Facilitators and Barriers to the Implementation of the Primary Care Asthma Paediatric Pathway: A Qualitative Analysis

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Abstract

Objective

The Primary Care Asthma Paediatric Pathway (PCAPP) included an EMR embedded pathway that provided an evidence-based approach to paediatric asthma management. The aim of this qualitative study was to use a theory-based approach to understand the facilitators and barriers that impacted the implementation of the PCAPP in primary care.

Methods

a randomized cluster-controlled design was implemented in 22 primary care practices in Alberta, Canada with half receiving the PCAPP intervention and the other half receiving usual care. Following the implementation of the complex intervention, a purposeful sample of intervention sites were selected to participate in qualitative focus groups to assess the barriers and facilitators to the implementation.

Results

Our qualitative findings are organized into three themes using the core constructs of the normalization process theory (NPT): (1) facilitators of implementation, (2) barriers to implementation, and (3) proposed mitigation strategies. Participants were positive about the pathway, and felt it served as a reminder of optimal paediatric guideline-based asthma management, a streamlined pathway multi-faceted approach to suggest evidence-based care, and an EMR-based targeted collection of tools and resources. Barriers included a generally low priority for the primary care teams, and, in accordance, clinicians suggested they had few children with asthma in their practices. The pathway was not integrated into clinic flow and there was not a specific process to ensure the pathway was used. Sites without project champions also struggled more with implementation. Despite these barriers, clinicians identified clear mitigation strategies to improve uptake including developing a reminder system within the EMR and creating a work-flow that incorporated the pathway.

Conclusion

Our study demonstrated the applicability of the NPT in the implementation of an evidence-based pathway for primary care. This study demonstrated it is important to ensure teams participate in *enrolment* (establishing buy-in), *legitimization* (ensuring teams see their role in the pathway) and *activation* (an ongoing plan for sustainability). Had these components of cognitive participation been addressed more carefully prior to implementation there may have been greater uptake, and ongoing use of the pathway.

Trial Registration: This study was registered at clinicaltrials.gov on June 25, 2015; the registration number is: NCT02481037, <https://clinicaltrials.gov/ct2/show/NCT02481037?term=andrew+cave&cond=Asthma+in+Children&cntry=CA&city=Edmonton&draw=2&rank=1>

Contributions To The Literature

- Complex interventions require a multifaceted approach to ensure team engagement, uptake, and ongoing sustainability.
- Paediatric asthma was identified as a low priority for focus group participants, and therefore impacted uptake of the intervention.
- Creating a reminder system and ensuring the evidence-based intervention includes a strategy for integration into existing work-flows would also facilitate usability in practical settings.

Facilitators and Barriers to the Implementation of the Primary Care Asthma Paediatric Pathway: A Qualitative Analysis

Background

An estimated 11–15% of Canada's children have asthma(1–3); and over half of these children experience poor disease control demonstrated by emergency department visits, hospital admissions, missed school days and low quality of life ratings(3–9). Because of the significant burden of paediatric asthma, high quality, evidence-based national and international guidelines have been widely disseminated, including guidelines for primary care providers and the management of chronic asthma(10–12). However, while most paediatric asthma is managed in the primary care setting, due to limited time and resources primary health care teams are infrequently able to provide asthma education to families, an intervention which is known to decrease health care utilization(13–16). Additionally, the consistency of evidenced-based asthma care is variable, with less than 2% of clinicians able to provide all of the recommended care suggested by the guidelines and less than 5% of asthma visits including the recommended assessment of asthma control(17,18).

Despite targeted strategies to improve outcomes, children with asthma take only approximately half of the asthma medication they are prescribed(19,20). Additionally, in the United States almost one half of children with asthma are not prescribed any preventative medication by their primary care providers(21,22). Increasingly there is concern regarding the long-term risks for children with poorly controlled asthma, suggesting there is a need to identify children at greatest risk of adverse outcomes, to develop strategies for ongoing monitoring and interventions that address the worsening of asthma in children(23). To address the significant challenges associated with paediatric asthma management, specifically the prescription and use of preventative asthma medications, an evidence based primary care clinical pathway for the electronic medical record (EMR) was developed(24).

