RECOMMENDATIONS FOR AN URBAN PEDIATRIC PRIMARY CARE CENTER TO REDUCE NON-URGENT EMERGENCY DEPARTMENT UTILIZATION

by

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ABSTRACT

Background: In the US, many emergency department (ED) visits are non-urgent. Use of the ED for non-urgent conditions may weaken patient-primary care provider relationships. In 18 months, patients of the UPMC Children's Hospital of Pittsburgh Primary Care Center of Oakland (CHP PCC) visited the ED 30% (N=135 visits) more, on average, than the CHP PCC for non-preventative outpatient visits. We aim to provide recommendations to the CHP PCC to reduce CHP PCC patients' non-urgent ED visits.

Methods: We conducted a systematic literature review of national pediatric ED utilization interventions published from 2008-2018. From the results, we identified targeted barriers to primary care and effective interventions. We then conducted a phone survey from December 2017–July 2018, and identified CHP PCC patients aged 1-5 years who presented at either the CHP PCC or the ED with acute respiratory infections. We called patients' caregivers 1-4 weeks after their visit and assessed their reasons for the index visit. We then compared the PCC group versus the ED group to identify barriers to care at the CHP PCC. We finally formulated recommendations to decrease ED utilization to the CHP PCC.

Results: In the literature review, 10 articles met inclusion criteria. Two barriers were identified; of the 10 studies, 6 targeted health literacy and 4 targeted access. Effective interventions targeting health literacy and access involved community engagement. Three barriers were identified in the CHP PCC survey: health literacy, access, and perceived quality of care. Responders tended to

perceive their child's acute illness as severe. Responders reported low perceived access in terms of availability/accommodation and affordability, and reported high perceived quality of care in terms of acceptability at the CHP PCC. To address barriers, recommendations to the CHP PCC included outreach to high ED-risk populations, improving scheduling, extending hours, and increasing staff and resources.

Public Health Significance: Use of the ED negatively impacts the continuity of care with primary care centers, which is essential for preventative health. Developing tailored, effective interventions to reduce ED visits may improve continuity and ultimately improve child health, with implications for decreasing costs and burden to the ED.

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PREFACE

I would like to acknowledge my friends, family, and mentors who have supported me throughout my graduate education. Thank you to Dr. David Finegold for encouraging me to pursue my graduate education at Pitt and to Dr. Nancy Glynn for accepting me into the Epidemiology program. Thank you to my committee of Dr. Marnie Bertolet, Dr. Kristin Ray, and Dr. Alicia Colvin for their support in this process. Thank you to the UPMC Children's Hospital Primary Care Center of Oakland for giving me the opportunity to explore this field. Lastly, thank you to my partner Benjamin Anderson for the never-ending encouragement.

KEY ABBREVIATIONS

Abbreviations and Definitions:

ACEP — American College of Emergency Physicians

Caregiver — Patient-Identified Guardian

CDC — Centers for Disease Control and Prevention

CHP — Children's Hospital of Pittsburgh

CHIP — Children's Health Insurance Program

CI — Confidence Interval

ED — Emergency Department

EHS — Early Head Start

EHR — Electronic Health Records

EMR — Electronic Medical Records

EMS — Emergency Medical Services

PCC — Primary Care Center

PCP — Primary Care Provider

PED — Pediatric Emergency Department

MA — Medicaid

NHAMCS — National Hospital Ambulatory Medical Care Survey

OR — Odds Ratio

RCT – Randomized Controlled Trial

RR — Risk Ratio

UPMC — University of Pittsburgh Medical Center

URI — Upper Respiratory Infection

1.0   INTRODUCTION

The pediatric emergency department provides immediate care and services for children's acute medical conditions. However, families often choose the emergency department (ED) to treat their children's non-urgent medical conditions, leading to wasteful healthcare spending, unnecessary use of supplies and equipment, loss of beds meant for patients in dire need of emergency medical services, overcrowding, and decreased continuity of care with primary care providers.[1–6] Non-urgent ED visits are commonly defined as visits in which withholding treatment for a condition for 2-24 hours would not increase the likelihood of an adverse outcome.[7,8] Patients can experience worse quality of care in the ED than in a primary care setting for non-urgent conditions.[9] The foundation of quality health care begins with the relationship between patient and primary care provider, and continuity is important for maintaining these relationships and preventing adverse health outcomes.[10–12]

This essay examines opportunities to reduce non-urgent ED visits for a pediatric population connected with a primary care practice. To do this, this essay first characterizes interventions to reduce non-urgent pediatric emergency department (PED) use published in research studies, including their efficacy, and their study population. Next, the essay describes data from a survey of caregivers of children at the University of Pittsburgh Medical Center (UPMC) Children's Hospital of Pittsburgh Primary Care Center in Oakland (CHP PCC) to investigate factors contributing to the decision to seek care in the ED or the clinic for non-urgent concerns. The CHP

PCC population and barriers are compared to the populations in the systematic review. Finally, recommendations for interventions are proposed to the CHP PCC.

Three major components of this essay include:

1. Literature Review of Interventions: Published articles describing interventions to decrease non-urgent PED use and their effectiveness will be reviewed.

2. Motivations to Use the ED in a Local Population: Survey of PCC patients who had an ED or primary care visit between December 2017 and June 2018 to elucidate factors influencing their decisions to use the ED or the CHP PCC.

3. Recommended Interventions for the Clinic to Reduce Non-Urgent ED Care: Results from the survey, including population demographics of families who have and have not used the ED for non-urgent situations, will be combined with results from the literature review of interventions to recommend potential interventions to the CHP PCC that would best serve its population.

This essay will inform stakeholders and provide direction to what interventions the UPMC CHP PCC could implement to decrease non-ED utilization among its patients.

1.1   UPMC CHILDREN'S HOSPITAL OF PITTSBURGH PRIMARY CARE CENTER

1.1.1   Overview

The CHP PCC is located in the urban, academic Oakland neighborhood of the city of Pittsburgh, Pennsylvania (3420 Fifth Ave, Pittsburgh, PA 15213, see Figure 1). The clinic is

located at the heart of the University of Pittsburgh Medical Center complex and the University of Pittsburgh Oakland campus. The CHP PCC is part of a top-ranked pediatric hospital system that is dedicated to improving the health and well-being of children, teenagers, and young adults through patient care, teaching, research, and advocacy.[13] Under their division of General Academic Pediatrics, their team of 25 providers and staff provide comprehensive health services, including sick visits and well-child visits throughout the Pittsburgh, Pennsylvania region.[14] Their services address nutrition, education, safety, family relationships, discipline, child care, behavior, and development, are important prevention points for families to mitigate child health risks. In addition to sick visits, they provide advice by telephone, evaluation and treatment of chronic illnesses, and referrals to subspecialists at the UPMC CHP Emergency Department (ED) in the Lawrenceville neighborhood (Figure 1). The center also accommodates Spanish-speaking families through bilingual physicians and staff and by providing foreign language assistance.
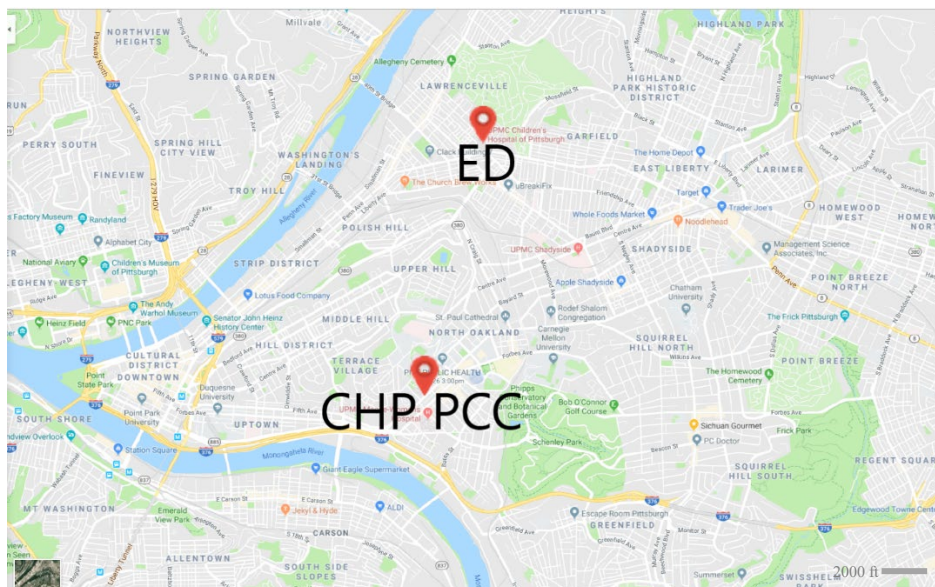
Figure 1. Location of the CHP PCC and the ED

The clinic seeks to serve a wide variety of family work schedules and provides extended hours for families who are unable to reach the clinic during standard business hours. Appointments are made by telephone for the hours of 8:00 a.m. to 5:00 p.m. from Monday to Friday. In addition, extended hours are available Monday through Thursday from 5:00 p.m. to 7:00 p.m., and weekend hours are available Saturdays from 9:00 a.m. to noon. Walk-in hours are available from 8:00 a.m. to 11:00 a.m. on Mondays, Tuesdays, Wednesdays, and Fridays and from 10:00 a.m. to 11:00 a.m. on Thursdays. A 24/7 telephone nurse advice line is also available.

