SC
19. Toledo, OH
20. Rochester, NY

AsthmaCAPITALS

The top 10 most challenging places to live with asthma are:

1. Detroit, Michigan
2. Cleveland, Ohio
3. Allentown, Pennsylvania
4. Lakeland, Florida
5. Fresno, California
6. Charleston, South Carolina
7. Harrisburg, Pennsylvania
8. Poughkeepsie, New York
9. Philadelphia, Pennsylvania
10. Baltimore, Maryland

Asthma and Allergy Foundation of America

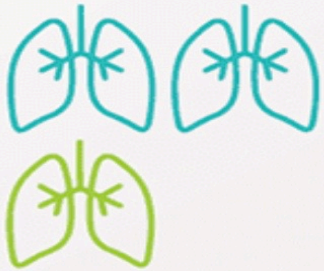
asthmacapitals.com

Black, Hispanic, and Indigenous individuals in the U.S. face THE HIGHEST BURDEN OF ASTHMA.

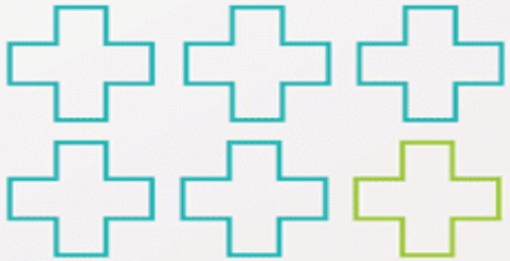
These disparities are caused by complex factors including systemic and structural racism.

Compared to white Americans:

Black Americans are nearly **1.5 times** more likely to have asthma



Puerto Rican Americans are nearly **2 times** more likely to have asthma



Black Americans are **5 times** more likely to visit the emergency department due to asthma

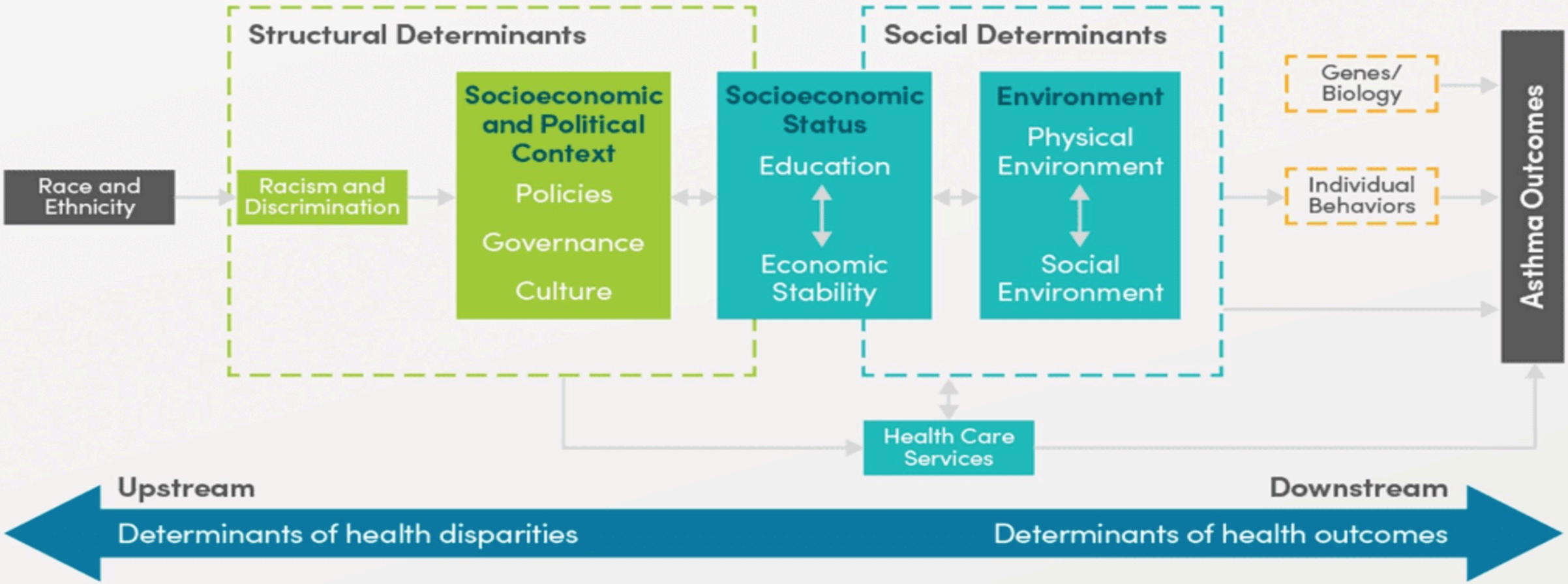
Black Americans are **3 times** more likely to die from asthma

When sex is factored in, **BLACK WOMEN** have the highest rates of death due to asthma

Asthma and Allergy Foundation of America

aafa.org/asthmadisparities

AAFA'S FRAMEWORK FOR ROOT CAUSES OF ASTHMA DISPARITIES

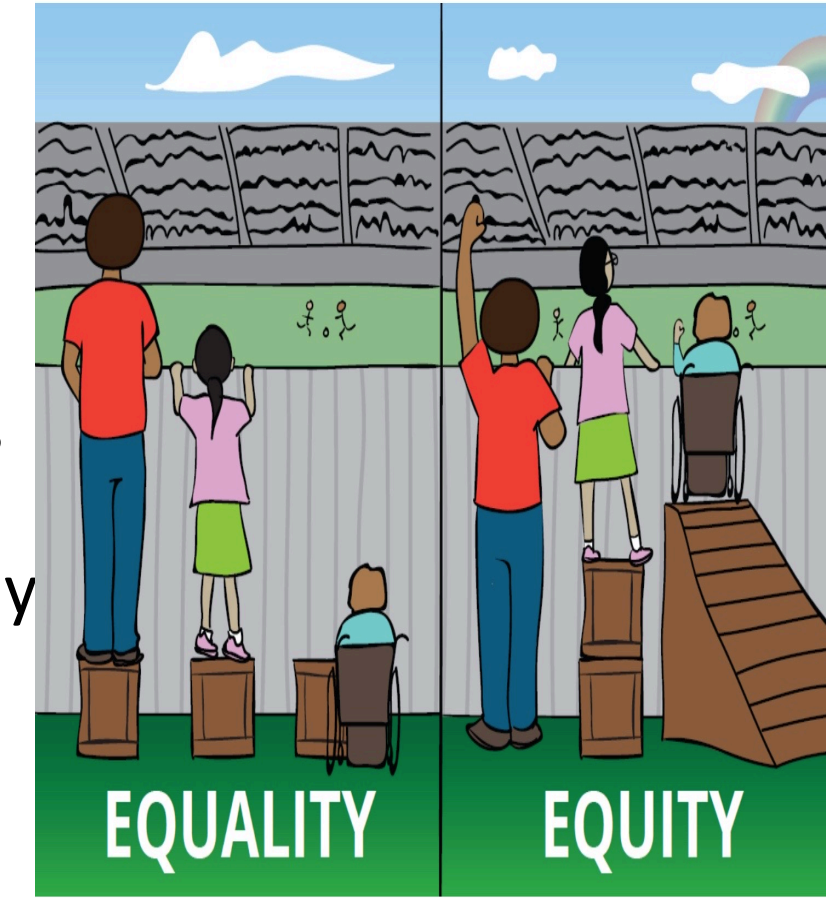


Asthma and Allergy Foundation of America

aafa.org/asthmadisparities

What is a Health Disparity?

When a health condition affects one group of people differently than another group



https://www.equitytool.org/equity/

Pediatric Asthma

- Asthma is the most common chronic childhood condition
- 1 in 12 children are affected in the United States
- Black and Hispanic children are twice as likely to have asthma than White Children
- Respiratory viruses such as human rhinovirus, respiratory syncytial virus, and influenza virus are common triggers for asthma exacerbations.
- Leading causes of school absenteeism, with approximately 49% of school-aged children with asthma missing one or more school days per year

Challenges in Asthma Management

On average, children and adults with asthma take 50% or less of their prescribed controller medications

Common barriers to self-management:

Poor adherence to treatment	Incorrect use of rescue and controller medications	Misunderstanding of triggers and symptoms

Journal of Asthma and Allergy

Dovepress

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REVIEW

Treatment Adherence in Adolescents with Asthma

This article was published in the following Dove Press journal:
Journal of Asthma and Allergy

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Abstract: The burden of asthma is particularly notable in adolescents, and is associated with higher rates of prevalence and mortality compared with younger children. One factor contributing to inadequate asthma control in adolescents is poor treatment adherence, with many pediatric studies reporting mean adherence rates of 50% or lower. Identifying the reasons for poor disease control and adherence is essential in order to help improve patient quality of life. In this review, we explore the driving factors behind non-adherence in adolescents with asthma, consider their consequences and suggest possible solutions to ensure better disease control. We examine the impact of appropriate inhaler choice and good inhaler technique on adherence, as well as discuss the importance of selecting the right medication, including the possible role of as-needed inhaled corticosteroids/long-acting β_2-agonists vs short-acting β_2-agonists, for improving outcomes in patients with mild asthma and poor adherence. Effective patient/healthcare practitioner communication also has a significant role to engage and motivate adolescents to take their medication regularly.