The Primary Care Asthma Paediatric Pathway (PCAPP) implementation included: 1) an asynchronous online learning module for primary care providers addressing how to use the pathway; 2) in-person training and discussion with a Certified Respiratory Educator for the chronic disease management health care team members to facilitate patient/family asthma education; and 3) an EMR embedded pathway that included asthma algorithms, templates, printable prescription and written asthma action plans and

links to online patient education resources(25). In addition, to facilitate the identification of paediatric asthma in the primary care setting a clinical dashboard tool was created to allow clinicians to quickly assess their patient population, including the medications they were prescribed and when they were last seen for asthma care(25). The intervention aimed to increase the prescription AND the dispensing of evidenced-based preventative asthma medication(24), and to better understand the implementation of the intervention in the primary care setting. The aim of this qualitative study was to use a theory-based approach to understand the facilitators and barriers that impacted the implementation of the PCAPP in primary care.

Methods

The research methodology for the three-year mixed methods health services study have been previously described(24). In brief, the randomized cluster-controlled design was implemented in 22 primary care practices in Alberta, Canada half receiving the PCAPP intervention and the other half receiving usual care. As suggested by the Medical Research Council, complex interventions use two or more information sources or two or more research methods to answer a research question, (26) in this instance quantitative and qualitative research approaches. Prior to implementation of the complex intervention a Theoretical Domains Framework study was conducted to facilitate a theory-based approach to the implementation strategy(25). This primarily addressed potential barriers to implementation of the intervention by subjects rather than by the physicians.

Following implementation, a purposeful sample of intervention sites were selected to participate in qualitative focus groups that would provide an information-rich sample(27). Sites were purposefully selected based upon the size of the practice (small, medium, large) and the geographical location (rural, urban) to facilitate maximum variation. The semi-structured interview guide was framed by the Ottawa Model of Research Use(28) to address the facilitators/barriers that impacted uptake of the pathway by the providers, the potential improvements and attributes of the pathway. The interview guide was developed by the authors who provide expertise in knowledge translation, primary health care, paediatrics and asthma management. While participants had already consented to participate in the intervention/study, an additional consent for the focus group was completed. The four focus groups were scheduled based upon the clinic's schedule and to best accommodate the teams' availability were held at the clinic site. Each of the focus groups were held during the lunch hour, at which time the clinical teams did not have patients booked. The focus groups were conducted by HS and were limited to no more than one hour in length to accommodate the schedule of the clinics.

The Normalization Process Theory (NPT) was used to inform and guide our interpretations of the study results, as it provides an explanation of how innovations may become embedded into routine clinical practice(29). NPT can assist in understanding the success and/or failure of the implementation of an innovation in health care(30). It is an action theory, which means it is concerned with explaining what clinical teams do rather than their attitudes or beliefs, and how they work, that is, the focus is on what individuals and groups do to normalize a new innovation/process(31,32).

The inclusion criteria for the participants included: a) being a member of a clinical team that delivered the complex PCAPP intervention at their site (they were randomized to the intervention group of the cluster randomized control trial); b) providing direct patient care or providing administrative support for the clinical team to children aged 2–17 years with asthma; c) coming from a site with at least 50 children with asthma in the practice. Participants were not required to have successfully implemented the pathway, as the aim was to include all levels of implementation of the pathway.

Analysis

To facilitate accurate, timely transcription, court reporters were used to conduct live transcription in addition to audio recordings (33). Data analysis was an iterative and concurrent process to allow for further development of new ideas from focus group data. For each focus group conducted, a memo was created by the interviewer, and incorporated into the analysis. Focus group data was analyzed using a three phase approach: coding, categorizing and development of themes(34). Data collection concluded when there was agreement within the study team that data addressed the research questions and when no new messages emerged. The transcripts provided by the court reporter were initially reviewed and compared to the audio files for accuracy. Data for each focus group was then coded using code words that captured the essence of the data(24). Codes were defined to ensure consistent application through the data coding phase. As the categorizes emerged from the data the theoretical properties were further defined. Lastly, comparisons were completed between the categories to identify similarities and differences(24). NVivo 10 software(35) was utilized to help manage the data analysis process. Ethical approval was granted from both the Health Research Ethics Board at the University of Alberta and the Conjoint Health Research Ethics Board at the University of Calgary.