In 2018, the CHP PCC encounters numbered 22,432 across 10,729 unique patients ranging from 0-21 years of age (Figure 2).[15] The majority of these patients were young children; 45% (N=4,824) of patients were aged 5 years and younger. The CHP PCC received approximately 1,870 visits a month, with the 10 most common patient ZIP codes accounting for 47.5% of these patients (Table 1).[15] About 11% (N=1,182) of patients reported residing in the 15210 area code, which contains the neighborhoods of Mt. Oliver, Arlington, Knoxville, Beltzhoover, and Carrick (Table 1, Figure 3).[15]
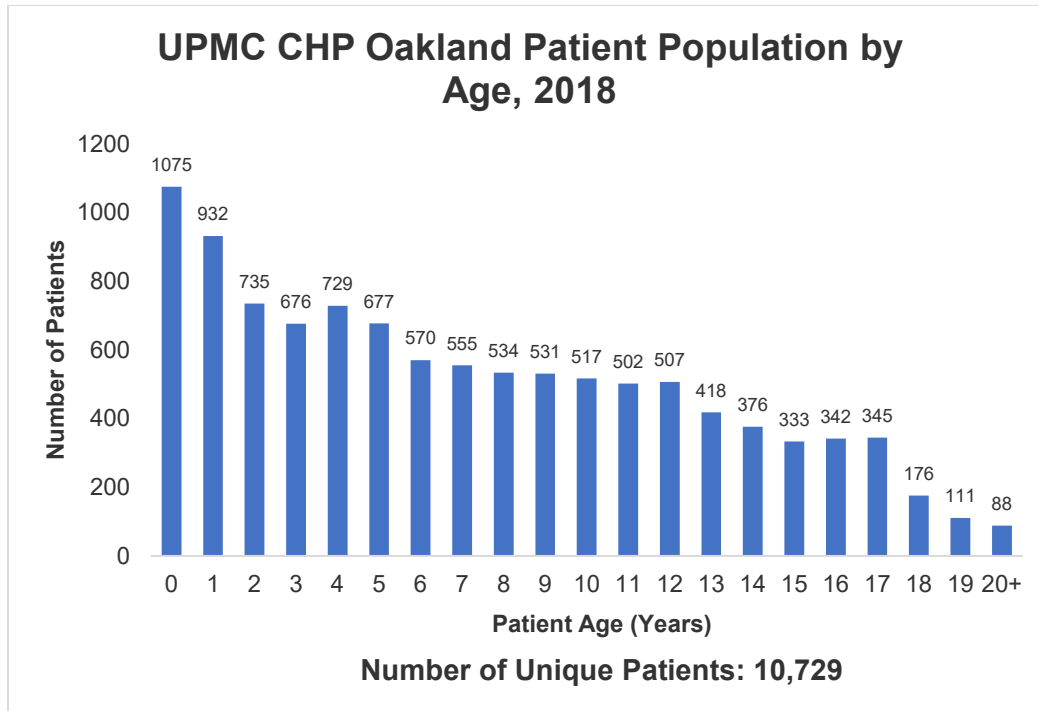
Figure 2. CHP PCC Patient Population by Age
Source: Faulds, Samantha. (General Academic Pediatrics 2018 – Year in Review). Pittsburgh, Pennsylvania; UPMC Children's Hospital of Pittsburgh. Retrieved April 3, 2019.

Table 1. The PCC Patient Population by Neighborhood (Top 10)

Rank	Zip Code	Neighborhoods	Number of Patients	Percent of Total Patients (N=10,729)
1	15210	Mt. Oliver, Arlington, Knoxville, Beltzhoover, Carrick	1182	11.0%
2	15219	Uptown, Hill District, Polish Hill	669	6.2%
3	15212	North Side, Marshall-Shadeland, Spring Hill, Troy	621	5.8%
4	15221	Wilkinsburg, East Hills, Forest Hills	570	5.3%
5	15214	Northview Heights	502	4.7%
6	15136	McKees Rocks	446	4.2%
7	15120	Homestead, Munhall, West Homestead	387	3.6%
8	15206	East Liberty, Larimer, Highland Park, Morningside	376	3.5%
9	15235	Penn Hills	369	3.4%
10	15104	Braddock, Rankin	352	3.3%

Source: Faulds, Samantha. (General Academic Pediatrics 2018 – Year in Review). Pittsburgh, Pennsylvania; UPMC Children's Hospital of Pittsburgh. Retrieved April 3, 2019.

Figure 3. Map of the CHP PCC Patient Population by Zip Code
Source: Faulds, Samantha. (General Academic Pediatrics 2018 – Year in Review). Pittsburgh, Pennsylvania; UPMC Children's Hospital of Pittsburgh. Retrieved April 3, 2019.

By race, their patient population consisted of 76% (N=8,137) Black, 16% (N=1,689) White, 3% (N=272) Asian, 1% (N=144) multi-racial patients, and 4% (N=437) with unknown race (Figure 4). By ethnicity, 6% (N=693) of patients were Hispanic or Latino, 90% (N=9,614) were not Hispanic or Latino, and 4% (N=422) were of unknown ethnicity (Figure 4).
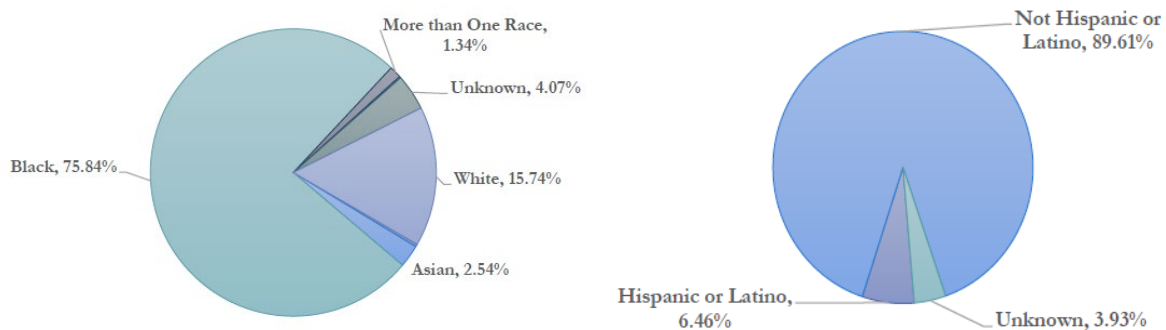
Figure 4. CHP PCC Patient Population by Race and Ethnicity
Faulds, Samantha. (General Academic Pediatrics 2018 – Year in Review). Pittsburgh, Pennsylvania; UPMC Children's Hospital of Pittsburgh. Retrieved April 3, 2019.

Insurance status of patients in the last year included Children's Health Insurance Program (CHIP, 4%, N=573), Medicaid (MA, 78%, N=10,511), commercial insurance (15%, N=2131) or no insurance (3%, N=346) .
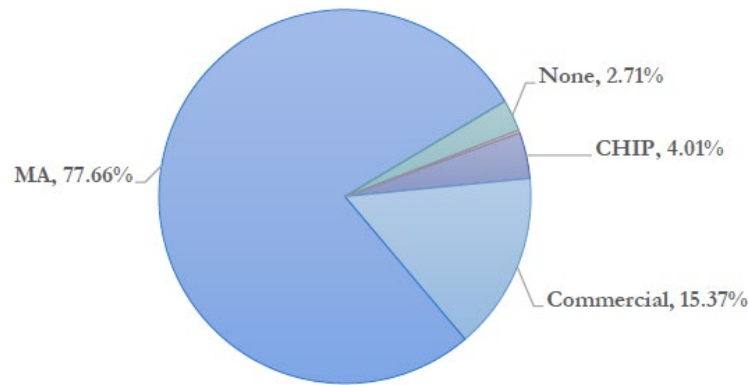
Figure 5. CHP PCC Patient Population by Payor Type
Faulds, Samantha. (General Academic Pediatrics 2018 – Year in Review). Pittsburgh, Pennsylvania; UPMC Children's Hospital of Pittsburgh. Retrieved April 3, 2019.

1.1.2 Emergency Department Utilization

CHP PCC patients can use the ED's 24-hour services for serious illnesses and life-risking injuries if they cannot wait to see their primary care provider. However, the CHP PCC has had longstanding concerns about high ED utilization rates among their patients and recognition that this may reflect inadequate access within the clinic. Among CHP PCC patients from January 2017 to June 2018, there were up to 244 more ED visits per month than total non-preventative care outpatient PCC visits (PCC visits that did not include wellness visits i.e. routine checkups, annual exams, yearly preventative visits) (Figure 7). Because the pediatric primary care office strives to be the first choice among patients, the CHP PCC recognized that the volume of ED visits may indicate an opportunity to improve care for their patients.
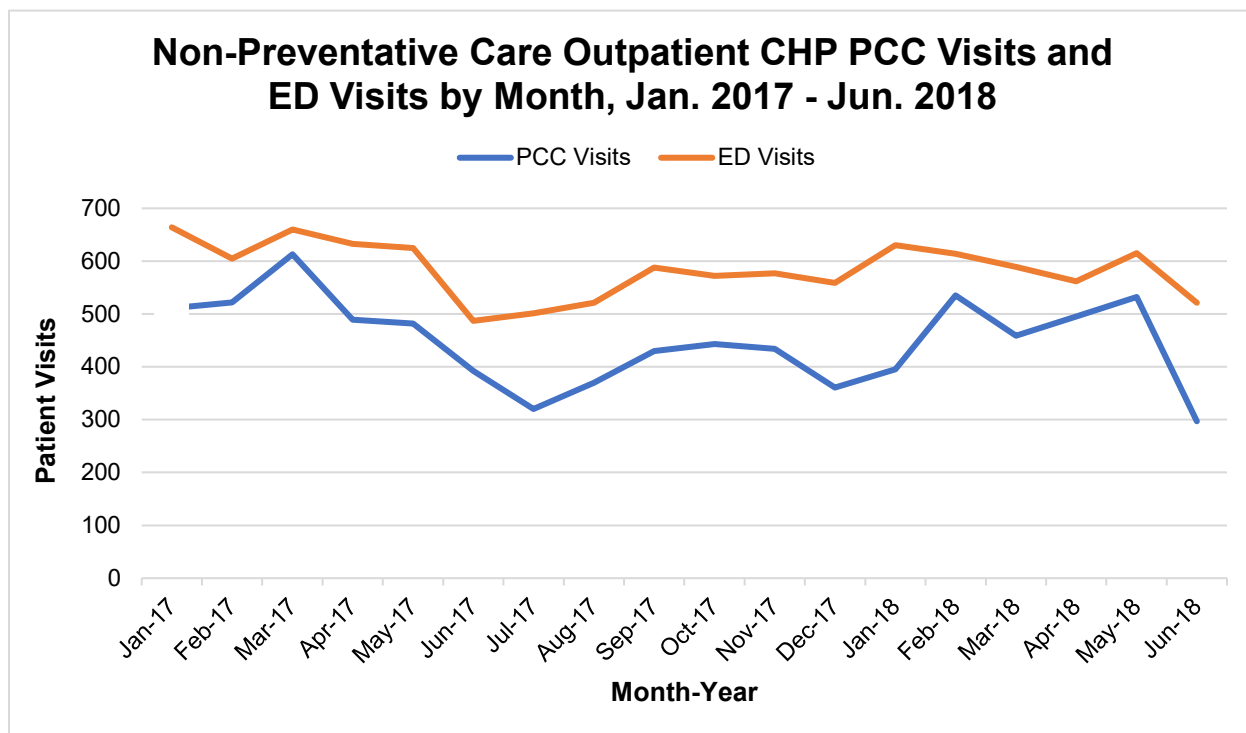
Figure 6. Total ED and Non-Preventative Outpatient CHP PCC Visits by CHP PCC Patients.
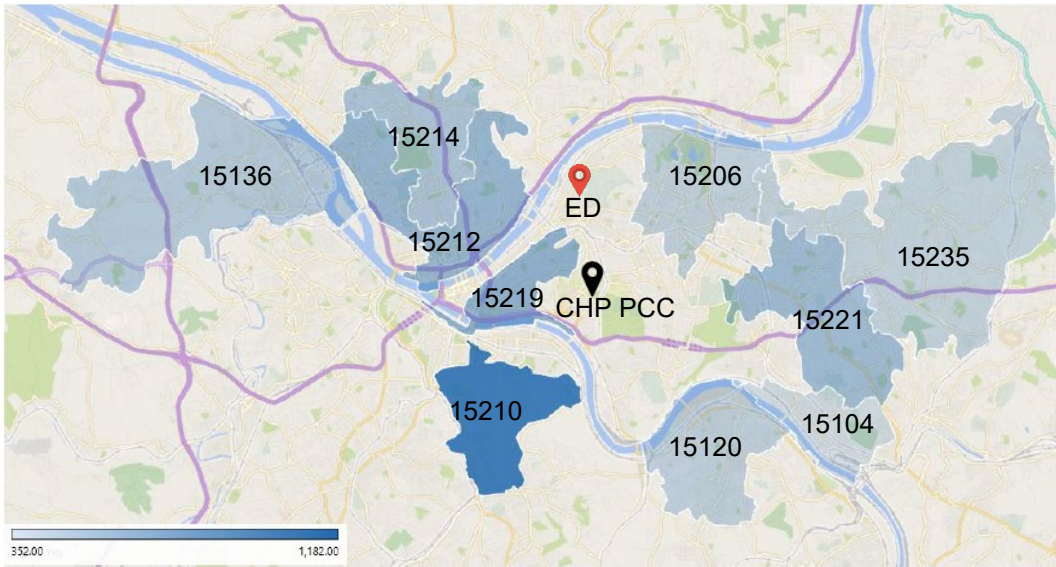Source: Faulds, Samantha. (General Academic Pediatrics 2018 – Year in Review). Pittsburgh, Pennsylvania; UPMC Children's Hospital of Pittsburgh. Retrieved April 3, 2019.