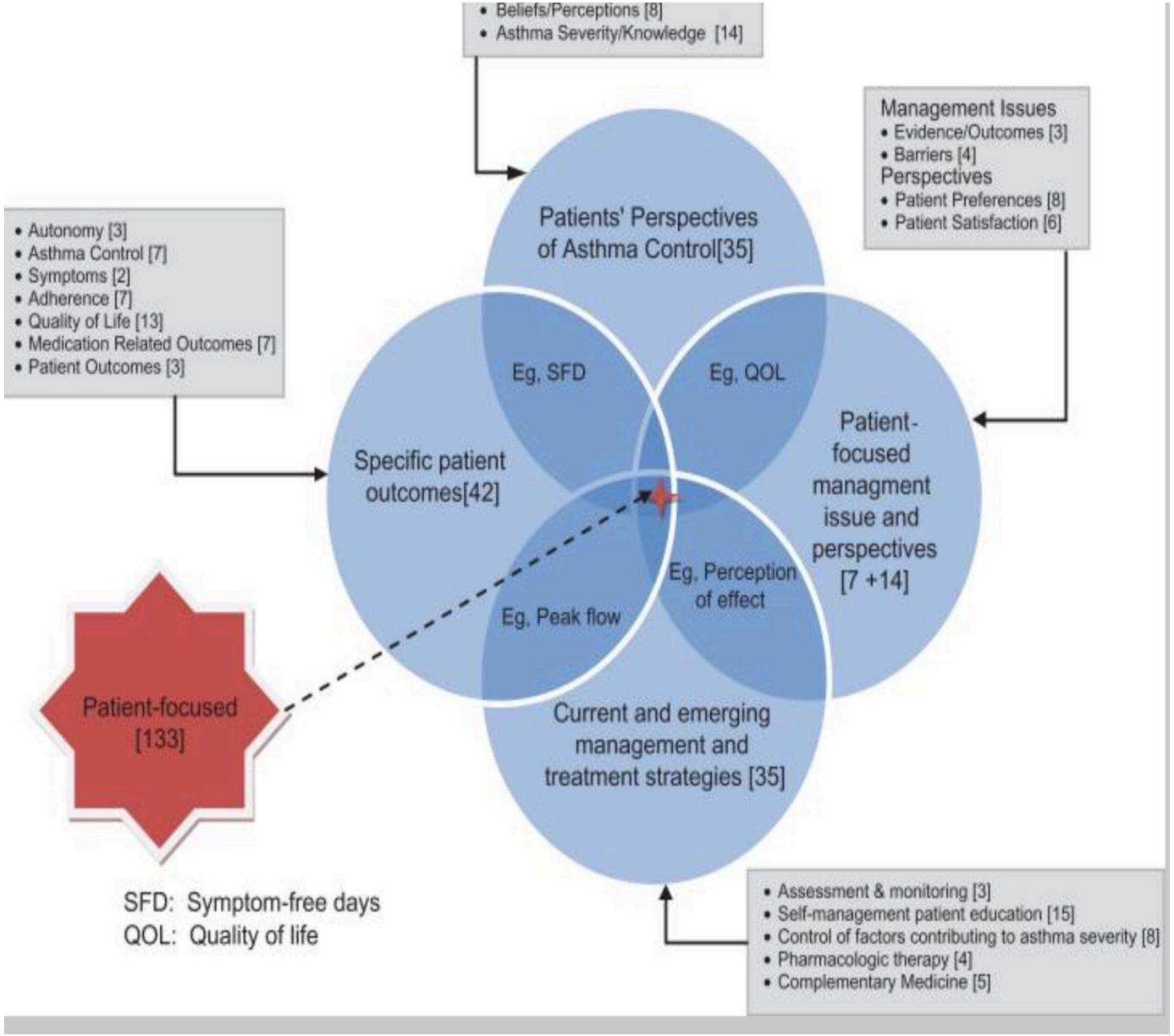
Keywords: asthma, adherence, adolescents, treatment

Table 1 Factors Affecting Asthma Medication Non-Adherence

General Factors	Adolescent-Specific Factors
• Inadequate instructions or complex/time-consuming regimen	• Desire for independence and responsibility, including rejection of parental monitoring and support
• Lack of structured home environment/routine, including hectic schedules	• Parent–child conflict and confusion over who is responsible for ensuring that medications are taken correctly
• Lack of communication/coordination between patients and caregivers	• Difficulties in organizing time and setting priorities
• Insufficient education and negative perceptions about treatment, eg, unpalatable taste, fear of side effects and concerns about addiction/dependence	• Forgetfulness or being too busy to take medication
• Incorrect inhaler use	• Lack of engagement in decision-making around medication use
• Lack of awareness of difference between rescue and controller medication	• Overreliance on parents/caregivers coupled with lack of parental motivation, eg, due to emotional/financial burden or maternal depression
• Unwillingness to take medication to prevent or reduce future risks rather than to address immediate symptoms	
• Lack of trust or poor rapport between patients and HCPs	• Not being motivated to take medication or considering regimen to be too time-consuming or to conflict with other activities
• Inability to recognize asthma symptoms or tolerance of asthma symptoms that most HCPs would find unacceptable	• Lack of perceived effect of asthma medications
• Impact of mental health, eg, depression and anxiety	• Social stigma/embarrassment in front of friends
	• Risk-taking behaviors such as smoking, drinking alcohol and marijuana use
	• Increased impact of mental health disorders in adolescents

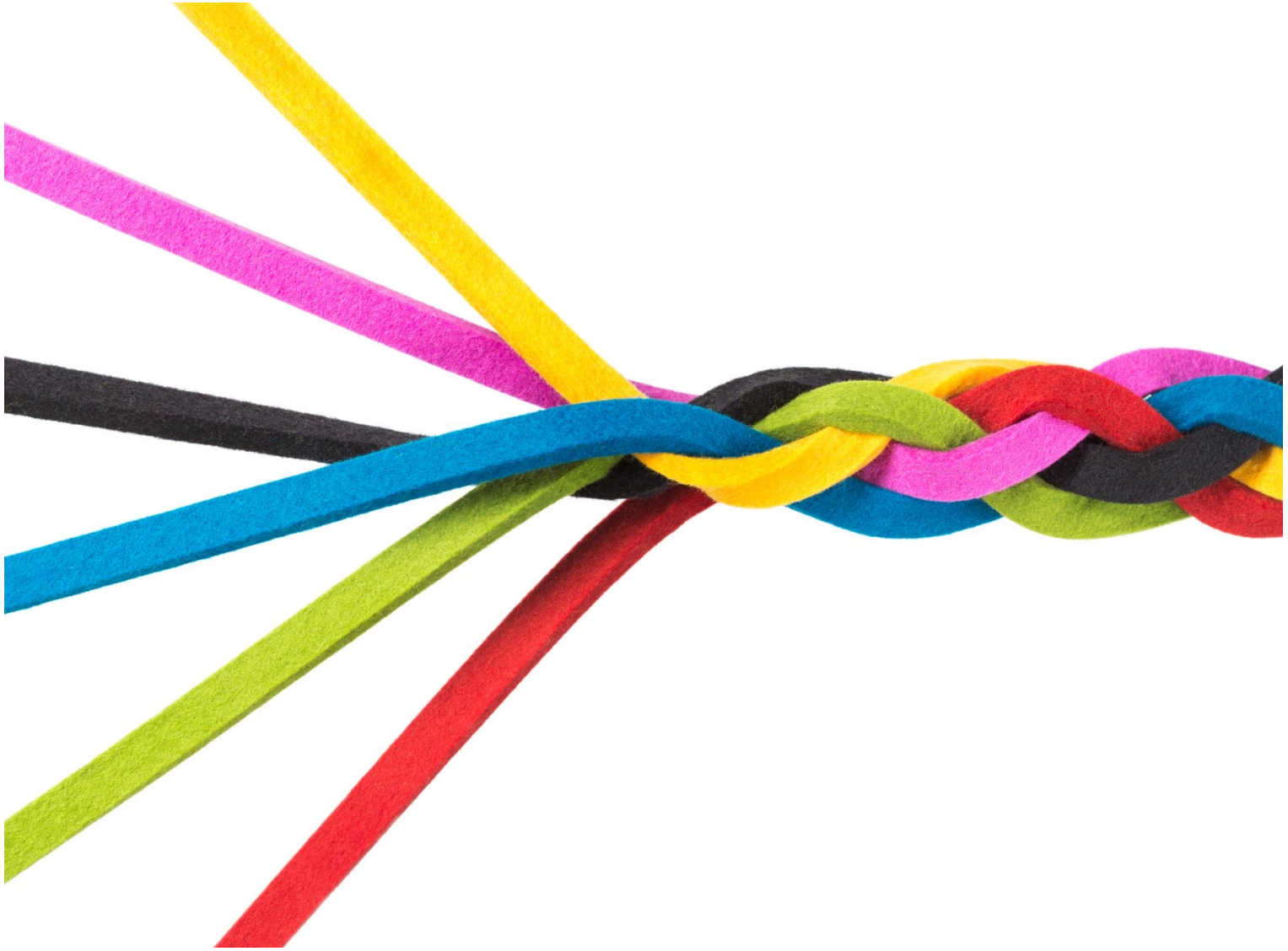
Abbreviation: HCP, healthcare practitioner.

Models in Asthma Care: Patient Centered Care



Qamar N, Pappalardo AA, Arora VM, Press VG. Patient-centered care and its effect on outcomes in the treatment of asthma. Patient Relat Outcome Meas. 2011 Jul;2:81-109. doi: 10.2147/PROM.S12634. Epub 2011 Mar 6. PMID: 22915970; PMCID: PMC3417925.

What is Shared Decision Making?



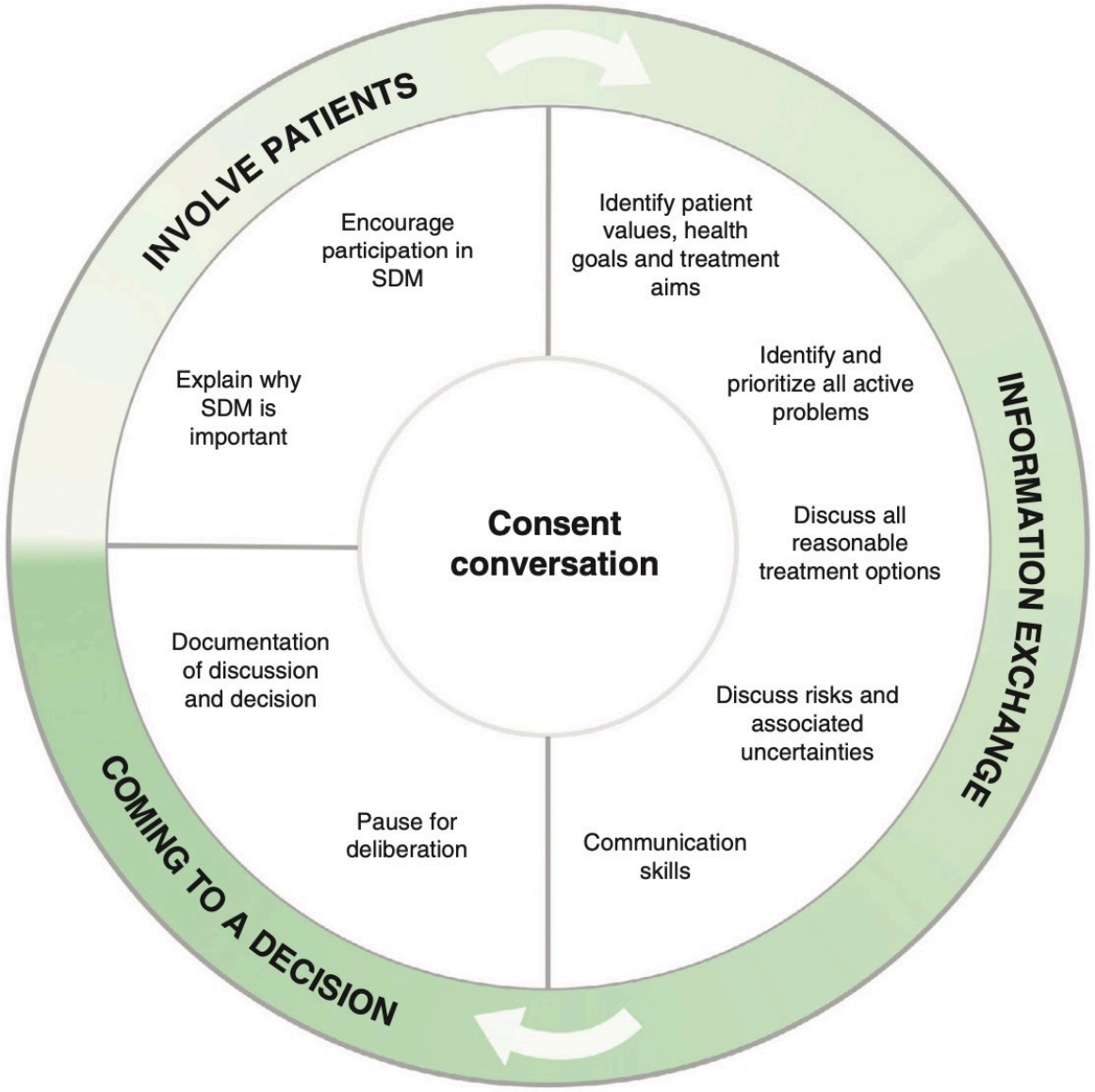
Shared Decision Making- Multistep Process