Results

Four focus groups were held across four primary care sites; Table 1 provides a summary of the participating sites and the participants. Given that the uptake of the pathway was generally described as low, much of the focus group data identified the barriers, and possible mitigation strategies to address the barriers in the future. Interestingly, many of the clinicians indicated they liked the components of the pathway, including the evidenced-based approach and access to resources, such as the written asthma action plan. In fact, while many said they never or rarely used it, there were no participants that stated that they didn't like the pathway or would never use it. One of the physicians stated the pathway was well-used in their clinic and they had developed a system of their own to facilitate successful implementation. Table 2 outlines the constructs of the NPT and the corresponding components. Specifically, we employed the theory to enhance our understanding of three key results from the research: (1) facilitators of pathway uptake; (2) barriers to implementation and; (3) mitigation strategies identified by the participants that may improve the implementation of future interventions. Table 3 summarizes the NPT and its applicability to the understanding of the PCAPP intervention implementation.

Table 1
Participating Sites Description

Practice	Urban or Rural	Practice Type	Participants Profession	Number of Participants	Self-described use of implementation of the pathway
1	Urban	Academic	Physician Medical Office Administrator (MOA)	2	High use
2	Rural	Non-Academic	Physicians Respiratory Therapists (RTs)	12	Used by Respiratory Therapists only
3	Urban	Academic	Physicians Nurses	15	Minimal use
4	Urban	Non-Academic	Physicians Medical Office Administrators	8	Minimal use

Table 2
Normalization Process Theory Core Constructs and Components

Core Construct of NPT	Components of the Core Construct
Coherence-is the sense-making individuals and teams do to operationalize a new practice.	<ol style="list-style-type: none"> 1. differentiation (how it differs) 2. communal specification-development of shared understanding 3. individual specification-personal responsibilities related to the practice 4. internalization-understanding the value and benefits
Cognitive Participation-the work that is done to create a community related to the new practice.	<ol style="list-style-type: none"> 1. initiation-are the key individuals driving the practice forward 2. enrolment-establishing buy-in and communal support 3. legitimization-team members feel they should be involved/can contribute 4. activation-team members plan for sustainability and continued involvement
Collective Action-the operational work that is undertaken to implement the new practice.	<ol style="list-style-type: none"> 1. interactional workability-the interactional work team members do with others-including patients 2. relational integration-the knowledge individuals and teams have that builds confidence and accountability 3. skill set workability -the division of labour among the team 4. contextual integration-the allocation of resources and implementation of new policies and procedures
Reflexive Monitoring- team members assess and understand how new practices affect them and others around them.	<ol style="list-style-type: none"> 1. systematization-determine how useful and effective the practice may be for the individual and team 2. communal appraisal-collective discussions to determine the worth of the practice, is this working? 3. individual appraisal -individual determination of the worth of the practice and their relationship to the innovation 4.reconfiguration-they may seek to redefine procedures or modify practices to better suit needs

Table 3
Normalization Process Theory and Pathway Implementation

Core Construct of NPT	Demonstrated by the Focus Groups
Coherence -is the sense-making individuals and teams do to operationalize a new practice.	<p>-there was a recognized value of the pathway, providing a consistent approach to paediatric asthma care within the EMR</p> <p>-participants noted the value and benefit of the pathway (evidence-based, reminder of components of optimal care, encouraged patient education)</p>
Cognitive Participation -the work that is done to create a community related to the new practice.	<p>-successful implementation was linked to a team approach with clear roles for team members</p> <p>-project champions may facilitate uptake and awareness</p> <p>-sites with limited cognitive participation lacked uptake and were unable to fully implement the pathway</p>
Collective Action -the operational work that is undertaken to implement the new practice.	<p>-participants identified further resources may be required to facilitate implementation, such as a reminder system</p> <p>-clinics that created the division of labour for pathway implementation were more likely to use it, and have a champion for implementation</p>
Reflexive Monitoring - team members assess and understand how new practices affect them and others around them.	<p>-participants quickly identified the pathway required reconfiguration to optimize it for use in primary care, it was modified to better meet the clinicians needs</p> <p>-focus groups identified mitigation strategies (reminder system, prompt to initiate the pathway) that may improve future implementation.</p>