The PCC staff were aware of the high ED utilization and aware that some prior intervention studies had not proven to be effective, prompting a desire to identify potential interventions through both a review of existing evidence and through a closer analysis of PCC patient's needs and experiences. We seek an evidence-based approach to improve the ED utilization rate among the patients. A literature review will identify potential evidence-based interventions. We will explore studies' methods to decrease ED utilization by comparing the population and barriers to care with the CHP PCC among primary care patients in order to inform interventions that can be tailored to their specific population.

1.2   GAPS IN CURRENT KNOWLEDGE

Persistently high ED use is not unique to the CHP PCC. Recent data from the American College of Emergency Physicians (ACEP) found that the highest users of the ED for non-urgent conditions were pediatric patients, accounting for nearly one-fifth of all non-urgent ED visits.[16] Of these, 97% were evaluated and discharged from the ED.[16] The National Hospital and Ambulatory Medical Care Survey (NHAMCS) reported that infants less than a year old were the most common patients in an ED per capita all ED visits, visiting the ED at a rate of 84.5 per 100 infants in 2006[8] and 102.2 per 100 in 2015.[17] For children aged 1-4 years, non-urgent ED use increased from 11.4% (2006)[8] to 12.7% (2015)[17] of all non-urgent ED visits, as reported by NHAMCS. Nationwide non-urgent ED use is increasing disproportionately to overall ED utilization among both patients and adults, according to the Centers of Disease Control and Prevention (CDC); while the overall rate of ED visits decreased by 3% in 2014, the rate of non-urgent ED visits increased from 4% to 6% of all ED visits.[16]

It is not known what the most effective interventions to apply to primary care clinics will be to reverse this trend of non-urgent ED use. Current literature describes many interventions in clinics, however, we are uncertain of which interventions could be most effectively targeted to the CHP PCC's unique population. This essay will explore these questions and generate conclusions and inform recommendations that will be used to decrease non-ED utilization among the CHP PCC patients.

1.3 PUBLIC HEALTH SIGNIFICANCE

In 2015, there were 30 million ED visits for children aged 18 years and younger, at a rate of 383 per 1,000 population.[18] More than 40% of pediatric ED visits were among children aged 5 years and younger, although they represented 26% of all children in the US.[18] The growing ED utilization rate[8,17] is a public health concern. ED use and non-urgent ED use is reflective of racial and socioeconomic health equity issues. Rates of ED use among pediatric patients were higher among children from low-income households with African-American race and in urban neighborhoods.[19]

Use of the ED for nonurgent conditions is problematic in terms of cost and quality. High costs negatively impact both patients and payors. On average, pediatric urgent or emergency room care was $250 or more than office-based appointments.[20] The quality of emergency care can decrease as a result of increased crowding, long wait times, and strained staff availability for patients in true need of emergency care.[1,2,4] Use of the ED also fragments the delivery of care, undermining the continuity of care that is essential for preventative healthcare that clinics provide. Incorporating the utility and benefits of past interventions with the unique challenges of a given primary care clinic to develop future recommendations to reduce ED utilization can inform local improvement, with potential impact on continuity, child health, health equity, and health care costs.

2.0   LITERATURE REVIEW OF INTERVENTIONS TO REDUCE NON-URGENT ED UTILIZATION

2.1   INTRODUCTION

In this literature review, we aim to identify evidence-based strategies to reduce non-urgent pediatric ED visits. By comparing interventions across studies, we will rank their effectiveness among their respective populations. From a review of each study's population characteristics, we will assess the generalizability of results to our local PCC patients. We are interested in understanding how different approaches in interventions can address the proposed sources of non-urgent ED utilization and what methods are implemented to directly impact them.

Specifically, we are interested in understanding:

1. What are the existing interventions that effectively decrease ED utilization?

2. What are the caregivers and patient population characteristics and what are their barriers to primary care access?

3. How do effective interventions target patient barriers to primary care access?

4. What study designs, follow-up times, and comparator groups are being used in the evaluation of effective interventions?

5. What are the existing limitations of these effective interventions?

By understanding how specific interventions that target patient-perceived barriers of unique populations, we can identify the intervention(s) most likely to be effective for the PCC population.

2.2   METHODS

The literature search design consisted of the database selection, query construction, formation of review tiers, and exclusion criteria to identify relevant publications detailing interventions for decreasing ED utilization among pediatric patients. The database selection was important for acquiring the appropriate breadth of studies. The query construction was a crucial part of the review and required a balance of terms and operators that would capture all possible relevant studies without adding too many ineligible ones. Improperly defining the query would return either an overwhelming number of results or a narrow and potentially biased selection. The formation of review tiers produced a thorough and systematic process of eliminating studies based on specific eligibility criteria.

2.2.1   Eligibility Criteria

Articles of interest had to fulfill 5 inclusion criteria:

1. Study population age from birth to 21 years.

2. Study population of US, primary care clinic-identified patients.

3. Primary outcome of non-urgent ED utilization.

4. Intervention based study to compare different strategies.

5. Published within the last 10 years (2008-2018).

Studies that did not contain all five criteria were not included for review.

Exclusion criteria include:

1. Adults.

2. Chronic conditions.

3. Infectious diseases and vaccination.

4. Injuries, urgent conditions, and mortalities.

5. Surgical, dental, imaging procedures.

Excluded terms can be viewed in Table 2.

2.2.2   Developing the Search

In this literature review, the PubMed database was selected for its large selection of over 29 million studies, its accessibility, and focus on medicine and health sciences.[21] The timeframe chosen was 2008 to 2018, within the last ten years to evaluate interventions set in the current health care environment. The search was conducted December 23rd, 2018.

The query began by defining the population, outcome, the intervention, and the time period. The search was restricted to "titles and abstracts" searches of full-text articles rather than "all fields" to increase the specificity of the search. By limiting search terms to titles and abstracts, there is a higher likelihood the study will focus on the topics of interest. Studies were further limited to human participants and published in the English language.

Five pillars were created as overarching themes as the basis from which more specific search terms were grouped: *"age"* (inclusion item 1), *"ED", "use", and "non-urgency"* (inclusion item 3), *"intervention,"* (inclusion item 4) and *"exclude"* for exclusion criteria (Table 2). Search terms within each pillar were separated by "OR" and each pillar separated other pillars by "AND." The "exclude" pillar was added last by a "NOT" statement to further refine results. Asterisks

described all variants of the word beginning with the preceding phrase, while phrases in quotation marks specified the query to search for the words within the phrase together.

Terms chosen for exclusion were commonly seen in preliminary searches and were excluded from the title search rather than the abstract search, to exclude publication topics that were relevant to the search terms used and not relevant to the literature review from appearing.

Table 2. PubMed Literature Search Terms

Age	ED	Use	Intervention	Non-Urgent	Exclude
pediatric	ER	utiliz*	intervention	non-urgent	asthma
child*	ED	visits	initiative	nonurgent	brain
infant	"emergency	use	collaborative	low-acuity	mental
toddler	room"		protocol	"low acuity"	vaccine
newborn	"emergency		"quality	unnecessary	disease
adolescent	department"		improvement"	avoidable	dental
teen*			QI	preventable	imaging
preteen*			model	excess	elderly
pre-teen*			program	"upper	mortality
young			training	respiratory	injur*
			education	infection"	surg*
			prevention	URI	
				URI-related	
				URIs	
				complaints	
				"subsequent	
				visits"	
				nonemergen*	
				non-emergen	
				"acute	
				illness"	

Legend
▭ = Title/Abstract Search
▭ = Title Search
* = Wildcard
" " = Search Together

2.2.3 Study Selection

After the keyword search, the studies that returned were examined for potential inclusion in the review. A series of three tiers of review were implemented to reduce returned studies to a relevant selection: the title review, abstract review, then full-text review (Figure 7). The first tier of review was the title search where studies were excluded based on examination of the title alone. Studies that were not excluded after the title review continued to the second round of the abstract review. The second tier was the abstract review where potential eligible studies from the title review were inspected further by abstract alone. Studies that were not excluded in the abstract review continued to the full-text review, the third and final tier of review. Studies that underwent the full-text review were examined from introduction to results to determine the relevancy of the intervention, outcome, and population.

2.2.4 Removed Studies Summary

Studies that had ineligible populations, ineligible interventions or comparators, ineligible outcomes, ineligible settings, were duplicates or replicates of existing studies, or were systematic reviews were excluded from further review. Though articles could be excluded for multiple reasons, for organization, each article was excluded for a single main reason.

Reasons for exclusion were defined loosely using the PICOS hypothesis elements. The acronym describes:

P – Patient, Problem or Population.

I – Intervention.

C – Comparison, Control or Comparator.