Relationship building

Sharing of information

Patients can express preferred treatment or non-treatment

How Do I Approach Shared Decision Making?



Normahani P, Sounderajah V, Harrop-Griffiths W, Chukwuemeka A, Peters NS, Standfield NJ, Collins M, Jaffer U. Achieving good-quality consent: review of literature, case law and guidance. BJS Open. 2020 Oct;4(5):757-763. doi: 10.1002/bjs5.50306. Epub 2020 May 31. PMID: 32475083; PMCID: PMC7528509.

Pediatrics and Shared Decision Making

Evolving developmental context

- Biological, cognitive, and psychosocial variables

Multiple stakeholders

- Child, family, and health care provider

Parents act as surrogate decision makers

Legislation and policy about pediatric health decisions

- State/Provincial laws

Effective Communication Strategies to Use with Children

- Visual aids
- Turn-taking
- Eliciting attention/Requesting help
- Clarifying communication with children
- Role modeling

Barriers To Shared Decision Making

Providers

Time constraints

Lack of applicability due to

patient characteristics

clinical situation

inadequate knowledge

Patient

- Power imbalances in the doctor-patient relationship
- Inadequate knowledge

Benefits of Shared Decision Making

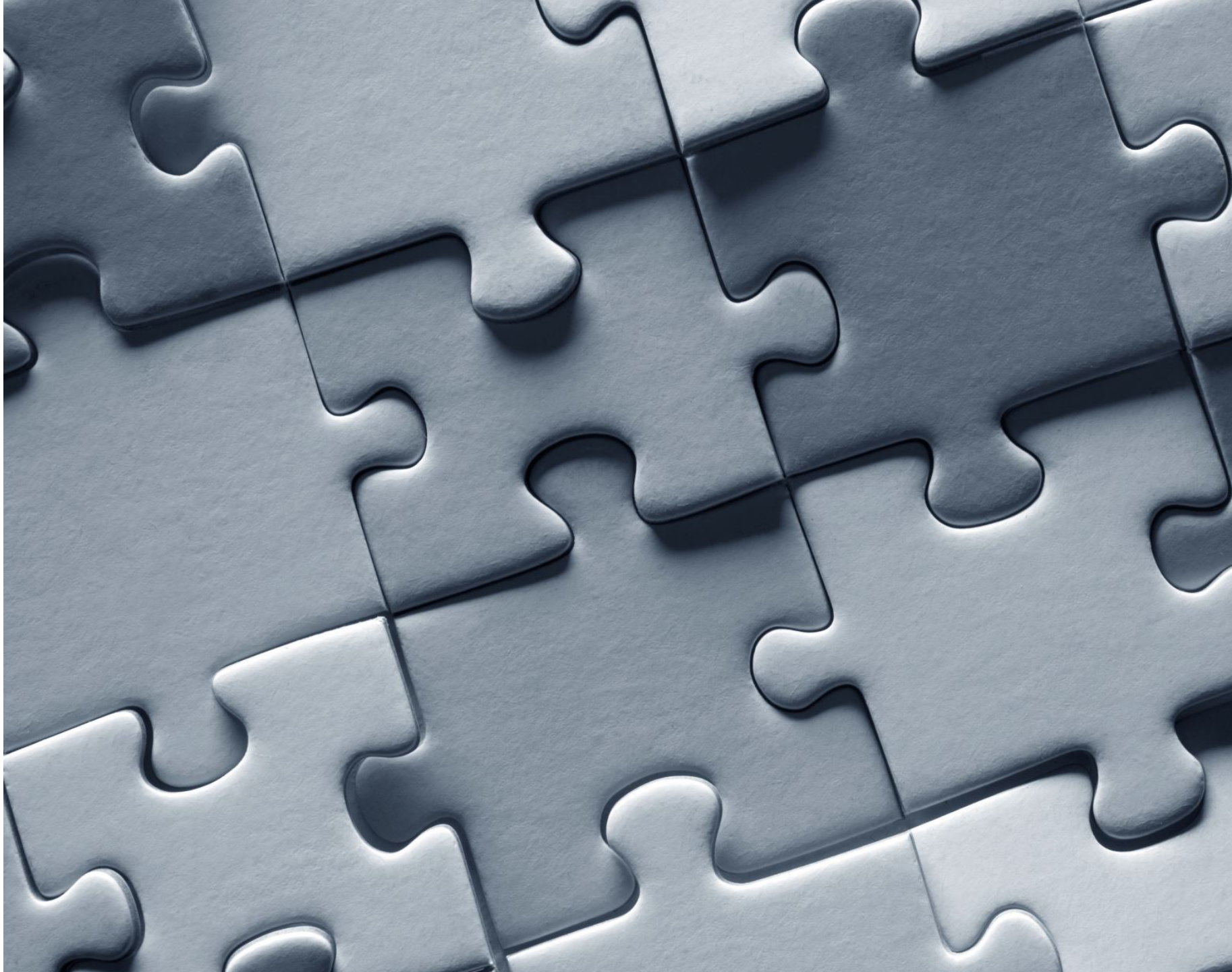
Improvement

- asthma outcomes
- medication adherence
- patient and parent satisfaction
- quality of life

Reduction of health care disparities

- Incorporate social, cultural, and environmental consideration leading to more inclusive, effective, and culturally appropriate care

Is Shared Decision Making Effective?



HHS Public Access
Author manuscript
J Asthma. Author manuscript; available in PMC 2020 May 16.

Published in final edited form as:
J Asthma. 2018 June ; 55(6): 675–683. doi:10.1080/02770903.2017.1362423.

Impact of Shared Decision Making on Asthma Quality of Life and Asthma Control among Children

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Abstract

Objective: Few studies have examined the effectiveness of shared decision making (SDM) in clinical practice. This study evaluated the impact of SDM on quality of life and symptom control in children with asthma.

Methods: We conducted a prospective 3-year study in six community-based practices serving a low-income patient population. Practices received training on SDM using an evidence-based toolkit. Patients aged 2 to 17 with a diagnosis of asthma were identified from scheduling and billing data. At approximate 6-month intervals, patients completed a survey consisting of the Mini Pediatric Asthma Quality of Life Questionnaire (range 1–7) and the control domain of the Pediatric Asthma Therapy Assessment Questionnaire (range 0–7). We used propensity scores to match 46 children receiving SDM to 46 children receiving usual care with decision support. Included children had completed a baseline survey and at least one follow-up survey. Random coefficient models incorporated repeated measures to assess the effect of SDM on asthma quality of life and asthma control.

Results: The sample was primarily of non-White patients (94.6%) with Medicaid insurance (92.4%). Receipt of SDM using an evidence-based toolkit was associated with higher asthma quality of life (mean difference 0.9; 95% confidence interval [CI] 0.4–1.4) and fewer asthma control problems (mean difference –0.9; 95% CI –1.6– –0.2) compared to usual care with decision support.

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Contributors' Statement

Dr. Taylor developed the analysis plan, managed the study data, conducted initial statistical analyses, drafted the manuscript and approved the final manuscript as submitted.

Dr. Tapp and Ms. Shade assisted with conceptualization of the study, conducted training on shared decision making, assisted with interpretation of results and approved the final manuscript as submitted.

Dr. Liu conducted statistical analyses, critically reviewed the manuscript, and approved the final manuscript as submitted.

Ms. Mowrer coordinated the data collection, critically reviewed the manuscript, and approved the final manuscript as submitted.

Dr. Dulin conceptualized and designed the study, assisted with interpretation of results and approved the final manuscript as submitted.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

Prospective 3 year study in 6 community based practices serving a low income patient population.

Patients 2-17 with a diagnosis of asthma

Quality of Life Survey given at 6 month intervals

Matched case and controls

- 46 children receiving SDM
- 46 children usual care and

Results- Shared decision making using evidence based toolkit

- Associated the higher asthma quality of life
- Fewer control problems

Published in final edited form as:
J Asthma. 2018 September ; 55(9): 949–955. doi:10.1080/02770903.2017.1378357.

Shared decision making and time to exacerbation in children with asthma

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Abstract

Objective: Although shared decision making (SDM) is a promising approach for improving outcomes for patients with chronic diseases, no evidence currently supports the use of SDM to delay asthma exacerbations. We evaluated the impact of an SDM intervention implemented by providers in a real-world setting on time to exacerbation in children with asthma.

Methods: This study used a prospective cohort observed between 2011 and 2013 at five primary care practices that serve vulnerable populations (e.g., Medicaid and uninsured patients) in Charlotte, NC. Patients aged 2 to 17 receiving SDM were matched to those receiving usual care using propensity scores. Time to asthma exacerbation (asthma hospitalization, emergency department visit or oral steroid prescription in the outpatient setting) was compared between groups using Kaplan-Meier curves and conditional Cox proportional hazards models.