Facilitators of Implementation

Primary care offers an opportunity to engage with families and promote healthy behaviours, “the power of family medicine is really in the relationship, to invite people to make changes or to try things that they might not normally do” (physician, small urban site). The pathway was intended to be a tool to facilitate this relationship, and to provide optimal disease management for paediatric asthma in primary care. Three categories emerged from the data related to the facilitators of the pathway. The categories included: (1) the evidenced-based approach to paediatric asthma management, (2) a willingness to modify the pathway to better meet the needs of primary care, and (3) education related to the pathway.

Evidence-Based Approach

All participants were positive about the components of the pathway, and its possible benefits for children with asthma and for the clinical teams. The pathway served as a reminder of optimal asthma care, and provided access to resources and tools, such as educational materials and the written asthma action

plan. “I think it's been good in terms of ensuring that I'm following all the guidelines and getting all of the important pieces for the education and management of the young asthmatic.” (physician, small urban site). One Participant indicated that the pathway led to a practice change in having a more complete or thorough approach to asthma management.

Modifying the Pathway to Meet Clinical Needs

Initially there were three separate templates that were developed as components of the pathway. Each template was to be used to address an aspect of asthma management that may be encountered in primary care (suspected asthma, acute exacerbation, ongoing management). However, following initial launch of the pathway, preliminary feedback suggested it was not working well as it was cumbersome. There were concerns about the complexity of the first version of the pathway (3 templates) which impacted usability. Based upon this feedback, the development team responded, and the pathways were modified into a single pathway. “And when it was first introduced, there was three different pathways to consider...so everybody found it a bit confusing with the three different pathways. But then that merged into one pathway on the EMR, which was much more user-friendly.” (allied health team, large, urban site).

Pathway Education

Clinicians indicated the education was valuable. However, particularly at teaching practices there was often turnover of staff, and they didn't have a structured approach for ensuring new team members were onboard with the asthma education. It was suggested that education to prioritize the pathway would be valuable. “This is primary care. You don't have a whole hour to do it. You're not in the Children's Hospital in the asthma clinic doing everything.... you're not expected to do every component every visit, and that's probably unrealistic” (physician, small urban site). Thus, while the education was valuable, it required an ongoing strategy and perhaps a mechanism for establishing key priorities at each visit.

Barriers to Implementation

Despite the positive comments, uptake of the pathway was generally low. Issues of uptake were not related to the components of the pathway, but rather the implementation of the innovation. The most significant barriers were grouped according to three categories: (1) relatively low importance of paediatric asthma in primary care related to the low paediatric asthma populations; (2) a lack of awareness of the pathway, contributing to a lack of use; (3) a lack of integration of the pathway into clinic flow. These barriers led to a low uptake at all but one of the sites included in the focus groups.

Clinic Population and Priority

Low paediatric asthma population at the clinics was a barrier to use. “For me, the reason I cannot give you more feedback about how we work is that I really don't have many pediatric asthma patients” (physician, large urban site). “I don't remember the last time I saw a kid with asthma” (physician, moderate urban site). “I didn't have any paediatric patients with asthma, especially new diagnoses; but when I used it, then I found it was quite straightforward and clear to use (physician, moderate urban site).

In addition to a low paediatric asthma population, practitioners felt individuals with asthma are often the healthiest chronic disease patients they have in the clinic (compared to others with multiple co-morbidities etc.) and as such wouldn't be referred to other health professionals (such as pharmacists) on the team for education and disease management.