O – Outcome.

S – Setting.

In addition, any duplicates and systematic reviews were excluded from review.

2.2.5   Data Collection and Summary Collection Method

Results from PubMed were exported into a Microsoft Excel (2016) spreadsheet and organized in separate tabs for each tier of review with either inclusion status or reasons for exclusion in the adjacent column. Counts of results by reasons for exclusion were acquired by filtering and summing. Pivot tables were used to generate column bar charts to view the sum of results for all reasons. This was repeated in each tier of review.

2.3   RESULTS

The search query resulted in 327 articles (Figure 7). All 327 articles were reviewed in the title search and 273 were excluded:

- 32 did not match the population criteria; all were adult studies.

- 36 did not meet intervention criteria; 33 studies observed factors (i.e. vaccination rates) that were not studied as interventions and 3 were editorials that detailed opinions and theories for high non-urgent ED utilization.

- 112 did not match outcome criteria; criteria. Specifically, 58 focused on chronic conditions or injuries that would commonly be perceived as urgent or would justify an ED visit (i.e. inflammatory bowel disease, head trauma), 16 described clinical

procedures and x-ray processes, 19 studies were from the perspective of hospital administration or logistics (i.e. patient flow, Manchester triage system, transfers), 10 observed medical prescriptions (i.e. doses, antibiotics, drug events) and 9 centered on mental disabilities (i.e. overutilization by children with autism).

- 36 did not match setting criteria; 16 were conducted in countries outside of the United States, 3 were government program centers and were not affiliated with a primary care setting, and 17 analyzed insurance data and were not affiliated with any particular hospital.

- 9 were duplicates or systematic reviews.

After the 273 exclusions from the title review, 54 studies were left for inclusion in the abstract search. Of the 54 abstracts, 33 studies were excluded:

- 1 was from an ineligible population and pertained to the adult population.

- 24 were ineligible interventions and comparators; 22 were not interventions and 2 did not use ED utilization as the primary outcome.

- 4 were ineligible outcomes; 1 observed the influence of reduced Medicaid costs on ED utilization and 3 had goals of decreasing ED visits specifically for lethargy and infant crying complaints.

- 4 were ineligible settings; all 4 studies were conducted in Canada.

After removing 33 studies from the abstract search, 21 full-text studies remained and were read for inclusion in the full-text review. Of these, 11 were excluded:

- 3 were of ineligible interventions; 2 were not affiliated with a primary care center and 1 was telemedicine-based that did not implement a new intervention.

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- 5 were of ineligible outcomes in that they did not examine rates of non-urgent ED visits.

- 3 were systematic reviews.

After the full-text review, 10 studies remained and were eligible for inclusion in the literature review (Table 3).