Results: The cohort included 746 children, 60.5% male and 54.2% African American, with a mean age of 8.6 years. Of these, 625 received usual care and 121 received SDM. The final analysis included 100 matched pairs of children. Kaplan-Meier curves showed longer exacerbation-free time for patients in the SDM intervention compared to those in usual care ($p = 0.005$). The difference in risk of experiencing an exacerbation was marginally significant between the two groups (HR = 0.56, 95% C.I. = 0.29–1.08, $p = 0.08$).

Conclusions: SDM was found to delay exacerbations among children with asthma. Clinicians should consider incorporating patient preferences in treatment decisions through SDM as a means for longer exacerbation-free time among children with poor asthma control.

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Declaration of interest

Dr Blanchette reports being employed and receiving consulting fee from Precision Health Economics, receiving consulting fee from Grifols and United Therapeutics, and receiving research fund as principal investigator at Teva Pharmaceuticals and Novartis Pharmaceuticals. Dr Dulin reports receiving consulting fee from Tresata. The authors alone are responsible for the content and writing of the paper.

Prospective cohort 2011-2013 based at 5 practices serving a low income patient population.

Patients 2-17 with a diagnosis of asthma

Time to asthma exacerbation

(asthma hospitalization, ED visit, or oral steroid in outpatient setting)

100 Matched case and controls

- 50 children receiving SDM
- 50 children usual care

Results: Risk difference of experiencing an exacerbation was marginally significant.

Shared decision making delayed exacerbations among children with asthma

Parent-Reported Outcomes of a Shared Decision-Making Portal in Asthma: A Practice-Based RCT

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abstract

BACKGROUND: Electronic health record (EHR)-linked patient portals are a promising approach to facilitate shared decision-making between families of children with chronic conditions and pediatricians. This study evaluated the feasibility, acceptability, and impact of MyAsthma, an EHR-linked patient portal supporting shared decision-making for pediatric asthma.

METHODS: We conducted a 6-month randomized controlled trial of MyAsthma at 3 primary care practices. Families were randomized to MyAsthma, which tracks families' asthma treatment concerns and goals, children's asthma symptoms, medication side effects and adherence, and provides decision support, or to standard care. Outcomes included the feasibility and acceptability of MyAsthma for families, child health care utilization and asthma control, and the number of days of missed school (child) and work (parent). Descriptive statistics and longitudinal regression models assessed differences in outcomes between study arms.

RESULTS: We enrolled 60 families, 30 in each study arm (mean age 8.3 years); 57% of parents in the intervention group used MyAsthma during at least 5 of the 6 study months. Parents of children with moderate to severe persistent asthma used the portal more than others; 92% were satisfied with MyAsthma. Parents reported that use improved their communication with the office, ability to manage asthma, and awareness of the importance of ongoing attention to treatment. Parents in the intervention group reported that children had a lower frequency of asthma flares and intervention parents missed fewer days of work due to asthma.

CONCLUSIONS: Use of an EHR-linked asthma portal was feasible and acceptable to families and improved clinically meaningful outcomes.

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Dr Fiks contributed to the conception and design of the study, acquisition of data, analysis and interpretation of the data, drafted the manuscript, and approved the final manuscript as submitted; Ms Mayne contributed to the acquisition of data, analysis and interpretation of data, drafting the manuscript, and approved the final manuscript as submitted; Mr Karavite, Mr Suh, and Mr O'Hara contributed to the acquisition of data, critically reviewed the manuscript, and approved the manuscript as submitted; Drs Localio, Ross, and Grundmeier contributed to the conception and design of the study, analysis and interpretation of data, critically reviewed the manuscript, and approved the final manuscript as submitted.

This trial has been registered at clinicaltrials.gov (identifier NCT01715389).

www.pediatrics.org/cgi/doi/10.1542/peds.2014-3167

DOI: 10.1542/peds.2014-3167

Accepted for publication Jan 6, 2015

WHAT'S KNOWN ON THIS SUBJECT: Strategies are needed to engage families of chronically ill children at home in an ongoing process of shared decision-making regarding treatment that is responsive to families' concerns and goals and children's evolving symptoms.

WHAT THIS STUDY ADDS: This study evaluated a novel patient portal that facilitates shared decision-making in asthma. The portal was feasible and acceptable to families, improved outcomes, and provides a model for improving care through an electronic health record portal.

TABLE 2

Asthma-Related Health Care Use Among Children in the Intervention and Control Groups Reported at 6-mo Follow-up

Type of Visit	Number and Proportion of Children With ≥1 Event, *n* (%)		Total Count of Events	
	Intervention, *n* = 26	Control, *n* = 27	Intervention	Control
Hospitalizations	0 (0)	1 (4)	0	2
ED visits	2 (8)	6 (22)	3	9
Asthma specialist visits	8 (31)	12 (44)	11	21
Primary care asthma visits	16 (62)	18 (67)	29	41

Based on parent report. Twenty-six of 30 parents in the intervention group and 27 of 30 parents in the control group completed the 6-mo follow-up survey.

TABLE 3

Change in Days of School and Work Missed Because of Asthma

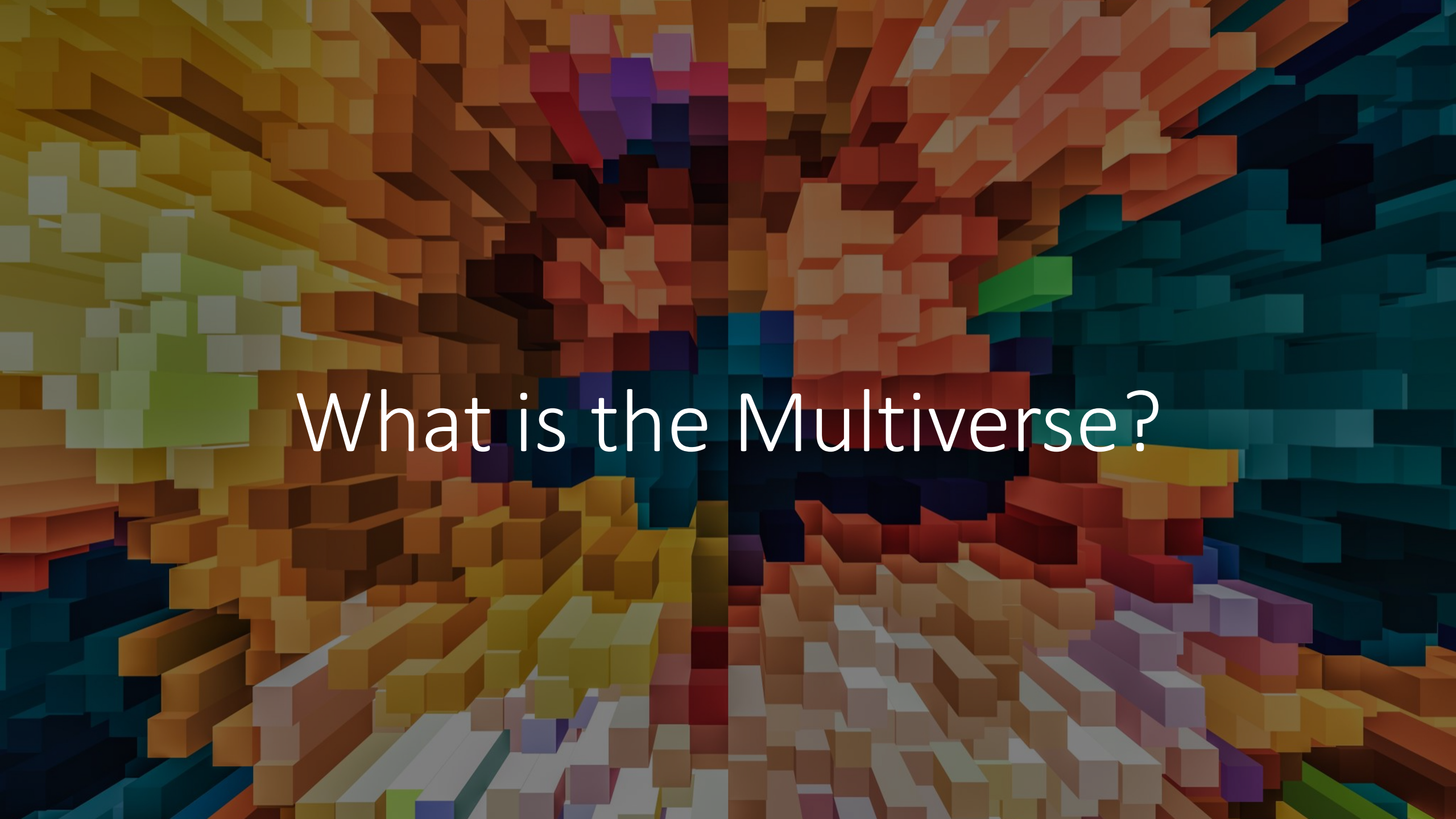
	Number and Proportion of Children/Parents Missing ≥1 Day, *n* (%)				Mean Number of Days Missed per Child/Parent in Each Study Arm			
	Intervention	**Control**	**DID**	***P*[a]**	**Intervention**	**Control**	**DID**	***P*[b]**
Days of school missed in the past month (child)								
Baseline	14 (52)	16 (57)			1.7	2.3		
At 6 mo	7 (27)	11 (41)			0.6	1.9		
Change	−7 (−25)	−5 (−16)	−2 (−9)	.7	−1.1	−0.4	−0.7	.2*
Days of work missed in the past month (parent)								
Baseline	12 (46)	8 (32)			1.1	0.8		
At 6 mo	1 (4)	10 (37)			<0.1	1.5		
Change	−11 (−42)	+2 (+5)	−13 (−47)	.07	−1.1	+0.7	−1.8	.001*

At baseline, $n = 30$ for each group. At follow-up, $n = 26$ for intervention, $n = 27$ for control. DID, difference in difference.