One primary care provider advised that the children identified as having asthma on their panel through the study, may not have confirmed asthma. "I was going through the files, sure, some of the kids had a bit of wheezing, and they – maybe after a virus infection and – and so on. But if you're looking at moderate to severe asthma patients, I really didn't have any like that in my practice" (physician, large rural practice). Thus, they felt the pathway was not appropriate for many children, particularly those with mild disease (reducing the number of children that would benefit from the pathway). Given these comments, it would suggest there was low motivation to use the pathway, as it did not address a highly prevalent condition they encounter in their daily practice.

Lack of Awareness of the Pathway

There were participants that exhibited an attitude of indifference or ambivalence regarding the pathway- "To be honest, for me, I saw somebody with asthma the other day, and I was, like, Are we still doing that asthma pathway? Like, I was, like, Is that still on? I don't know if I was supposed to be still using it?" (physician, moderate urban site). This lack of awareness of the pathway implementation would suggest that sustainability following the intervention may be limited. Primary care providers indicated that they simply forgot about the pathway, or would have already begun using the 'regular' EMR when they realized the patient was visiting for asthma concerns.

One participant stated 'if it wasn't in their face' they were not likely to use it. "I feel like I definitely underutilized it, though. I think it just wasn't always on my radar. If it was something like a straightforward asthma follow-up, I don't think I always thought to pull it up" (physician, moderate urban site). Primary care providers needed to remember there was a pathway and actively look for the template within their EMR to use. In one clinic (physician, large, urban site) one of the allied health professionals indicated she had undertaken activities to build awareness of the pathway (going to each physician to remind them of it) and put the pathway in their 'favorites' folder within the EMR, however integrating with the clinic practices remained a challenge.

Lack of Integration in the Clinic

In order for an innovation to be successful in primary care, it needs to integrate with the existing clinic structure and processes. The structure of the EMR impacted the uptake of the pathway. The EMR did not have a 'flag' or have a reminder system that pulled up the pathway for children with asthma. "The whole just remembering to click on the pathway (has) been a challenge. But when you get there, so helpful" (physician, moderate urban site). If the family had not disclosed prior to the appointment that the purpose of the visit was for asthma, then the pathway would not be readily available at the point of contact. "Yeah, you maybe could have designated one person in the clinic as a champion to the cause and then given out monthly reminders" (physician, moderate urban site). They highlighted that often their patients

are complex and have several concerns to be addressed so they need a team approach to ensure the pathway is used.

Proposed Mitigation Strategies

While the barriers to implementation were significant, participants were readily able to identify possible mitigation strategies that they felt would impact uptake. Mitigation strategies included: (1) reminder system; (2) improved clinic flow; and (3) expanded scope of the pathway.

Reminder System

The single most suggested strategy was to create a reminder system to encourage use. Both an EMR based reminder, as well as team members identifying children with asthma prospectively (prior to the visit) was suggested as a mitigation for lack of use. “So I think that the – one of the changes that we can consider isif it's a kid with asthma diagnosis, ask them (staff) to pull up the asthma pathway template from the get-go. So when you go open the visit, you see the asthma pathway, not that you have to pull it up yourself. I think that that would be a process that would make a difference. Because we just forget” (physician, large urban). One idea suggested was having the front desk staff or nursing staff flag patients before appointments that could serve as a reminder to use the pathway. Participants indicated that the pathway needed to be embedded into the processes of the clinic, and that it was required for success. This may mean having one of the allied health team members responsible for identifying children with asthma in the clinic and ensuring the pathway is available at the time of the appointment.

Despite the intention to use the pathway, it was common to hear they failed to use it. One clinic identified that they flagged children with asthma, and the intention was to use the pathway for visits-however the children often came in for other reasons (non-asthma), and the pathway was not used for them. Another site was successful at having the office MOA identify children with asthma prior to the appointment and made use of the pathway more successful. “It's easy to access, but the thing is you have to remember to access it” (physician, small urban site).