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                    ┌─────────────────────────────────────────┐
                    │  Original Search   N = 327               │
                    │                                          │
                    │  327 articles included for review.       │
                    └─────────────────────────────────────────┘
                                      │
                    ┌─────────────────────────────────────────┐
                    │  Title Review N = 327                    │
                    └─────────────────────────────────────────┘
                                      │
```

Excluded N = 273

Ineligible Population
    32 adult population
Ineligible Intervention/Comparator
    33 no intervention
    3 ED utilization editorials
Ineligible Outcome
    58 chronic conditions/injuries
    16 clinical/surgical/x-ray procedure
    19 hospital administration
    10 drugs/prescriptions
    9 mental disabilities
Ineligible Setting
    16 not in the US
    3 government program centers
    17 insurance coverage
Replicates & Reviews
    3 duplicates
    6 systematic/literature reviews

Abstract Review N = 54

Excluded N = 33

Ineligible Population
    1 adult population
Ineligible Intervention/Comparator
    22 no intervention
    2 telemedicine
Ineligible Outcome
    1 insurance coverage
    3 crying/lethargy complaints
Ineligible Setting
    4 not in the US

Full-Text Review N = 21

Excluded N = 11

Ineligible Intervention/Comparator
    2 non-hospital setting
    1 telemedicine
Ineligible Outcome
    5 not reducing ED visits
Replicates & Reviews
    3 systematic reviews

Articles Included in Review N=10

Figure 7. Determining Interventions to Decrease Pediatric ED Utilization.

2.3.1 Study Design and Patient Demographics

At least 11,726 caregivers and patients across 10 studies were included in this review (Table 3). Six of the 10 articles used a randomized control trial design with a total of 2,771 participants randomized to an intervention compared to 2,805 controls. Of the 6 trials, 5 used a two-armed parallel design[22–26] and 1 was a cluster randomized design.[27] The 4 non-randomized studies used a quasi-experimental or pre-post design to determine whether ED use was reduced after the intervention in comparison to the time period before the intervention.[28,29,30,31] One of these 4 quasi-experimental studies incorporated historical data of clinics from two different primary care centers (negative controls) for the comparison.[30]

Population characteristics are detailed in Table 4 and all numbers are as reported by participants. The number of participants enrolled per study ranged from 332 – 4,246 clinic patients and from 32-1203 caregivers of clinic patients. Four studies reported caregiver characteristics,[24,26,29,31] 2 studies mainly reported child characteristics,[23,25] 2 studies reported both child and caregiver characteristics,[27,32] and 2 studies did not report characteristics beyond child age.[28,30] Seven studies did not report the child's sibling status,[23–25,27–30] 6 did not report race/ethnicity of the children.[24,26,28–31] and 5 did not report the child's sex.[24,26,28–30] Child age ranged from 0 – 21 years with the median child age ranging from 1.33 – 4.5 years. The percentage of male children enrolled ranged between 45-57%. Children of non-Hispanic Black race ranged from 2-66% and children of non-Hispanic White race ranged from 3-17%. Hispanic or Latino children ranged from 55-87% and children of all other races and ethnicities ranged from 6-21%. Children with public insurance ranged from 43-92%, and with private insurance ranged from 7.5-55%. Households with more than one child ranged from 48-76%.

Four studies did not report the caregiver age,[25,28–30] 5 did not report caregiver sex,[23,25,26,28,30] 4 did not report caregiver race or ethnicity.[23,25,28,30] The majority of caregivers ages ranged from 15-34 years. The percentages of male caregivers ranged between 7-57%. Non-Hispanic Black caregivers ranged from 0-79% of the study sample while 0-29% of study sample were non-Hispanic White. Hispanic or Latino caregivers ranged from 2-87% of the study sample and other races and ethnicities ranged from 3-15%. Two studies reported the % of participants with annual household incomes of less than $20,000 at 47%[22] and 68%.[26] Caregivers with no post-secondary education ranged from 50-61%.

In both child and caregiver populations, Black race was most prevalent among populations, accounting for over 65% of study populations in four studies.[24–26,31] This was consistent with the CHP PCC whose patient population was 76% Black. The CHP PCC has a smaller Hispanic and Latino patient population than all other studies (7%). The percentage of male children, 51%, at the CHP PCC was similar to all other studies. More patients were publicly insured at the CHP PCC than 3 of the 4 studies reporting child's insurance.[22,23,25] The average child age at the CHP PCC (6.94 years) was slightly higher than the average/median child age of the studies. Annual household income at the CHP PCC was higher than the studies that reported the information (19% of households made $20,000 or less annually), however the percent of children on public insurance was higher than 3 of the 4 studies that reported this information.

Table 3. Literature Review of Interventions: Summary of Studies

#	Article	Author(s)	Population	Study Design & Starting Sample Size	Sites of Implementation	Intervention and Evaluation	Key Findings	Limitations
1.	Decreasing Low Acuity Pediatric Emergency Room Visits with Increased Clinic Access and Improved Parent Education[28]	Davis, T. et al. 2018	Caregivers of children aged 0-18 years	Prospective, Quasi-Experimental, Pre-Post N = 1203 caregivers	New Hanover Regional Medical Center Clinic N = 1	Increased Hours Evaluation: Self-reported assessments from pre-intervention (N=1203) and 1-year post-intervention (N=1404) ED use was compared.	Intervention significantly decreased ED use among clinic patients after 1-year post-intervention compared to pre-intervention, (42 visits per 100 persons per year vs. 72 visits per 100 persons per year, p<0.0001)	Small sample size, single clinic, possible confounding by yearly changes in acute illness, patients during after-hours did not benefit from the intervention.
2.	Enriched medical home intervention using community health worker home visitation and ED use[22]	Anugu, M. et al. 2017	Children aged 0-18 years. .	Randomized Controlled Trial N = 450 children	Stony Brook University Medical Center–affiliated pediatric primary care practices N=5.	Home Visit from Community Health Worker Evaluation: Self-reported assessments and EMRs from CHW monthly visitations for intervention group (N=225) and usual care group (N=225) during 1 year follow-up.	Intervention group had significantly fewer patients using the ED at least once during follow-up compared to usual care group after 12 months (18% of intervention group visited the ED at least once vs. 35% of control group visited the ED at least once, p=0.004).	Authors could not assess records from ED visits outside the hospital system, underestimating total ED visits. Participants who received text messages may be more inclined to visit co-located ED rather than other EDs because of messages, biasing results.

Table 3 Continued.

#	Article	Author(s)	Population	Study Design & Sample	Sites of Implementation	Intervention and Evaluation	Key Findings	Limitations
3.	Effect of Telephone Calls From Primary Care Practices on Follow-up Visits After Pediatric Emergency Department Visits.[33]	Racine, A. D. et al. 2009	Children aged 0-21 years.	Randomized, Controlled Trial N=4,246 children	Urban, academic children's hospital. N = 1	Follow-Up Phone Call Evaluation: EMRs for intervention group (N=2,166) vs. standard group (N=2,080) during 12-month follow-up.	Intervention group had fewer patients using the ED at least once during follow-up compared to usual care group after 12 months, though not significant (38% of intervention group visited the ED at least once vs. 39% of control group visited the ED at least once, p=0.26).	Practices were unable to execute the intervention on a consistent basis, problems calling patients with disconnected phones, working schedules that required messages left on answering machine, wrong telephone numbers recorded in database, unable to identify health care service use beyond medical center that patients went to.
4.	Educational Text Messages Decreased Emergency Department Utilization Among Infant Caregivers: A Randomized Trial[26]	Ladley A. et al. 2018	Caregivers of newborn aged 0-10 weeks.	Randomized Controlled Trial N=231 caregivers	St. Louis Medical Center PCC N=1	Caregiver Education and Communication Evaluation: Chart reviews after 1 year from Text message group (N=114) vs. standard of care group (N=117) over 6-months each.	Intervention group had significantly fewer mean ED visits in first year compared to control group (1.47 mean visits over 1 year vs. 2.14 mean visits over 1 year, p<0.05).	Participants who received text messages may be more inclined to visit co-located ED rather than other EDs because of messages, biasing results. Authors could not assess records from ED visits outside the hospital system, underestimating total ED visits.

Table 3 Continued.

| #	Article	Author(s)	Population	Study Design & Sample	Sites of Implementation	Intervention and Evaluation	Key Findings	Study Limitations
5.	Reconnecting Patients With Their Primary Care Provider[25]	Sturm, J.J. et al. 2014	Children aged 3 months-16 years.	Randomized Controlled Trial N=332 children	PED of a Tertiary Children's Hospital and 35 PCCs N=35	Caregiver Education Evaluation: EMRs from intervention (N=164) and standard of care (N=168) groups over a 6-month and 12-month period.	Intervention group had significantly lower ED utilization than control group after 12-months (54% of control group visited the ED at least once vs. 43% of intervention group, p=0.047).	Patients were from a selected network of primary care providers and regional acceptance of public insurance may affect generalizability, potential bias in enrolling patients.
6.	Effects of an Education and Training Intervention on Caregiver Knowledge of Nonurgent Pediatric Complaints and on Child Health Services Utilization[31]	Fieldston, E.S. et al. 2013	Caregivers of children aged 7 months – 5 years	Quasi-Experimental, Pre-Post Pilot Study N= 32 caregivers	The Children's Hospital of Philadelphia ED and PCCs N = 4	Caregiver Education Evaluation: Self-reported assessments from Pre-intervention (N=n.a.) and post-intervention (N=n.a.) groups after 6-months.	Post-intervention group had fewer mean ED visits than pre-intervention group after 6 months, though not significant (0.58 mean visits per child vs. 0.67 mean visits per child, p=NS).	Single setting may limit generalizability of results, small sample size, use of the ED post-intervention was for more acute conditions or seasonal ailments.

Table 3 Continued.

#	Article	Author (s)	Population	Study Design & Sample	Sites of Implement ation	Intervention and Evaluation	Key Findings	Study Limitations
7.	A reduction in emergency department use by children from a parent educational intervention[30]	Yoffe SJ et al. 2011	Caregivers of children aged 0-10 years.	Quasi-Experimental Pre-Post N=n.a.	St. Joseph Regional Center hospital, 4 satellite hospitals, 2 PCCs N=7	Caregiver Education Evaluation: EMRs from intervention (N=n.a.) and control group (N=n.a.) over 11-months.	Intervention significantly decreased ED use among clinic patients after 13 months (21% ED use per month vs. 6% ED use per month, $p < 0.001$).	Not a randomized experiment, could have used statistical process control charts instead of trends, how the intervention was presented to families could have affected the success.
8.	Effect of a URI-Related Educational Intervention in Early Head Start on ED Visits.[27]	Stockw ell, M.S. et al. 2014	Caregivers of Latina Early Head Start (EHS) children aged 6 months - 4 years	Cluster-randomized Controlled Trial N=154 caregivers	Columbia U. Medical Center, 4 EHS sites in NYC N=4	Parent Education Evaluation: Self-reported assessments from intervention group (N=76) vs. standard curriculum group (N=78) after 5-months.	Intervention families had significantly fewer ED visits than standard curriculum families after a 5-month period (8% ED visits of total illness episodes vs. 16% ED visits of total illness episodes , $p=0.025$).	Single community, randomization was site-based instead of individual-based, small number of clusters, randomized sites did not differ in demographic variables, data collection was not blinded, most outcomes were self-reported.

25

Table 3 Continued.

#	Article	Author(s)	Population	Study Design & Sample	Sites of Implementation	Intervention and Evaluation	Key Findings	Limitations
9.	Effectiveness of fever education in a pediatric emergency department.[24]	Baker, M. et al. 2009	Caregivers of children aged 3-36 months.	Prospective, Randomized Controlled Trial N=280 caregivers	Children's Hospital of Alabama Emergency Department N=1	Parent Education Evaluation: Self-reported assessments of intervention group (N=140) and control (N=140) after a mean of 16 months follow-up period.	Intervention did not significantly decrease ED visits for subsequent febrile episodes between intervention vs control group (81 ED visits vs. 81 ED visits, p=0.46)	A single ED was observed, therefore, caregivers may have used other EDs for subsequent febrile illnesses. Participants may have moved before study completion. Participants were not asked if main reason for coming was for fever or other symptoms.
10.	Impact of a Health Literacy Intervention on Pediatric Emergency Department Use.[29]	Herman A. et al. July 2009.	Caregivers of children aged 0 -18 years.	Pre-Post N=113 caregivers	Harbor-UCLA Medical Center PED N=1	Parent Education Evaluation: Self-reported assessments from intervention group (N=n.a.) and control (N=n.a.) after 6 months.	Intervention significantly decreased ED use among clinic patients after 6 months (73% of group visited ED at least once vs. 43% of group visited ED at least once, p < 0.0001).	Non-randomized controlled sample was used, potential recall bias by parents as to actual number of clinic and ED visits, low follow-up rate, no control group.