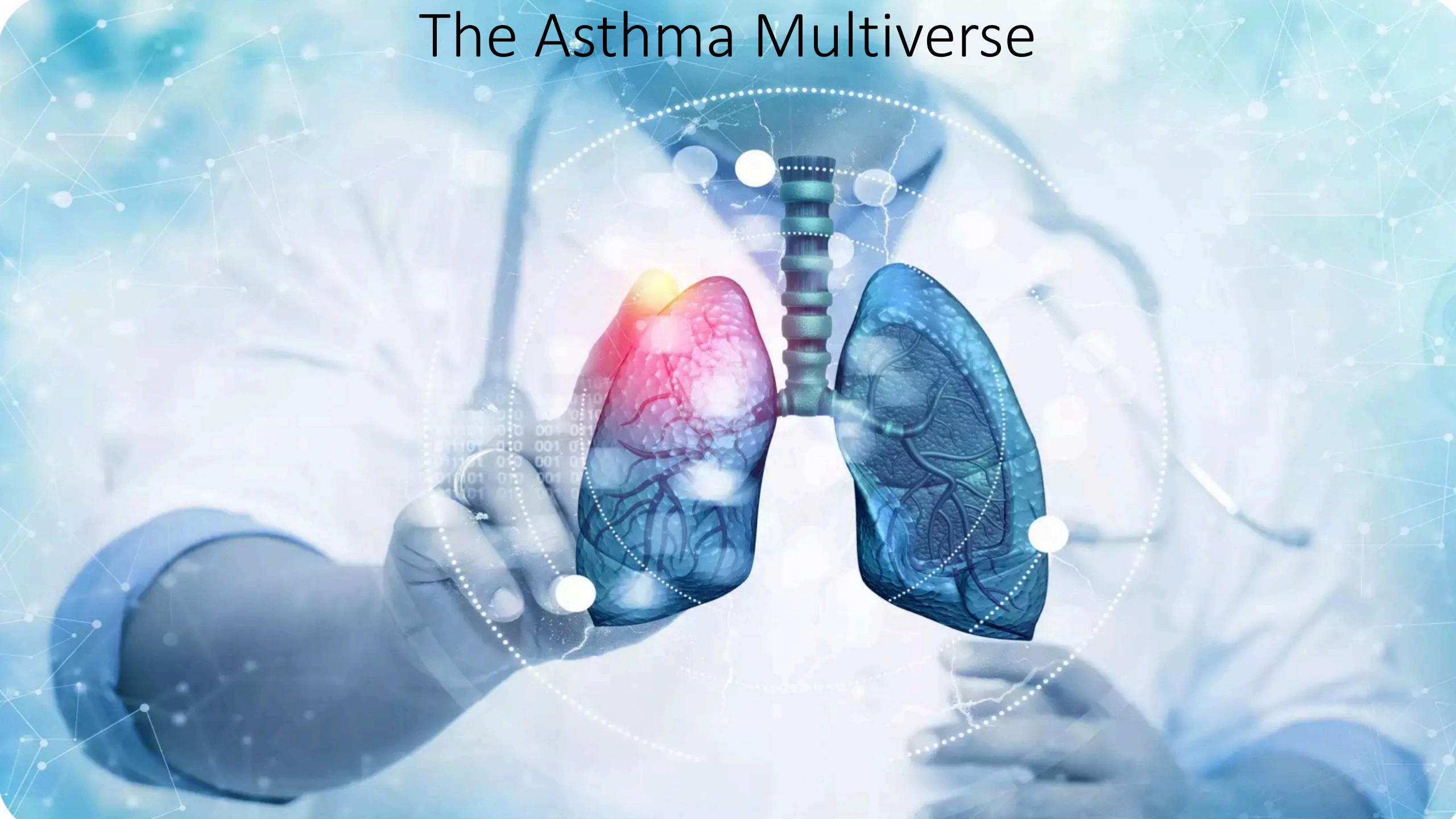
[a]From longitudinal random intercept logit models (xtlogit in Stata) with a time*study arm interaction, clustering by patient; *P* value is for the interaction term.

[b]From longitudinal random intercept negative binomial models (xtnbreg in Stata) with a time*study arm interaction, clustering by patient; *P* value is for the interaction term.

Fiks AG, Mayne SL, Karavite DJ, Suh A, O'Hara R, Localio AR, Ross M, Grundmeier RW. Parent-reported outcomes of a shared decision-making portal in asthma: a practice-based RCT. Pediatrics. 2015 Apr;135(4):e965-73. doi: 10.1542/peds.2014-3167. Epub 2015 Mar 9. PMID: 25755233; PMCID: PMC4379463.


What is the Multiverse?

The Asthma Multiverse



Technology and Shared Decision Making

Received: 14 September 2021 | Revised: 26 October 2022 | Accepted: 14 February 2023

DOI: 10.1111/bioe.13158

ORIGINAL ARTICLE

bioethics WILEY

Artificial intelligence and the doctor–patient relationship expanding the paradigm of shared decision making

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Funding information
Schweizerischer Nationalfonds zur Förderung der Wissenschaftlichen Forschung, Grant/Award Number: 407740_187263/1

Abstract

Artificial intelligence (AI) based clinical decision support systems (CDSS) are becoming ever more widespread in healthcare and could play an important role in diagnostic and treatment processes. For this reason, AI-based CDSS has an impact on the doctor–patient relationship, shaping their decisions with its suggestions. We may be on the verge of a paradigm shift, where the doctor–patient relationship is no longer a dual relationship, but a triad. This paper analyses the role of AI-based CDSS for shared decision-making to better comprehend its promises and associated ethical issues. Moreover, it investigates how certain AI implementations may instead foster the inappropriate paradigm of paternalism. Understanding how AI relates to doctors and influences doctor–patient communication is essential to promote more ethical medical practice. Both doctors' and patients' autonomy need to be considered in the light of AI.

Artificial Intelligence (AI) and Shared Decision Making: A Paradigm Shift

Effective Communication + Respect for Voluntary Choices = Shared Decision Making

AI Benefits

- Enhance diagnostic ability
- Empower decision making

AI Risks

- Limiting autonomy (Double Paternalism)
  - Creating paternalistic doctor-patient relationship
  - AI may limit doctor's decisions
- Create additional obligations
- Lacks contextual and emotional intelligence

RESEARCH ARTICLE

Artificial intelligence-assisted clinical decision support for childhood asthma management: A randomized clinical trial

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OPEN ACCESS

Citation: Seol HY, Shrestha P, Muth JF, Wi C-I, Sohn S, Ryu E, et al. (2021) Artificial intelligence-assisted clinical decision support for childhood asthma management: A randomized clinical trial. PLoS ONE 16(8): e0255261. https://doi.org/10.1371/journal.pone.0255261

Editor: Christophe Leroyer, Universite de Bretagne Occidentale, FRANCE

Received: April 6, 2021

Accepted: July 8, 2021

Published: August 2, 2021

Data Availability Statement: If any investigators at other academic institutions who wish to obtain the de-identified minimal data set used in the publication request access from the authors and Mayo directly, we can ensure the appropriate IRB approval and agreement is put into place to share the data. This process will ensure that they retain control of the data in accordance with Mayo policy. The appropriate contact person is Ms. Julie A. Hanson at Mayo Clinic (Hanson.Julie1@mayo.edu).

Abstract

Rationale

Clinical decision support (CDS) tools leveraging electronic health records (EHRs) have been an approach for addressing challenges in asthma care but remain under-studied through clinical trials.

Objectives

To assess the effectiveness and efficiency of Asthma-Guidance and Prediction System (A-GPS), an Artificial Intelligence (AI)-assisted CDS tool, in optimizing asthma management through a randomized clinical trial (RCT).

Methods

This was a single-center pragmatic RCT with a stratified randomization design conducted for one year in the primary care pediatric practice of the Mayo Clinic, MN. Children (<18 years) diagnosed with asthma receiving care at the study site were enrolled along with their 42 primary care providers. Study subjects were stratified into three strata (based on asthma severity, asthma care status, and asthma diagnosis) and were blinded to the assigned groups.

Measurements

Intervention was a quarterly A-GPS report to clinicians including relevant clinical information for asthma management from EHRs and machine learning-based prediction for risk of

A-GPS reduced clinician burden for chart review

Table 2. Primary and secondary outcomes in intervention and control groups.

	Intervention (n = 90)	Control (n = 94)	P-value
Primary outcome			
Asthma exacerbation, n (%)	11 (12%)	14 (15%)	0.60
Secondary outcomes**			
Clinician's time in minutes taken to make clinical decision, median (IQR)	3.5 (2–5) min	11.3 (6.3–15) min	<0.001
Health care cost ($), mean (95% CI)**			
Pre-intervention predicted cost	$2474 ($1540, $3409)	$1721 ($1085, $2357)	
Post-intervention predicted cost	$1438 ($895, $1981)	$1800 ($1135, $2466)	
Difference	-$1036 (-$2177, $44)	$80 (-$841, $1000)	0.12
Percentage of the duration of well-controlled asthma by quarterly ACT or TRACK score (%), median (IQR)	100 (75 to 10)	100 (100 to 100)	0.56
Timeliness for follow-up care after asthma exacerbation (days)^, median (IQR)	7 (2 to 27)	28 (6 to 48)	0.10

^Using Kapan Meier method among those with asthma exacerbation (11 for the Intervention and 14 for the control group)

**Clinician's time for making clinical decision related to asthma for the intervention vs. the control group was compared, while clinicians themselves were not randomized.

https://doi.org/10.1371/journal.pone.0255261.t002

Digital Twin System for Children: Artificial Intelligence

JOURNAL OF MEDICAL INTERNET RESEARCH

Viewpoint

Technical, Ethical, Legal, and Societal Challenges With Digital Twin Systems for the Management of Chronic Diseases in Children and Young People