Improved Clinic Flow

Primary care physicians indicated that they have limited time within their appointments with families. The pathway may be overwhelming and require more time than available in a short patient interaction. “I don't know that a physician would have time to do all of that at an appointment...so I think overall it's probably a good thing but just needs to be able to fit into the usual pace of a primary care doc(tor) if they're expected to use it” (physician, large rural site). It was suggested prioritizing the components of the pathway to allow clinicians to use it in ‘pieces’ rather than its entirety, which would feel more manageable given the time constraints. “That was my main stumbling block in using it. When it was just something that was totally stable, it was, like, yeah, I don't have time for that; I just – will just do a regular thing” (physician, moderate urban site). Therefore, the pathway would fit the clinic flow more effectively if it prioritized the components to reflect the time limitations that exist. This was a significant learning-the

pathway may be effective and valuable to improving patient outcomes, but needs to be integrated into the clinic flow to be utilized.

Expanded Scope of the Pathway

For some clinics it would be more valuable to have a pathway that managed several conditions/populations, rather than the narrow focus. “It wasn't meant to be used with adults. I know many people said it would be helpful to use with adults as well” (allied health team, large, urban site). Expanding the scope of the pathway may increase usability for clinicians, which may include additional populations (adult) or disease states (such as COPD).

Discussion

Our findings identified facilitators including participants were positive about the pathway, felt it served as a reminder of guideline-based asthma management, a multi-faceted approach to suggest evidence-based care, and an EMR based targeted collection of tools and resources. Barriers included a generally a low priority for the primary care teams, and similarly clinicians suggested they had few children with asthma in their practices. The pathway was not integrated into clinic flow and sites without project champions struggled more with implementation. Despite these significant barriers, clinicians identified clear mitigation strategies to improve uptake including developing a reminder system within the EMR and creating a work flow that incorporated the pathway. We will discuss each of these factors: 1) facilitators to pathway uptake, 2) barriers to implementation, and 3) mitigation strategies.

The PCAPP was implemented in 11 primary care practices in a randomized cluster-controlled study with the aim of improving the use of preventative medication for children with asthma. The complex intervention included a paediatric asthma EMR pathway, in-person training and asynchronous online learning. To assess the facilitators and barriers of the implementation, a purposeful sample of intervention sites were selected to participate in qualitative focus groups. The results of the focus groups identified facilitators including participants were positive about the pathway, felt it served as a reminder of guideline-based asthma management, a multi-faceted approach to suggest evidence-based care, and an EMR based targeted collection of tools and resources. Barriers included a generally low priority for the primary care teams, and similarly clinicians suggested they had few children with asthma in their practices. The pathway was not integrated into clinic flow and sites without project champions struggled more with implementation. Despite these significant barriers, clinicians identified clear mitigation strategies to improve uptake including developing a reminder system within the EMR and creating a workflow that incorporated the pathway.

Facilitators of Pathway Uptake

Historically primary care adherence to paediatric asthma guidelines has been poor,(36) however strategies to improve uptake have been increasingly prevalent. Research has demonstrated that decision support tools improve adherence to guidelines including increased preventer medication prescription(37).

More specifically, computer-based decision support tools may improve standardized asthma assessments and treatment and documentation of asthma severity/control for children(38–40). A systematic review of trials of clinical decision support tools (not asthma specific) found the following features to be predictors of improved clinical practice: providing decision support automatically as a part of clinic flow, providing recommendations in addition to assessments, providing decision support at the time of decision making and using a computer based approach(41). The PCAAP was successful at incorporating several of these key features, such as providing recommendations using an EMR based approach, although it did not include an automatic prompt for use as a component of clinic flow, the most significant barrier of this implementation.

Asthma quality improvement initiatives that have improved hospitalization, emergency department visits, readmission rates and provision of educational tools found the following strategies to be effective: inpatient, outpatient and community-based approaches, increased medication access, education for families and health care providers and in-home follow-up(19,42,43). Kuhn and colleagues(44) created a job aid and training video to improve the uptake of an electronic asthma action plan embedded in the EMR. Similarly, the PCAPP intervention combined the EMR based pathway with a clinical pathway, patient education, and online training, to address paediatric asthma management. The participants had little difficulty identifying the strengths of the pathway including this multi-faceted approach that serves as a reminder for education, referrals, promotes the use of written asthma action plans, and offered a more thorough evidence-based approach to asthma management (as the pathway provided reminders of what ‘optimal disease management’ includes).