Table 4. Literature Review of Interventions: Population Characteristics

	1. Davis, T., et al. 2018[28]	2. Anugu, M. et al. 2017[22]	3. Racine, AD et al. 2009[33]	4. Ladley, A. et al. 2018[26]	5. Sturm, JJ. et al. 2014[25]	6. Fieldston, ES et al 2013[31]	7. Yoffe, SJ, et al. 2011[30]	8. Stockwell, MS et al. 2014[27]	9. Baker, M. et al. 2009[24]	10. Herman A. et al. 2009[29]	CHP PCC[15]
Child											
Age (years)											
— Range	0-18	- -	0 –21	0 -10 w	3 m – 16	7 m – 5	0 – 10	0-4	- -	0 – 18	0–25
— Mean/Median	- -	1.5	- -	- -	4.5	--	- -	1.75	1.33	4	6.94
Sex %											
— Male		47	52		50	57		45			51
Race/Ethnicity %											
— White		17	4		13			3			16
— Black		10	35		66			2			76
— Hispanic/Latino		59	55		--			87			7
— Other		14	6		21			8			8
Insurance %											
— Public		45	43		53			92			81
— Private		55	42		46			7.5			16
— Other		--	15		--			--			3
Child Siblings											
— Any Siblings		76		50	48						
Respondent/Caregiver											
Age (years)											
— Majority Range (%)		15-34 (63)		20-29 (73)	--			19-29 (52)	--		
— Mean/Median		--		--	25			--	26		
Sex %											
— Male		47			57			45	13	7	
Race/Ethnicity %											
— White		17		16	22			0	29	3	
— Black		9		79	72			0	66	13	
— Hispanic/Latino		59		--	12			87	2	80	
— Other		15		5	6			13	3	3	
Insurance %											
— Public		80						91	62	87	
— Private		20						7	22	5	
— Other		--						--	16	8	
Income %											
— <20,000		47		68							19
Education %											
— No Post-Secondary Edu.		56		50	50			61			

▢ = Studies with Caregiver Education Interventions.

▢ = Studies with Caregiver Access Interventions.

Table 5. Literature Review of Interventions: ED Utilization

	1. Davis, T. et al. 2018[28]	2. Anugu, M., et al. 2017[22]	3. Racine, A.D. et al. 2009[33]	4. Ladley, A. et al. 2018[26]	5. Sturm, J.J. et al. 2014[25]	6.Fieldston, E.S. et al 2013[31]	7. Yoffe, S.J. et al. 2011[30]	8.Stockwell, M.S. et al. 2014[27]	9. Baker, M. et al. 2009[24]	10.Herman A. et al. 2009[29]	CHP PCC[15]
Intervention Time Length (months)	12	12	12	6	12	6	13	12	16 (mean)	6	
Pre-Intervention	72 mean visits per 100 persons per year					0.67 mean visits per child per month.	21% ED visits of total visits per month			73% of group visited the ED at least once.	1.41 mean visits per patient.
Post-Intervention	42 mean visits per 100 persons per year					0.58 mean visits per child after 6 months of follow-up.	6% ED visits of total visits per month			43% of group visited the ED at least once.	
Comparator Group		35% of group visited the ED at least once.	39% of group visited the ED at least once.	2.14 mean visits per child in the first year.	54% of group visited the ED at least once.			16% ED visits of total illness episodes.	81 total ED visits		
Intervention Group		18% of group visited the ED at least once.	38% of group visited the ED at least once.	1.47 mean visits per child in the first year.	43% of group visited the ED at least once.			8% ED visits of total illness episodes.	81 total ED visits		
Change in Non-Urgent ED Visits	-30 mean visits per 100 persons per year. (p<0.0001)	-17% of group visited the ED at least once. (p = 0.004)	-1% of group visited the ED at least once. (p = 0.26)	- 0.67 mean visits per child in the first year. (p<0.05)	-11% of group visited the ED at least once. (p=0.047)	-0.09 mean visits per child in 6 months of follow-up. (p=NS)	-15% ED visits of total visits per month. (p<0.001)	-8% ED visits of total illness episodes. (p=0.025)	0 total ED visits (p=0.46)	-30% of group visited the ED at least once. (p<0.0001)	
Brief Intervention Description	Walk-in Clinic	CHWs	Follow-up Phone Calls	Text Messages	PCP-Specific Handouts	Nurse Skills Demo.	Humorous Book	Latina-Led Classes	Video	Easy-to-Read Book	

*NS indicates not significant at alpha level 5%, as reported.

☐ = Studies with Caregiver Education Interventions.

☐ = Studies with Caregiver Access Interventions.

2.3.2 Intervention Settings

Interventions to decrease ED utilization occurred in primary care offices or pediatric EDs of major hospitals (see Table 3). PED sites were often used in conjunction with co-located hospitals or affiliated primary care settings to determine ED utilization of primary care patients. The interventions were delivered in multiple settings including pediatric hospitals,[22,24–31,33] Early Head Start (EHS) sites,[27] and families' homes.[22] Three studies held interventions in PEDs;[24,25,29] 1 distributed educational handouts with primary care provider (PCP)-specific input to caregivers at an outpatient clinic,[25] 1 presented caregivers with an 11-minute education video about home management of fever,[24] 1 distributed a health-aid book after child visitations[29]. Five studies implemented interventions in primary care offices,[26,28,31,30,33] 1 created posters, revised scripts for staff and their after-hours triage line, and created bookmarks for distribution,[28] 1 sent 4 text-messages per week to caregivers,[26] 1 used nurses to present and teach caregivers first-sign skills,[31] 1 distributed an educational booklet,[30] 1 made follow-up phone calls within 72 hours of patients using the PED.[33] One study conducted the intervention in EHS sites where Latina community health workers taught education classes on infections, vaccinations, influenza, and when to seek care.[27] Only one study delivered their intervention in the home setting; community health workers visited caregivers monthly to support adherence to recommended care.[22]

2.3.3 Intervention Contents and Goals

Interventions are used to address identified barriers in health care. The literature review of interventions suggested two main barriers to health care identified by patients: lack of health

literacy and limited access. Literature has shown the importance of targeting health literacy and access to improve health outcomes in many different scenarios. Previous studies have addressed the efficacy of patient education interventions in improving decision-making and reducing adverse outcomes, particularly in knowledge of treatment options,[34,35,36] recognition and management of conditions,[37,38,39] and reporting acute conditions.[40] Interventions have also been used to increase access to primary care by improving health equity of vulnerable populations,[41–43] improving scheduling processes and wait times,[44,45] and increasing lines of communication.[46–48]

Studies from the literature review of interventions were found to target barriers of health literacy and access. The studies were grouped by these two barriers.

2.3.3.1 Barrier: Health Literacy

Almost all of the interventions targeted health literacy of caregivers and sought to improve knowledge of common medical conditions and increase communication between providers and patients (Table 3). Seven of ten articles implemented caregiver education interventions and targeted caregivers' health literacy and decision-making.[24–27,30,31] These studies had goals of increasing caregivers' knowledge of the first signs of unknown illness and how to treat them accordingly. Educational interventions for health literacy included dedicated time for discussion, skills demonstrations, and recognition training for fever, colds, and minor trauma. In one study, caregiver education was incorporated in text messages and addressed concerns such as fever, voiding and stooling, and skin concerns.[26] For three of these six studies, caregivers were taught what they could do at home in the presence of these signs; they were given educational materials that taught ways to obtain medical advice, identify symptoms, intervene with appropriate care, monitor and follow through if further care was needed.[25,31,24] Educational materials included sections such as: *What to expect?, When to worry?, What to do, What is considered a normal*

temperature versus a fever, What causes fever?[25] Skills that were taught in one of these three studies included reading a thermometer, using a bulb syringe, and measuring medication dosing.[25] Another study chose a classroom-style teaching method with five modules covering: viral versus bacterial infections, URI versus influenza, influenza vaccination, antibiotic resistance, and when and where a family should seek care, in addition to practice using similar tools.[27] In another study, a 146-page pediatrics book was adapted into a 20-page book with a Flesch-Kincaid readability grade of 6.7 and added humor as a teaching tool.[30] Likewise, a study used a fourth-grade reading-level self-help book that offers information on over 50 common childhood medical problems.[29]

2.3.3.2 Barrier: Access to Primary Care

Three of the ten studies designed interventions centered on increasing continuity with patients.[22,28,33] The interventions addressed limited access by increasing awareness of clinic hours, walk-in hours, phone services, and providing assistance with scheduling and appointment processes. One study had community health workers visiting families in their homes monthly to document the child's health and send notes to clinicians, and provide anticipatory guidance.[22] These workers also organized the children's medical information, medications, insurance, and appointments for these families. One of these studies used telephone calls to contact primary care patients who used the ED within 72 hours about their follow-up status and offer information on after-hours telephone contact and advice regarding appropriate use of the ED.[33] Another study designed an intervention that increased access to care by creating a business hours walk-in clinic for ages 0-18 years and supplementing with revised phone scripts and clinic posters.[28]

2.3.4   ED Utilization Results and Analysis

Of the 10 studies, 7 yielded statistically significant reductions in ED utilization for the given intervention.[22,25–30] For interventions targeting health literacy, 5 of the 7 studies[25,30,27,29,26] yielded statistically significant results. Of the 3 interventions targeting limited access to primary care, 2 yielded statistically significant results.[22,28]

We will next determine the most effective interventions to address each barrier, based on studies using the same measurements, effect size, and significance. Studies that do not use the same measurements will not be compared to narrow studies.

2.3.4.1 Evaluation of Caregiver Education Interventions to Address Health Literacy

Despite similarities in the barriers targeted by interventions, studies reported ED utilization many different ways (Table 5). Of the studies that evaluated caregiver education interventions, 2 reported the percentage of study groups visiting the ED at least once over a 6-month and 12-month follow-up period.[29,25] While both studies, Sturm et al. (2014) and Herman et al. (2009), used the same metric, they did not have the same study design; Herman et al. used a pre-post design over 6 months and had a 30% (p<0.0001) significant decrease in the intervention arm of the study group using the ED at least once,[29] while Sturm et al. used a randomized design over 12 months and had an 11% (p=0.047) decrease in the intervention arm.[25] Sturm et al. (2014) may have a more generalizable estimate due to the use of 35 primary care sites and more robust study design for longer period compared to Herman et al.'s (2009) single primary care site and non-randomized sample over half the time period. Sturm et al.'s (2014) sample size was also twice that of Herman et al.'s (2009) and obtained a better follow-up rate than Herman et al. (2009) did (Table 3). We

will exclude Herman et al. (2009) and continue to narrow studies by effectiveness, based on studies using the same measurements.

Two studies reported ED utilization index per child, defined as the mean number of ED visits per child. For Fieldston et al. (2013), this was obtained from a pre-intervention assessment and post-intervention assessment after 6 months of follow-up and for Ladley et al. (2018), this was obtained 6 months after the 6-month evaluation chart reviews. Fieldston et al. (2013) reported a 0.09 (p=NS) mean visit decrease per child over 6-months while Ladley et al. (2018) reported a 0.67 (p=0.05) decrease in mean visits per child over 1 year in the intervention arms. Fieldston et al. (2013) as a pilot study and had about a seventh of the study population of Ladley et al. (2018) (N=32). Since Ladley et al. (2018) used a randomized study design and included a larger sample size, Ladley et al. (2018) may have the more effective intervention. Therefore, we will exclude Fieldston et al. (2013) and continue to narrow studies by effectiveness, based on those using the same measurements.

Yoffe et al. (2011) and Stockwell et al. (2014) both reported proportions of ED visits; Yoffe et al. reported a 15% (p<0.001) significant decrease in the percentage of ED visits of total visits per month and Stockwell et al. (2014) reported an 8% (p=0.025) significant decrease in percentage of ED visits of total illness episodes in the intervention arms. Both studies used multiple sites for comparison, one was cluster-randomized[27] and one used other primary care practices as the control,[30] Yoffe et al. (2011) did not report a sample size and Stockwell et al. (2014) did (N=154). Since Yoffe et al. (2011) incorporates all visits in the denominator and Stockwell et al. (2014) only uses illness episodes, Yoffe et al.'s (2011) effect size would have a smaller proportion of ED visits compared to Stockwell et al. (2014) and comparing their effective sizes would not be appropriate.

Baker et al. (2009) reported the total number of ED visits per group. While using a strong randomized study design and large sample size (N=280), they found no change in ED visits across groups. Therefore, Baker et al. (2013) will be excluded in the narrowing of studies.