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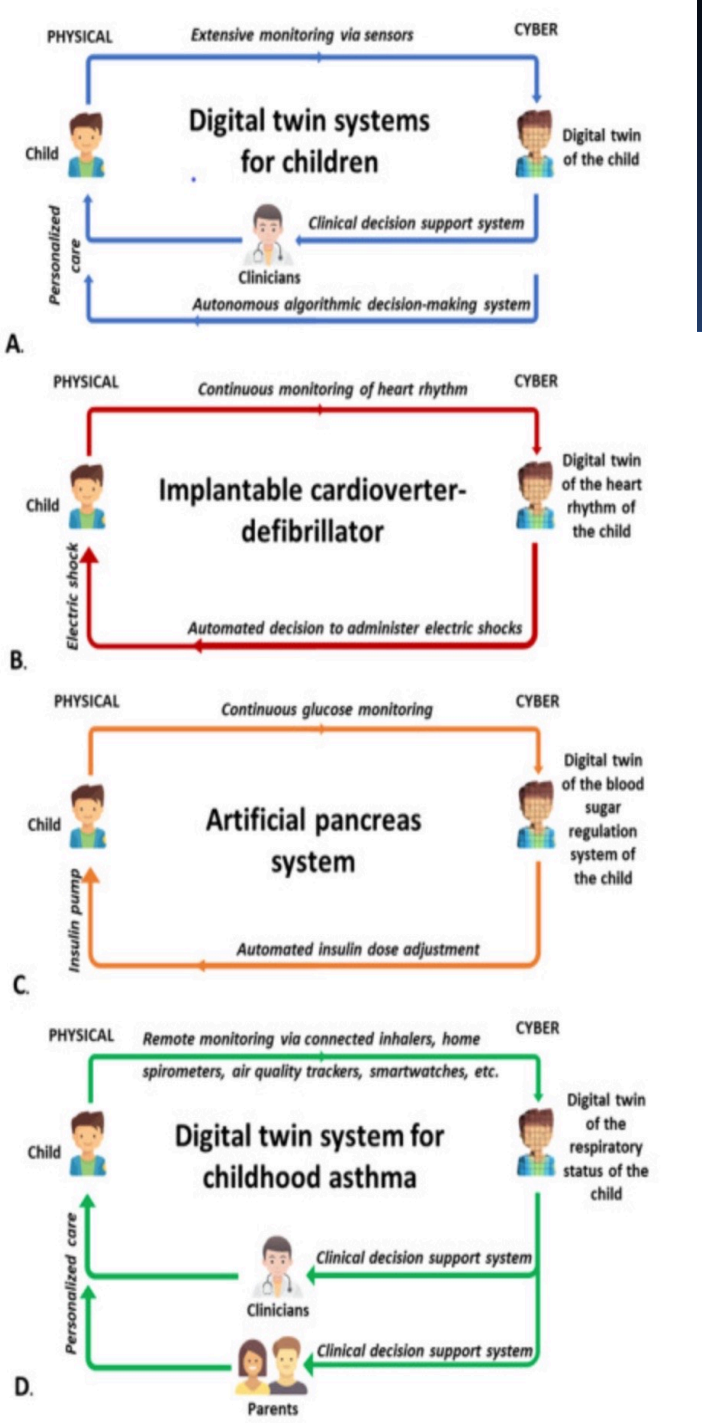
Abstract

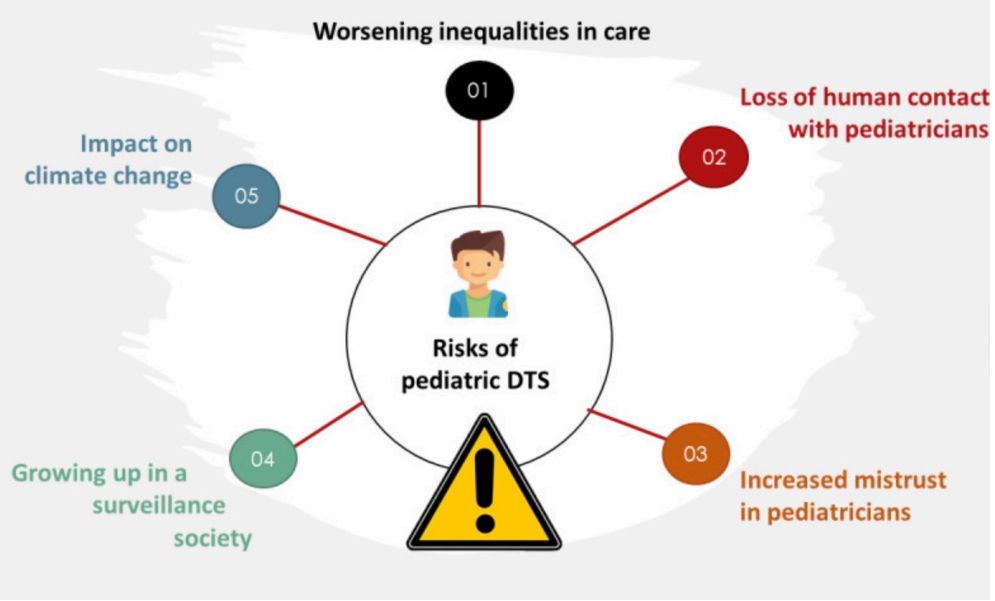
Advances in digital medicine now make it possible to use digital twin systems (DTS), which combine (1) extensive patient monitoring through the use of multiple sensors and (2) personalized adaptation of patient care through the use of software. After the artificial pancreas system already operational in children with type 1 diabetes, new DTS could be developed for real-time monitoring and management of children with chronic diseases. Just as providing care for children is a specific discipline—pediatrics—because of their particular characteristics and needs, providing digital care for children also presents particular challenges. This article reviews the technical challenges, mainly related to the problem of data collection in children; the ethical challenges, including the need to preserve the child's place in their care when using DTS; the legal challenges and the dual need to guarantee the safety of DTS for children and to ensure their access to DTS; and the societal challenges, including the needs to maintain human contact and trust between the child and the pediatrician and to limit DTS to specific uses to avoid contributing to a surveillance society and, at another level, to climate change.

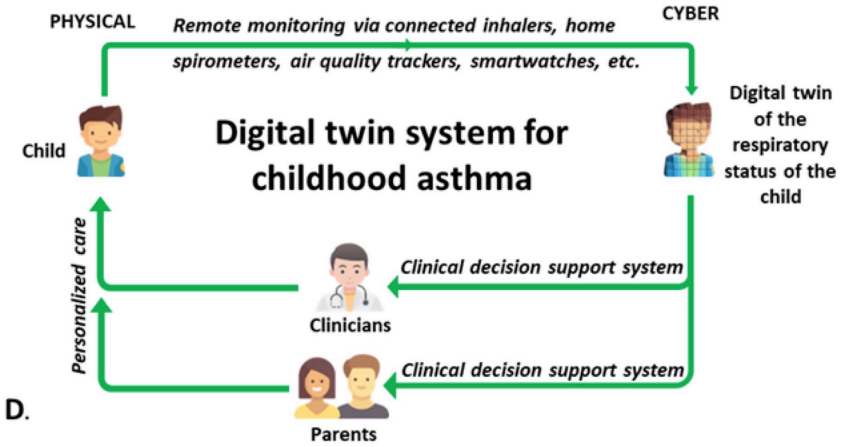
(J Med Internet Res 2022;24(10):e39698) doi: 10.2196/39698



Digital Twin System for Children: Artificial Intelligence

Figure 3





Drummond D, Coulet A. Technical, Ethical, Legal, and Societal Challenges With Digital Twin Systems for the Management of Chronic Diseases in Children and Young People. J Med Internet Res 2022;24(10):e39698
URL: https://www.jmir.org/2022/10/e39698

Artificial Intelligence and Shared Decision Making in Children

European Journal of Pediatrics (2023) 182:877–888
https://doi.org/10.1007/s00431-022-04754-8

RESEARCH

Children's views on artificial intelligence and digital twins for the daily management of their asthma: a mixed-method study

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Received: 15 October 2022 / Revised: 30 November 2022 / Accepted: 5 December 2022 / Published online: 13 December 2022

Abstract

New technologies enable the creation of digital twin systems (DTS) combining continuous data collection from children's home and artificial intelligence (AI)-based recommendations to adapt their care in real time. The objective was to assess whether children and adolescents with asthma would be ready to use such DTS. A mixed-method study was conducted with 104 asthma patients aged 8 to 17 years. The potential advantages and disadvantages associated with AI and the use of DTS were collected in semi-structured interviews. Children were then asked whether they would agree to use a DTS for the daily management of their asthma. The strength of their decision was assessed as well as the factors determining their choice. The main advantages of DTS identified by children were the possibility to be (i) supported in managing their asthma (ii) from home and (iii) in real time. Technical issues and the risk of loss of humanity were the main drawbacks reported. Half of the children (56%) were willing to use a DTS for the daily management of their asthma if it was as effective as current care, and up to 93% if it was more effective. Those with the best computer skills were more likely to choose the DTS, while those who placed a high value on the physician–patient relationship were less likely to do so.

Conclusions: The majority of children were ready to use a DTS for the management of their asthma, particularly if it was more effective than current care. The results of this study support the development of DTS for childhood asthma and the evaluation of their effectiveness in clinical trials.

What is Known:
- *New technologies enable the creation of digital twin systems (DTS) for children with asthma.*
- *Acceptance of these DTSs by children with asthma is unknown.*

What is New:
- *Half of the children (56%) were willing to use a DTS for the daily management of their asthma if it was as effective as current care, and up to 93% if it was more effective.*
- *Children identified the ability to be supported from home and in real time as the main benefits of DTS.*

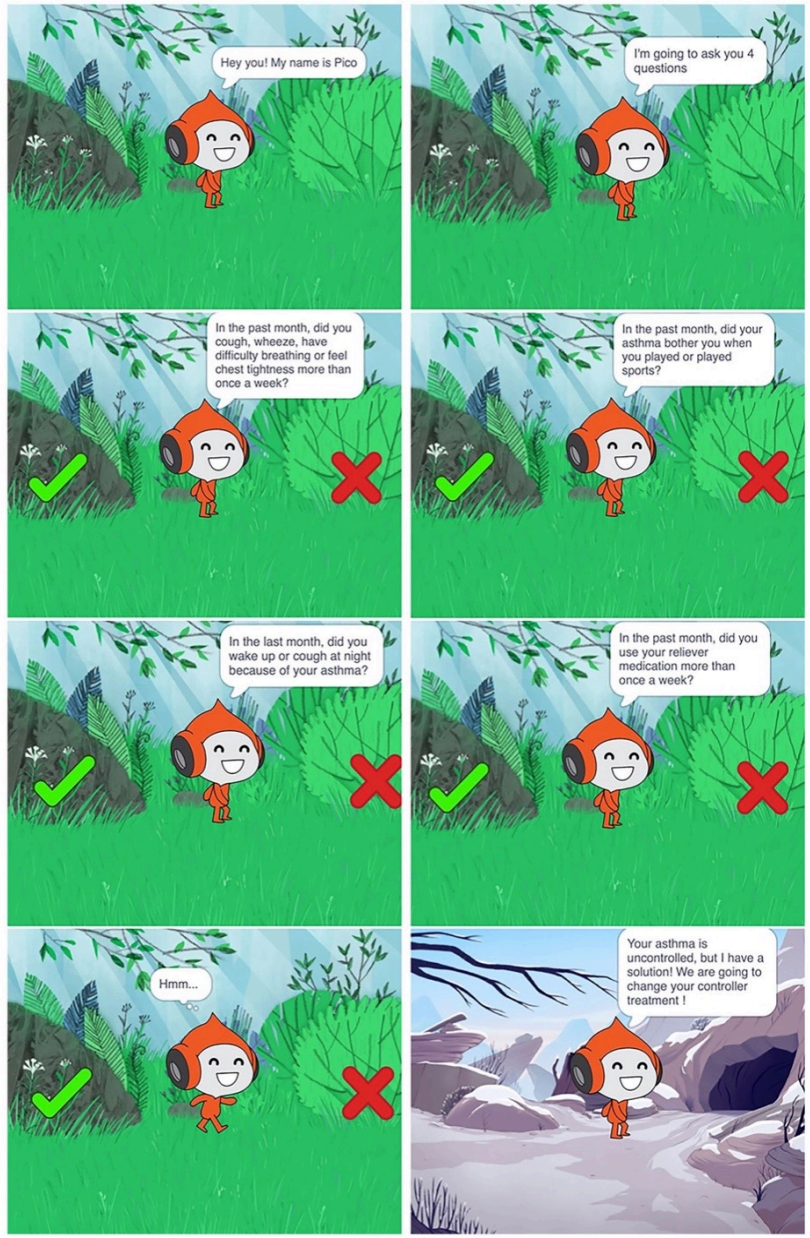

Fig. 1 Animation created for the study to show children what the interface of the digital twin system might look like (https://scratch.mit.edu/projects/721368471)