A systematic review of computerized clinical decision support systems for the management of asthma in primary care for adults and children determined computer based support tools were successful at improving patient outcomes(45). Many of these interventions included computer/online patient/family-based interventions, such as self-management education, reactive computer reminders, and online interactive asthma monitoring, that were not incorporated into the PCAPP intervention. The NPT indicates the importance of *coherence*. This means that operationalizing of a new process requires individuals to see their role and value in the new intervention, as well as requiring that a team creates a shared understanding of the benefits of the innovation(46). Consistent with previous research in primary care, asthma guideline implementation is more successful in settings with strong team culture and role definition(47). Therefore, *coherence* regarding the pathway was high, participants understood its use, felt it had value, and offered improved resources for the management of paediatric asthma in primary care, consistent with previous research.

Providing targeted education and resources to promote best practice has demonstrated improvement in assessment and documentation of asthma control, medication adherence, action plan development and appropriate follow-up(48). However, given the volume of guidelines primary care practitioners receive, approaches that are able to simplify the guidelines with decision support tools within the EMR may improve the quality of paediatric asthma care(49). Based on early feedback of participants the innovation was reconfigured from a detailed three template pathway to a streamlined, one template approach. This

change was perceived as positive and improved the physicians' ability to implement the pathway. This example of *reflexive monitoring* allowed the teams to consider the innovation and identify ways it could be modified to more effectively meet their needs(46).

Barriers to Implementation

Clinicians in our study indicated that they did not see a large population of paediatric asthma patients within their practices. Paediatric asthma was not as high priority as other health concerns, and they described asthma management as often addressed during appointments for other issues. Because of the low priority they simply forgot to use the pathway. Similarly, the Asthma APGAR tool implementation study found that participants indicated they were unsure of the need of an asthma specific tool in primary care, and physician and nursing buy-in was a limitation of implementation(50). Therefore, despite a recognition of the value and benefit of the pathway (*coherence*), teams were not highly motivated to use the pathway (*collective action*). A review of eight trials of computer decision support for the management of asthma similarly found challenges in improving asthma outcomes due to widespread limited use of the tools(51).

Engaging additional team members is effective at promoting the use of guideline-based care for children with asthma and creates a culture of teamwork(49). In this study, practices that identified a project champion and thus a higher likelihood of *cognitive participation*, indicated higher pathway use. The NPT suggests that *cognitive participation* creates a community of support that will influence the implementation of the intervention(46). Sites that did not have a project champion, were less likely to have a community of practice to support the intervention and to develop a process to integrate the pathway into clinic flow. To promote *cognitive participation* efforts were made to engage the teams by implementing a EMR based dashboard that would allow the teams to identify children with asthma that may require ongoing follow-up at the clinic. However, the dashboard was used rarely, and did not appear to increase uptake. Additionally, further work may have assisted the teams to ensure project champions were driving the intervention at each site and ensured *legitimization* occurred by specifying how each team member could contribute to the implementation.

Mitigation Strategies

A systematic review of knowledge translation activities for child health found that online education and computerized decision supports or reminders are effective(52). However, clinicians find it challenging to integrate decision aids into their daily practice(49). Therefore, a clear strategy for how the innovation can be incorporated with minimal effort from the clinic team is required. The focus groups in our study allowed participants the opportunity to undertake *reflexive monitoring* to offer several key strategies to improve the pathway. They suggested a flag or reminder in the EMR to indicate that the child had asthma would be helpful. This was widely repeated, as participants failed to remember to use the pathway and demonstrated limited activation. Lim et al.(53) found that having front desk staff provide an asthma management questionnaire to every patient with asthma in the practice at every appointment (regardless of the reason for the appointment) demonstrated a lower asthma severity rating than control sites.

Halterman(54) found that providing electronic prompts to healthcare providers increased the use of asthma action plans, smoking cessation education and reduction in asthma symptoms for children with asthma. Participants consistently recommended an EMR based reminder system to increase the uptake and visibility of the pathway. Interestingly, study participants did not indicate lack of content knowledge, disagreement with the evidence in the pathway, nor applicability of the pathway to the population to be barriers, which were major themes previously identified in the literature(49).