Having narrowed the effective caregiver interventions from 7 to 4, we are left to decide between Ladley et al. (2018),[26] Sturm et al. (2014),[25] Yoffe et al. (2011),[30] and Stockwell et al. (2014).[27] All reported significant decreases in ED utilization, but how interventions were presented to families could have affected their results. Educational classes,[27] handouts,[25] booklets,[30] and text messages[26] were the approaches used by these 4 studies. All four had unique modes of delivery and were engaging to their population in different ways. Educational classes were delivered by Latina community health workers to a primarily Latina and Hispanic population.[27] Handouts were distributed to caregivers with the added knowledge that they contained PCP-specific input.[25] The book that was distributed had injected humor as a teaching tool[30] and the text messages electronically administered fever education.[26] When looking at two of the four most effective caregiver education interventions that had the most statistically significant results, Yoffe et al. (2011) (15% decrease in ED visits of total visits per month, N=n.a., $p<0.001$)[30] and Stockwell et al. (2014) (8% decrease in ED visits of total illness episodes, N=154, p=0.025),[27] they were the humorous educational book and the classes led by Latina CHWs.

The non-significant studies may have not presented education in the most engaging or interesting way, or in the way that could best hold the attention of their unique populations. Though Sturm et al.'s (2014) and Yoffe et al.'s (2011) methods were unconventional and directly delivered to patients, they may have lacked connection with patients.[25,30] Sturm et al. (2014) distributed the PCP-specific handout to primarily Black (66%) children aged 3 months – 16 years[25] and Ladley et al. (2018) sent text messages to primarily Black caregivers, aged 20-29 years (73%), of infants.[26]

Yoffe et al. (2011) did not report population characteristics and Stockwell et al. (2014) had an 87% Hispanic study population.[27,30] While Yoffe et al. (2011) did not report population characteristics, humor is a universal tool for connection and caregivers of all demographics may have resonated with the book. Stockwell et al.'s (2014) intervention targeted its population best by using community members of similar backgrounds to caregivers to directly and repeatedly instruct them.[27]

2.3.4.2 Evaluation of Caregiver Access Interventions to Address Limited Access to Primary Care

Of the three study interventions that attempted to increase primary care access,[22,28,33] 2 studies reported the percentage of the study group that used the ED at least once during the follow-up period and one reported the mean number of visits per 100 person years.

Studies that targeted access will now be narrowed. Two studies reported proportions of the study group using the ED at least once: Anugu et al. (2017) reported a 17% (p=0.004)[22] significant decrease while Racine et al. (2009) reported a 1% decrease (p=0.26).[33] Both studies used a randomized design and a sample population from birth to adulthood. Though Racine et al.'s (2009) study had a much larger sample size than Anugu et al. (2017), it had a non-significant and small effect size,[22,33] suggesting Anugu et al. (2017) may be the more effective access intervention. Therefore, we will exclude Racine et al. (2009) and compare Anugu et al. (2017) and Davis et al. (2018) for most effective access interventions.

After narrowing the selection of studies that increased patient access from 3[22,28,33] to 2,[22,28], given significant results, we determined the most effective study targeting patient access. Of the two most effective interventions targeting limited patient access, Anugu et al. (2017) used community health workers to guide families[22] and Davis et al. (2018) established a walk-in clinic.[28]

Both significantly decreased ED utilization through the elimination of appointment scheduling and increased availability and flexibility. The follow-up phone call intervention[33] did not provide the aforementioned conveniences. Though Davis et al. (2018) did not report population characteristics, Anugu et al. (2017) reported 47% of caregivers earned household incomes of less than $20,000 and 56% were not educated beyond the high school level.[22,28]

2.4   DISCUSSION

ED utilization interventions can be feasible and effective across a broad spectrum of sites and populations. A wide variety of interventions can be used to address patient-identified barriers though some are more effective than others. The two main barriers targeted by the interventions appeared to be the lack of health literacy and the lack of patient access (or awareness of access) to primary care. The most effective interventions targeted both these barriers and the populations that addressed them. The most effective interventions targeting health literacy or access involved community engagement.[27,22] The use of community health workers may have been most effective because of their ability to connect with patients in ways beyond health. Not only do they understand families' cultures and livelihoods, but they can provide assistance to families in ways providers traditionally do not, such as with appointment scheduling, home-visits, and local social support.[49,50] They have the advantage of being trusted members of the patients' communities.[51,52] Their constant visibility and communication in their communities can increase continuity of care with patients beyond clinic hours.[50] The relationships between providers and patients formed beyond health are important to primary care.[49,51,50,52]

Two of the interventions addressing caregiver education that yielded less significant results had majority Black populations.[26,25] Though these interventions may have led to decreases in ED utilization they were not effective, perhaps because they did not adequately address the demographics of their patient population or the most salient barriers for these populations in intervention design. For example, Ladley et al. (2018) had a population of mainly Black (79%) 20-29 year-old caregivers (73%) with newborns, 50% of these families had more than one child, and 68% were earning household incomes of less than $20,000. It is possible these families were not able to engage with the 4 texts a week for 6 months.[26] In another example, Fieldston et al. (2013) administered on a weekend a 90-minute training session followed by a written exam (led by pediatric nurses) to a majority Black population (72%) where half were not educated beyond high school.[31] Prior work suggests that health systems may lack of understanding of how to connect with primarily Black populations.[31] Alternatively, these interventions may not have adequately addressed other barriers unique to Black populations, such as structural racism and history of discrimination in health care settings.

The most effective interventions were the ones that connected with its unique population most effectively. Clinics and hospitals need to better connect with their patients and communities. Tailored interventions targeting specific population characteristics are one way to address this issue. Another way would be to administer qualitative studies asking patients directly how clinics can improve their relationships with patients. Further, there is a need for more diverse providers who understand how to better serve their specific patient populations. Community partnerships that allow community members to facilitate care coordination and increase communication between patients and providers can address the lack of understanding of patient needs.

Health literacy appeared to be the most common barrier addressed by the interventions, though not all patient education interventions were effective. Current literature on interventions with the highest impacts on ED utilization are conflicting. In a systematic review by Morgan et al. (2013) of interventions based outside the ED, authors noted that the interventions that showed the greatest magnitude of ED use reductions were in patient education.[53] This conclusion was found more recently than a finding by Flores-Mateo et al. (2012),[54] in their systematic review of organizational interventions to reduce ED utilization. Flores-Mateo et al. (2012)[54] concluded that increased primary care accessibility was effective in reducing ED use while Morgan et al. (2013) found the opposite.[53]

Access was another common barriers addressed by the interventions. Caregivers with low income or educational attainment may be employed in low-skilled or unskilled positions that exceeded hours that the clinic was open, and did not want to prioritize the task of appointment scheduling as a result. They may also have been employed in situations where work schedules were not released adequately in advance to accommodate appointment scheduling. Alternatively, they may be uncomfortable with the task of appointment scheduling if they were unfamiliar with the process. As a result, a large reason for limited access to primary care may be appointment and scheduling, and future interventions targeting this may improve clinic access.

Comparing the effectiveness of interventions was challenging due to variability in many aspects of the studies: study design, interventions used and their implementation, time length and follow-up time, ED measurement, and control groups. In many cases, studies did not report sample sizes, especially studies using pre-post designs. Reporting of population characteristics varied between children and caregivers and studies did not use similar measurements. Caution had to be taken in interpreting results because of seasonality and pre-existing ED utilization trends if they

were not properly adjusted for. Participants could have naturally changed patterns in nonurgent ED use as they increased in age. Results could be biased if participants did not use the co-located ED in the study or opted for urgent care or retail clinics, potentially generating missing data. Self-reported assessments may lead to reporting bias if participants forgot how many times they went to the CHP PCC or ED. Low compliance to interventions by caregivers with chronically ill children could lead to information bias and deflate estimates. Missing data in EMRs and chart reviews could also negatively bias results if ED visits were not recorded. Though there was possibility of bias in both electronic records and self-assessments, use of EMRs in these studies appear to be a positive step towards consistent data collection and encourages future improvements in health analyses.

Studies in this review used randomized designs or pre-post methods to record effectiveness of intervention. Though randomized controlled trials are the gold standard, pre-post methods were a popular option for studies. Four studies used pre-post methods and two found significant reductions in ED utilization. Though pre-post methods did not always lead to significant results, they were a feasible and simple option for clinics; clinics could apply interventions and collect data from a changing patient population over time with lower costs and fewer restrictions. However, without randomization, the opportunity for masking is lost and the potential for selection bias is introduced. Future research in robust study designs that can be practical alternatives to randomization could reduce confounding and encourage more primary clinics to conduct intervention studies.

This literature review has strengths. The search terms were comprehensive and included all relevant translations based on knowledge from the literature. This review was unique in that it interpreted results with a specific primary care population in mind, such that population

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characteristics and intervention designs were used to form recommendations to the CHP PCC. This review is also unique to compare interventions aiming to decrease nonurgent PED utilization among primary care patients. This review is a first step towards clinic utilization of population-tailored interventions with implications for health care and socio-political reform.

This review also has limitations. The current review does not address ED utilization changes at different points during the follow-up time period. The comparison of studies based on change in ED utilization may not be an accurate or accepted approach. However, the purpose of the review was to identify barriers addressed by interventions and their effectiveness and there is currently no accepted approach in the literature for this kind of analysis. Associations between intervention effectiveness and population characteristics need to be explored. A meta-analysis may address these limitations, however, it may be difficult due to the varied approaches in measuring ED utilization. This review excluded the adult population despite possible similarities with older children in ED utilization. Non-hospital based interventions using claims data were excluded as well. The decisions to limit this review to children and interventions in medical settings were to increase generalizability to pediatric primary care clinics.

3.0   UPMC CHP PCC PATIENTS USING THE ED: ORIGINAL DATA

COLLECTION

3.1   INTRODUCTION

To inform interventions to reduce ED use, perceptions of primary care access of families of the UPMC Children's Hospital Primary Care Center of Oakland (CHP PCC) who visited the CHP PCC for acute respiratory infections were compared with those who presented to the ED for the same conditions. A phone survey was conducted from December 2017 through July 2018 targeting caregivers of children less than 5 years of age. Participants were caregivers of clinic-identified patients of the CHP PCC who received care for an acute respiratory infection (viral upper respiratory infection (URI), conjunctivitis, pharyngitis, otitis, or sinusitis) at either the CHP PCC or the ED. The goal of the survey was to contrast caregiver perceptions of the CHP PCC among those using the CHP PCC versus the ED for their child's acute respiratory infection.

The survey was conducted prior to the literature review of interventions and designed to comprehensively assess perceptions of access at the CHP PCC. Survey questions were designed to elucidate patient perceptions across multiple domains of access: availability, geospatial accessibility, accommodation, affordability, and acceptability of care. Questions regarding health literacy were not included.

3.2   SURVEY DESIGN/METHODS