Table 4 Analysis of factors associated with acceptance of a DTS by children

Variable	Adjusted for	Odds ratio	Confidence interval
Age		1.03	0.91–1.17
Sex (male)		1.56	0.76–3.25
School level	Age, parent's education level		
Elementary school		1 (ref)	Reference
Middle school		1.13	0.32–4.06
High school		1.21	0.16–9.95
Parent's education level			
No degree		1 (ref)	Reference
High school degree		0.42	0.14–1.21
Undergraduate and graduate degree		1.05	0.30–2.81
Agreement to the use of personal data	Age, sex, computer skills, AI knowledge, parent's academic level	1.19	0.80–1.78
Asthma severity (GINA Step)	Age, sex		
Step 1 (reference)		1 (ref)	Reference
Step 2 and 3		1.88	0.77–4.60
Step 4 and 5		2.10	0.73–6.16
Importance of the physician–patient relationship	Age, sex	0.82	0.68–0.98
Computer skills	Age, sex, school level Parent's academic level,	2.01	1.26–3.27
Knowledge of AI	Age, sex, computer skills, Agreement about the use of personal data, parent's academic level	1.40	0.93–2.13

AI artificial intelligence

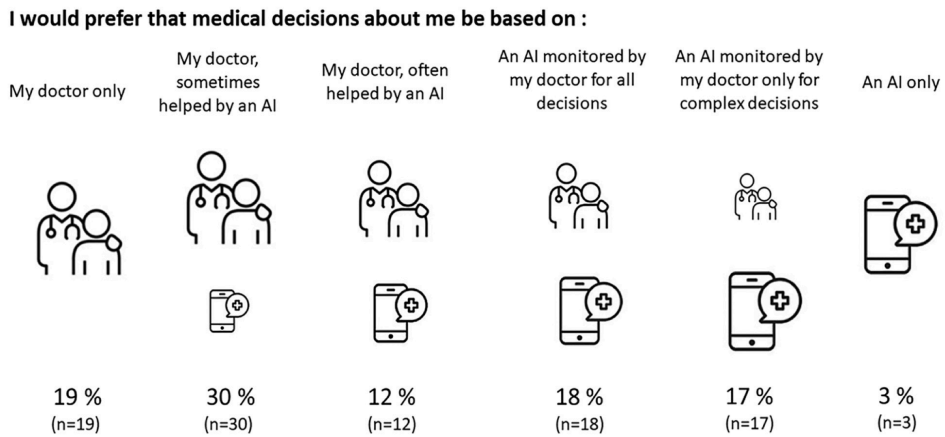

Fig. 3 Children's views on the place of the doctor and artificial intelligence in medical decisions about themselves. *AI* artificial intelligence

Potential benefits

- **Improved health**
  - Increased autonomy in life (new activities allowed)
  - Improved mental well-being (decreased cognitive load)
  - Improved social development (engagement in new social activities)
  - Increased participation in sports (decreased symptoms during exercise)
- **Improved access to health care**
  - Remote disease management
  - Timely treatment adaptation
  - Standardization of the level of care

Potential threats

- **Decreased health**
  - Risk of toxic exposure, choking (hardware)
  - Risk of malfunction (software)
- **Decreased autonomy in care**
  - Decreased participation in symptom description (child's PROM ignored)
  - Decreased participation in daily management (complexity)
- **Decreased well-being**
  - Decreased engagement in recreation and sports (complexity)
  - Reduced participation in social activities (shame and/or complexity of devices)
- **Exclusion of health care**
  - Not affordable
  - Not usable by families with low levels of digital literacy
  - Self-exclusion of low-income families (no trust in AI)

Drummond D, Coulet A. Technical, Ethical, Legal, and Societal Challenges With Digital Twin Systems for the Management of Chronic Diseases in Children and Young People. J Med Internet Res 2022;24(10):e39698
URL: https://www.jmir.org/2022/10/e39698

Emerging Trends in Pediatric Asthma: Digital Health Interventions

Digital health interventions in children with asthma

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Abstract

Although healthcare providers are actively involved in offering education, information and interventions for asthmatic patients, medication and therapeutic adherence remain low in the paediatric population, with estimates suggesting that adherence rates hover below 50%. A range of available digital health interventions has been explored in paediatric asthma with promising but variable results, limiting their widespread adoption in clinical practice. They include emerging technologies that yield the advantage of tracking asthma symptoms and medications, setting drug reminders, improving inhaler technique and delivering asthma education, such as serious games (video games designed for medical- or health-related purposes), electronic monitoring devices, speech recognition calls, text messaging, mobile apps and interactive websites. Some of the proposed digital interventions have used multiple components, including educational and behavioural strategies and interactions with medical professionals. Overall, the implementation of such interventions may offer the opportunity to improve adherence and asthma control. In a state of emergency as the COVID-19 pandemic, telemedicine can also play a central role in supporting physicians in managing children with asthma. This review evaluates the published literature examining digital health interventions for paediatric asthma and explores the most relevant issues affecting their implementation in practice and the associated evidence gaps, research limitations and future research perspectives.

KEYWORDS

adherence, asthma, children, control, digital health, intervention, serious games, telemedicine

1 | INTRODUCTION

Asthma is a common chronic disease in childhood, affecting approximately 10% of children worldwide.[1] The management of the disease is primarily aimed at maintaining symptoms control and reducing the risk of exacerbations.[2] Although most children achieve good control with standard therapies, such as inhaled corticosteroids (ICS) and/or one or more controllers, asthma still imposes a high burden, especially in children with uncontrolled symptoms.[3,4] A major cause of uncontrolled asthma is poor adherence to treatment, which has been described in 49%-71% of paediatric patients, resulting in an increased risk of missed days of school, decline in lung function, emergency department visits, hospitalizations and even death.[5-10] Therefore, it is important to take into account treatment adherence, inhaler technique and self-management education in the management of children with asthma . However, asthma management can be hampered by several factors related to individual, family, community, healthcare system and patient-provider interaction domains.[11]

Identifying interventions for promoting asthma treatment adherence and self-management is essential to obtain and maintain

Giuliana Ferrante and Amelia Licari are equally contributing co-first authors.

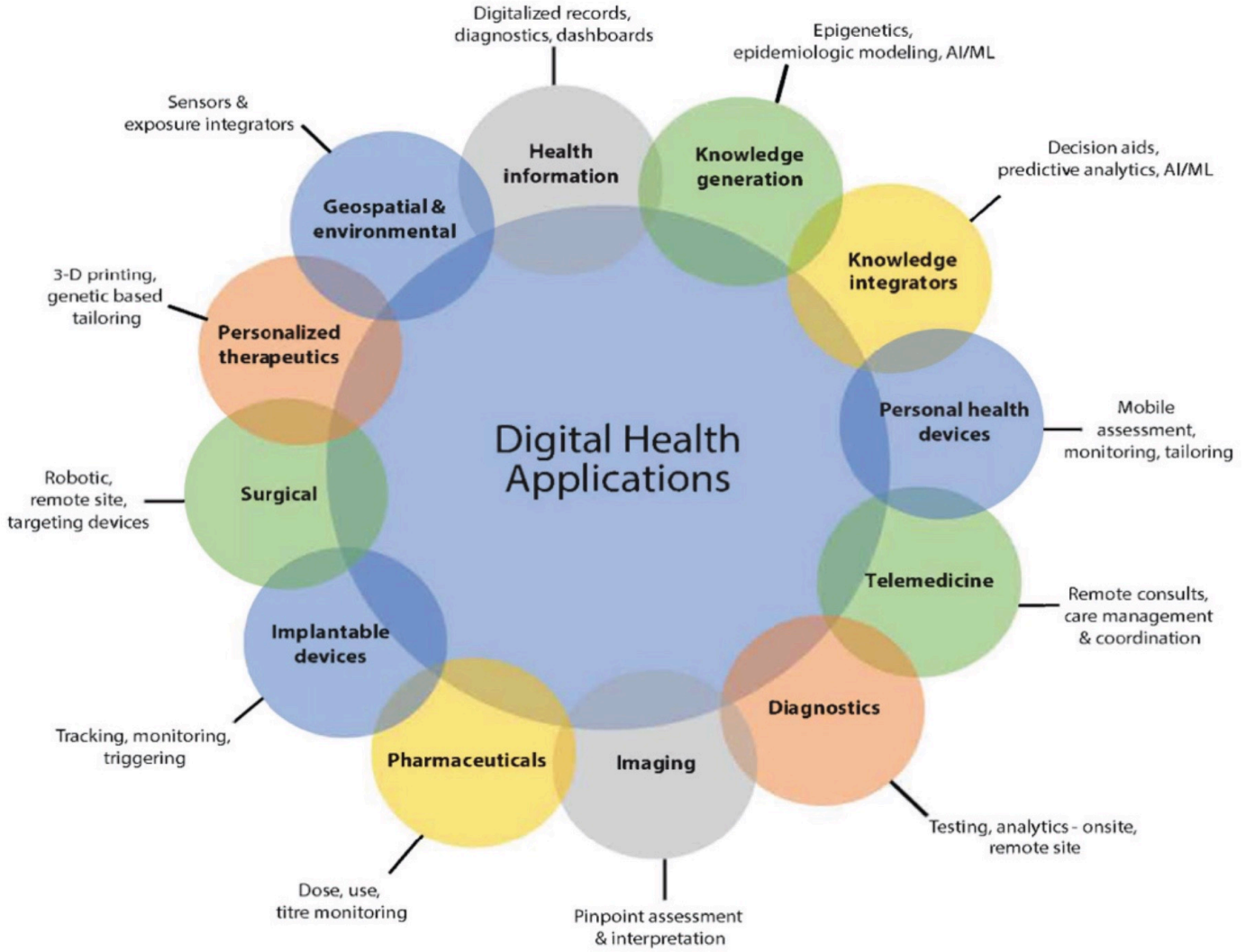


FIGURE 1 | Evolving Applications of Digital Technology in Health and Health Care
SOURCE: National Academy of Medicine. 2019. *Digital Health Action Collaborative, NAM Leadership Consortium: Collaboration for a Value & Science-Driven Health System.*