Another identified challenge was the need to integrate the pathway into the normal workflow of the clinic and prioritizing the components of the pathway. The Asthma APGAR tool was successful as clinicians identified it was easy to use, improved care and the tool was relevant to primary care(50). Similarly, participants felt the pathway needed to be simple, and core elements needed to be first. It was also suggested that clinicians needed to be advised they did not need to complete the entire pathway at each visit-it was to be used as a guide and pick and choose the components of relevance for the visit. De Bruin and colleagues(17) found that primary care clinicians were generally not able to complete all of the components of evidence based care in a regular visit, however, 75% completed some aspects of ideal care. Establishing core priorities for visits would assist clinicians to provide evidence-based care, despite rigid time limitations. In sub-speciality asthma practice workflow concerns were a barrier to computerized decision support tools, including slowing the pace of clinical practice(55). Bauer and colleagues(56) found that the uptake of health information technology in paediatrics improves over time, as understanding of the tool increases, and clinicians were able to provide feedback on how to improve the technology for future use. Computer-generated reminders have shown modest gains in improvement of clinical care(57). Participants were able to see the worth in the intervention, and they identified mitigation approaches that reconfigured the process to fit within existing clinic structure.

Our study demonstrated the applicability of the NPT in the implementation of an evidence-based pathway for primary care. While participants demonstrated a high *coherence*, or recognition of how to operationalize the pathway, the NPT demonstrates where the implementation was unsuccessful. For future interventions we would suggest ensuring teams participate in *enrolment* (establishing buy-in), *legitimization* (ensuring teams see their role in the pathway) and *activation* (an ongoing plan for sustainability). Had these components of cognitive participation been addressed more extensively prior to implementation there may have been greater uptake, and ongoing use of the pathway.

Limitations

The following limitations of this study are noted. The population was limited to a geographical area of one province, with clinics that were using one of two popular EMRs (MedAccess and Wolf). The participating clinics were invited to participate without a specific interest in paediatrics or asthma, and thus, had small patient populations relevant to the intervention. While during the clinic recruitment process it was specified that clinics should have a minimum of 50 children with asthma in their care, in hindsight it may have been advantageous to identify clinics with larger paediatric populations. Participants were generally positive about the pathway overall, despite very limited use in several

instances. Given the low use, it would be important to reassess the content of the pathway with high users to more fully understand the strengths and weaknesses of the pathway itself.

Conclusion

This study demonstrated through a theory-based approach that, despite a strong recognition of the potential utility of an evidence-based pathway for the management of paediatric asthma in primary care, overall uptake was low. Study participants articulated several key reasons for low implementation including, a limited paediatric asthma population within the practices, limited awareness of the pathway and a lack of integration with clinic flow and process. Participants felt the pathway would have continued utility with the implementation of several mitigation strategies including the development of a reminder system that would suggest using the pathway for children with asthma, creating a team-based approach that integrated the pathway with existing clinic flow and process, and to consider expanding the scope of the pathway to additional populations and/or disease states. This research provided valuable context and understanding of the challenges of implementing a pathway within primary care. The implementation of interventions in the future should focus more attentively on how it can be integrated within the existing clinic flow and structure, and the identification of strategies that may promote uptake such as reminders from the team or within the EMR itself.

Abbreviations

EMR-electronic medical record

PCAPP-primary care asthma paediatric pathway

NPT-normalization process theory

Declarations

Ethics approval- granted from both the Health Research Ethics Board at the University of Alberta and the Conjoint Health Research Ethics Board at the University of Calgary. Focus group participants provided written consent to participate in the focus groups

Consent for Publication-N/A

Availability of data and materials- the datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing Interests- the authors declare that they have no competing interests

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Authors Contribution

HS was responsible for the data collection, analysis and manuscript preparation. MP was responsible for data analysis and manuscript preparation. AC and DJ provided guidance on the development of the interview guide, data interpretation and manuscript revision. SS, senior author was the methodological expert for the study design, data collection and analysis. SS oversaw the manuscript preparation.

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