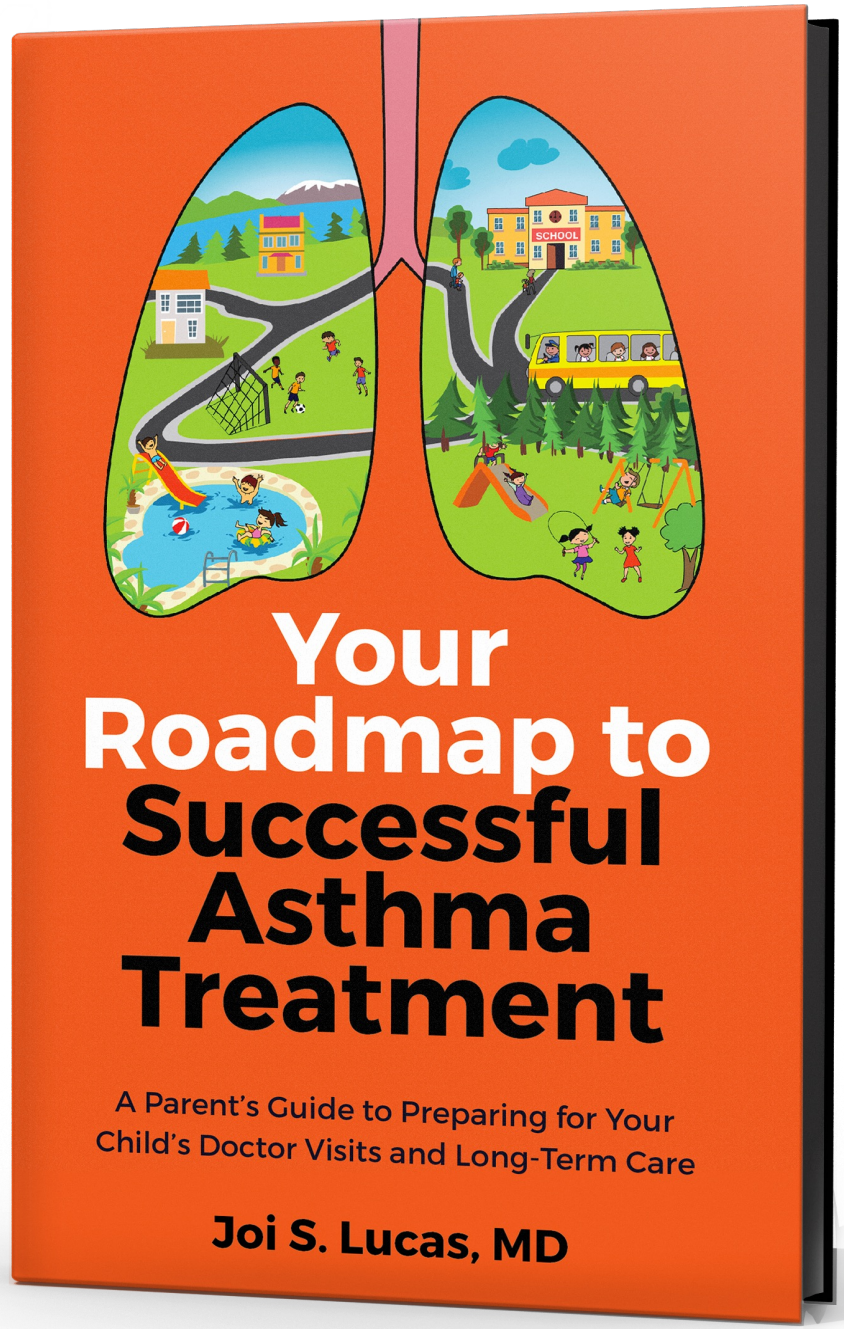
Digital Health Interventions

- Serious Games
- Electronic Monitoring Devices
  - Measure time and date of drug actuations
    - Smartinhalers
- Tools for self monitoring symptoms
  - Asthma symptom tracker
  - Medication reminder
- Mobile Health
  - over 500 asthma apps

Shared Decision Making and Social Media

ASTHMA KIDCARE GO-BAG

DR. JOI LUCAS



www.amazon.com and www.asthmagobag.com

Do Your Patients Listen to Asthma Advice from Social Media?

ORIGINAL RESEARCH

Check for updates

Describing the Digital Footprints or "Sociomes" of Asthma for Stakeholder Groups on Twitter

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ABSTRACT

Background: Although there is a great deal of conversation on social media, there may not be good communication.

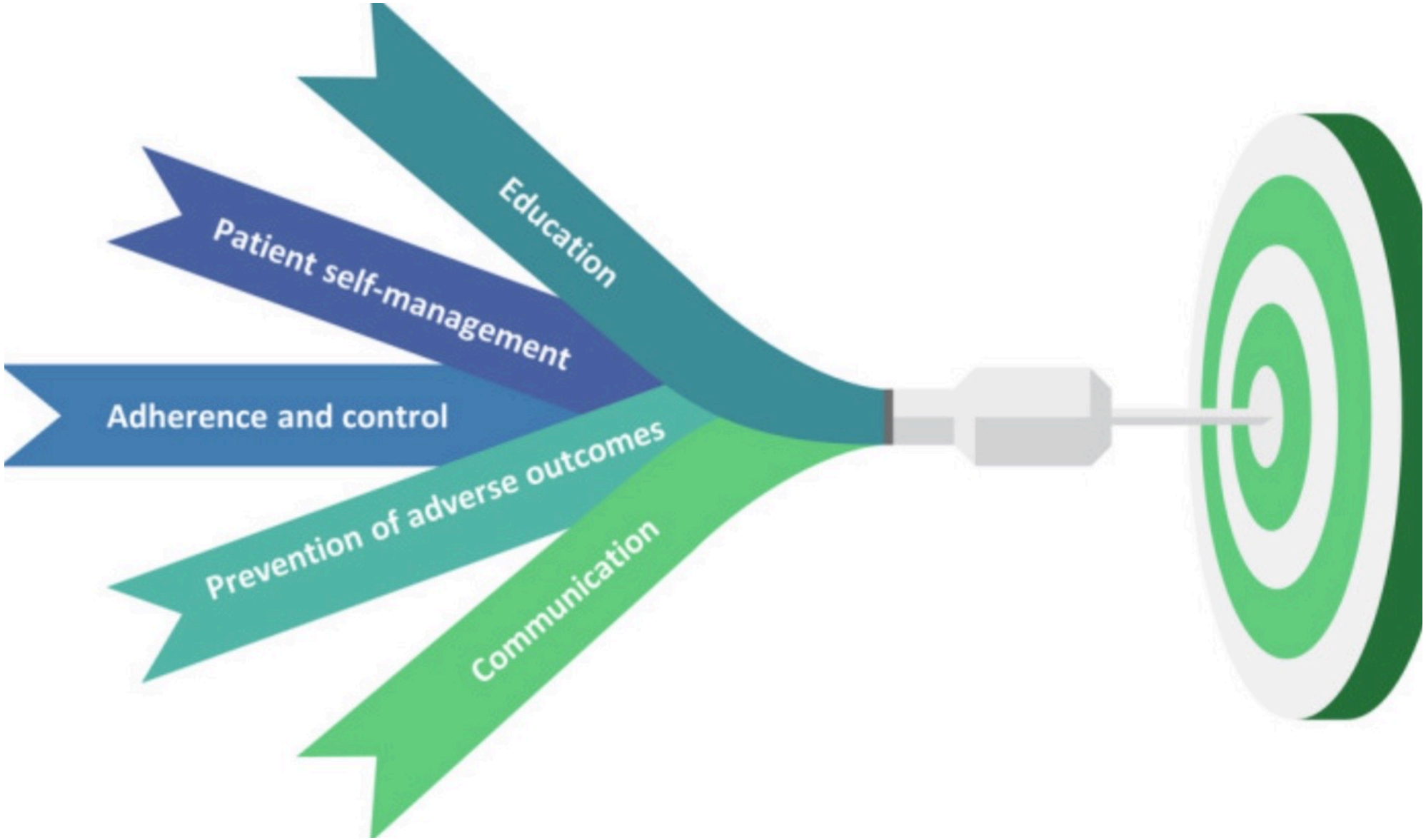
Objective: We sought to investigate communicaton activity online by examining digital footprints (or "sociomes") of asthma stakeholders on Twitter.

Methods: Tweets containing the word "asthma" and the hashtag #asthma were collected using Symplur Signals. Characteristics of usage and tweets were analyzed and compared first between the word "asthma" and the hashtag #asthma, and then among four different stakeholder groups: clinicians, patients, healthcare organizations, and industry.

Results: The #asthma sociome was significantly smaller than the "asthma" sociome, with fewer users and tweets per month. However, the #asthma sociome correlated better to asthma seasons and was less susceptible to vulgarity and viral memes. For the #asthma sociome, there were 695,980 tweets by 308,370 users between April 2015 and November 2018. Clinicians were responsible for 16% of tweets, patients 9%, healthcare organizations 22%, and industry 0.3%. There were significant differences in the tweet characteristics, with healthcare organizations more likely to tweet with links, clinicians more likely to mention other users, and industry more likely to use visuals. Each April–May, there were significant spikes in the frequency of tweets by patients, healthcare organizations, and industry, whereas the usage patterns of clinicians were more random. There were also differences in the top terms and hashtags tweeted with #asthma in the stakeholder groups.

Conclusion: Asthma stakeholder groups tweet differently, at different times, and use different associated terms. Further exploration may help improve health care–related communication and help guide education of patients and clinicians.

Shared Decision Making



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