The survey consisted of 51 questions that addressed population characteristics, ED experiences, and perceptions of availability, accommodation, geographic accessibility, affordability, and acceptability of the CHP PCC (Appendix B). Perception questions were answered on two 5-point Likert scales: 1) *Very Easy, Somewhat Easy, Somewhat Difficult, Very Difficult, Not Applicable* and 2) *Never, Sometimes, Usually, Always, Not Applicable*. In a section for open-ended responses, caregivers could detail their ED and CHP PCC experiences and suggestions for improvement. The survey lasted approximately 10 minutes. Caregivers were identified for potential inclusion through weekly review of administrative lists of CHP PCC patients presenting to the ED and CHP PCC patients presenting to the CHP PCC. At the time of screening for eligibility, patient age, race, number of prior ED and CHP PCC visits, and index visit diagnosis were recorded.

Caregivers were called 1-4 weeks after visiting the CHP PCC or ED for an acute respiratory infection; caregivers were informed of their confidentiality and choice to refuse to participate or to refuse response to any question. Survey data, including the decision to participate or not, was deidentified and stored separately from patient names or phone numbers. Calls for each caregiver were attempted a maximum of 4 times. If a family requested a call-back at different time, we accommodated their request when possible. Caregivers who consented to participating were categorized as "Responders" and caregivers who declined to participate or were not able to be reached were categorized as "Non-Responders" (Table 5). Basic demographic data collected from initial chart review for eligibility was compared for responders versus non-responders. I performed interviews along with other CHP PCC personnel. Participant responses were recorded by the interviewer in Qualtrics, a web-based survey software.

All responses were exported from Qualtrics and uploaded into STATA 15 for quantitative analysis. Percentages of responses with *Always* or *Very Easy* were calculated, consistent with methods used in current literature.[55,56,57] Caregivers were grouped into "ED" and "PCC" groups based on whether they had visited the ED or the CHP PCC for the specific index acute respiratory infection visit that had initiated the survey contact. Responses were tested using Pearson's chi-squared test. Fisher's exact test p-values were reported if any cell in a contingency table had a value of less than 5. Responses were significant if p-values were below α-level 0.05. Open-ended responses were exported in a spreadsheet, and analyzed qualitatively within Dedoose 8.0.35 (2018), an application for analysis of qualitative and mixed methods research.[58] From Dedoose, excerpts of responses were coded into weighted themes. The survey was approved by the UPMC Quality Improvement Review Committee. Projects approved by this committee did not meet the federal definition of human subjects research, so formal approval by an institutional review board was not required. The survey can be viewed in Appendix B.

3.3   RESULTS

Of the 186 caregivers called, 57% (N=106) were reached. Of the 106 reached, 41% (N=43) declined to participate and 59% (N=63) consented. Overall, one-third of the 186 caregivers agreed to participate in the survey (34%, N=63). The percentage of responders were similar for PCC and ED groups. Of all responders, 52% (N=33) visited the PCC for their child's most recent ARI, while 48% (N=30) visited the ED. Of all non-responders, 48% (N=59) went to the PCC and 52% (N=64) went to the ED. Overall, response rates were similar between the two groups. Of all caregivers

who visited the PCC, 36% (N=33) responded. Of all who went to the ED, 32% (N=30) responded to the survey (Table 6).

Table 6. CHP PCC Survey: Response

Response	ED	PCC	Total
Responders	(N=30)	(N=33)	(N=63)
— Row %	48	52	100
— Column %	32	36	34
Non-Responders	(N=64)	(N=59)	(N=123)
— Row %	52	48	100
— Column %	68	64	66
Total	(N=94)	(N=92)	(N=186)
— Row %	51	49	100
— Column %	100	100	100

3.3.1 PCC vs. ED Responder Demographics and Utilization

Compared to PCC responders, ED responders had close to significantly different distributions of age (p=0.08, included for borderline significance) and race (p=0.003). ED responders had higher percentages of younger-aged caregivers in the ED (18-24 years, 30% [N=11] vs. 9% [N=3]), responders who identified as Black race (86% [N=31] vs. 57% [N=18]). In addition, ED responders had a lower proportion of single child households (64% vs. 88%, p=0.007) (Table 7). Among ED responders, 25% (N=10) reported to have never called the CHP PCC for advice, contrasted to only 6% (N=2) among PCC responders (p=0.03).

Caregivers who presented at PCC for the index visit had been treated at the ED for more acute visits over the past year than caregivers who presented at the ED for the index visit (p<0.001). Specifically, 50% of ED responders went to the ED 3 or more times, compared to only 12% of PCC responders whereas all ED responders had presented to the ED in the past year, but 36% of

the PCC responders had not been to the ED in the past year. With regards to the number of PCC

acute visit in the past year, those whose index visit was at the ED had fewer acute visits at the PCC

than those whose index visit was at the PCC (p<0.001). Specifically, 50% of the ED responders

had not gone to the PCC for acute care in the past year (while all PCC responders, by definition,

had). While 55% of PCC responders went to the CHP PCC 3 or more times in the past 12 months

compared to only 3% of ED responders. Thus while selected based on most recent acute respiratory

infection visit, ED responders and PCC responders appeared to strongly prefer their respective

sites in their visits over the prior year.

No statistical significance was found when comparing population characteristics of child

age, child insurance, responder education, responder social support, or having a usual doctor at the

CHP PCC.

Table 7. CHP PCC Survey: Population and Visit Characteristics of Responders

CHP PCC Survey: Responders	ED Group % (N=36)	PCC Group % (N=32)	P-value
Child			
Age (years)			
— Range	1-5	1-4	0.32
— Mean (SD)	2.67 (0.20)	2.34 (0.19)	
— 1-2	47 (17)	59 (19)	
— 3-5	53 (19)	41 (13)	
Insurance			
— Public	89 (31)	78 (25)	0.51
— Private	9 (3)	16 (5)	
— Other	3 (1)	6 (2)	
Child Siblings			
— Any Siblings	64 (23)	88 (28)	0.007
Diagnosis			0.27
— Conjunctivitis	7 (2)	12 (4)	
— AOM	50 (15)	30 (10)	
— URI	27 (8)	39 (13)	
— Pharyngitis	13 (4)	6 (2)	
— Sinusitis	3 (1)	12 (4)	
Respondent/Caregiver			
Age			
— 18-24	30 (11)	9 (3)	0.08
— 25-44	67 (24)	85 (27)	
— >45	3 (1)	6 (2)	
Race/Ethnicity			
— White	3 (1)	31 (10)	0.003
— Black	86 (31)	57 (18)	
— Hispanic/Latino	3 (1)	3 (1)	
— Other	8 (3)	9 (3)	
Education			
— No Post-Secondary Education	50 (28)	28 (9)	0.30
Social Support: Someone Available to Help With Chores			
— Yes	78 (28)	84 (27)	0.55
Social Support: Someone to Talk to About Problems			
— Yes	78 (28)	84 (27)	0.55
ED/PCC Experience			
Has a Usual MD at PCC			
— Yes	65 (26)	80 (28)	0.20
Has Called For Advice	(N=40)	(N=35)	
— Never	25 (10)	6 (2)	0.03
— >=1	75 (30)	94 (33)	
Average Number of Acute Visits to PCC in the Past 12 Months			
— 0	50 (15)	0 (0)	<0.001
— 1-2	47 (14)	45 (15)	
— ≥ 3	3 (1)	55 (18)	
Average Number of Visits to ED in the Past 12 Months			
— 0	0 (0)	36 (12)	<0.001
— 1-2	50 (15)	52 (17)	
— ≥ 3	50 (15)	12 (4)	

3.3.2   Responder-Identified Barriers to the CHP PCC

Responses of the survey were organized into 2 barriers: access and perceived quality of care, similar to the systematic review (Table 8). Questions involving *availability/accommodation*, *accessibility*, and *affordability* themes were nested under the "access" barrier. Questions regarding *acceptability* were placed under the "perceived quality of care" theme. Percentages of reported responses with *Always* or *Very Easy,* the most positive category of response, were calculated. Table 8 was organized by question type then by smallest to largest percentage of most positive responses among ED responders.

After testing survey items, none significantly differed between ED and PCC responders (Table 8). Overall, both ED and PCC groups held similar views of access and quality of care at the CHP PCC.

Under the barriers of "access," neither ED nor PCC responders exceeded 50% in *availability/accommodation* themed questions. The smallest percentage was in the availability of timely appointments (Q6): 26% [N=10] of ED responders compared to 29% [N=10] PCC responders. More than 50% of ED and PCC responders felt at least some difficulty in calling for an appointment (Q5), getting a convenient appointment (Q7), scheduling with their usual doctor (Q8), or calling for advice (Q9) (Table 8). *Affordability was* also a concern: many responders displayed at least some difficulty in getting time off of work to go to the clinic (Q11), covering costs associated with the visit (Q13), and covering the costs of the visit itself (Q13) (Table 8). However, many ED responders had higher "best" percentages of ease in getting to the CHP PCC (Q10), more so than PCC responders (77% [N=30] vs. 56% [N=19]). ED responders also had higher "best" percentages in affording associated visit costs (Q50) and withstanding the long waiting times (Q29), than PCC responders (Table 8).

Under the barrier of "perceived quality of care," most of the ED and PCC responders felt positively about the acceptability of the CHP PCC. Of all acceptability domains, the lowest percentages of most positive responses in each group concerned waiting times (Q29); 46% [N=17] of ED responders and 35% [N=12] of PCC responders felt they never had to wait too long. Trusting phone advice (Q24) and feeling like questions were answered (Q14) also had lower percentages of highest positive response than other questions about *acceptability* (Table 8). Fewer ED responders had highest percentages in questions regarding approval of the CHP primary care physicians (PCPs) than PCC responders (Q21, Q18, Q23, Q15). However, the CHP PCC had high percentages of "best" responses for questions regarding *acceptability* (Table 8), particularly with judgement and respect by the PCP (Q15-Q23, Q26). The CHP PCC had mostly high percentages of most positive response regarding the quality of care by PCPs.

Though not significant, the 5 largest differences between ED and PCC groups, respectively, were in ease of getting to the clinic (21%), covering costs associated with visits (16%), feeling that the PCPs spent adequate time with patients (13%), trusting the doctor's knowledge (12%), and feeling that the doctor explained well (12%) (Table 8).

Table 8. Patient-Identified Barriers Among PCC vs. ED Groups at the CHP PCC

		ED Group % (N) of caregivers with the most positive response ("Always" or "Very Easy") N=36	PCC Group % (N) of caregivers with the most positive response ("Always" or "Very Easy") N=32	Percentage Difference %	P-value
Access					
Availability/Accommodation					
Q6	Very easy to get timely appt	26 (10)	29 (10)	+3	0.72
Q8	Very easy to schedule with usual MD	41 (15)	32 (11)	-3	0.74
Q5	Very easy to call for appt	44 (17)	41 (14)	-3	0.92
Q7	Very easy to get convenient appt	49 (19)	40 (14)	-9	0.85
Q9	Very easy to call for advice	49 (17)	44 (15)	-5	0.50
Accessibility					
Q10	Very easy to get to clinic	77 (30)	56 (19)	-21	0.20
Affordability					
Q11	Very easy to get time off of work to get to clinic	44 (16)	35 (11)	-9	0.19
Q13	Very easy to cover costs associated with visit	50 (19)	34 (12)	-16	0.64
Q12	Very easy to cover costs of visit	53 (20)	51 (18)	-2	0.97
Perceived Quality of Care					
Acceptability					
Q29	Never wait too long	46 (17)	35 (12)	-11	0.70
Q24	Always trust phone advice	59 (20)	56 (18)	-3	0.38
Q14	Always questions are answered	62 (21)	55 (18)	-7	0.19
Q25	Never overwhelmed by paperwork	68 (25)	71 (24)	+3	0.35
Q21	Always trust MD has the needed knowledge	76 (28)	88 (30)	+12	0.28
Q18	MD always spends adequate time	78 (29)	91 (31)	+13	0.37
Q23	Always trust MD has best intentions	78 (29)	85 (29)	+7	0.20
Q26	Always find papers useful	78 (29)	76 (26)	-2	0.95
Q15	MD always explains	79 (30)	91 (30)	+12	0.43
Q20	Always feel respected by staff	84 (31)	88 (30)	+4	0.13
Q16	MD always listens	89 (34)	85 (29)	-4	0.87
Q22	MD always answers questions	89 (34)	97 (33)	+8	0.62
Q19	Never feel judged by MD	92 (34)	88 (30)	-4	0.66
Q17	MD discusses treatment plan	97 (36)	88 (30)	-9	0.17

3.3.3 Responder Decision Making

Open-ended responses were asked about site decision-making, child diagnosis, barriers to accessing the clinic, and ways to improve the CHP PCC (Q41 – Q44, Appendix B). After qualitative analysis, 7 major themes were identified: responder perceptions of child illness, CHP PCC hours, appointment availability and scheduling, waiting times, provider and staff engagement, phone advice, and environment (Table 9). These themes were further categorized ad-hoc into the broader barrier categories identified in the literature review: access, health literacy, and perceived quality of care. While health literacy was not explored quantitatively, the theme was present in qualitative analyses on responder decision making. All responder decision making comments can be viewed in Table 9.

The first barrier was health literacy. Both ED and PCC responders discussed perceptions of their child's illness as a driving factor in their decision about where to seek care. Many responders in both the PCC and ED groups noted the ED would be necessary when their child's symptoms required immediate attention or medication. Some specific beliefs noted included the belief that the PCC was appropriate for some forms of acute conditions (i.e. common cold) while the ED was more appropriate for other forms of acute conditions (i.e. fever or ear infection). All expressed knowledge that they preferred the ED when their child was in a state of emergency. However, responders had seemingly different views on what was considered to be an emergency; some based their decision on how the child felt, others based their decision on the child's temperature.

The second barrier addressed was access. Many responders in both groups expressed beliefs that the ED was the optimal site of choice when the CHP PCC was closed. Some of this belief interacted with beliefs about illness severity: some responders expressed being unable to

wait until clinic opened because they felt their child's illness was too severe. Many reported they were unaware of the CHP PCC's Saturday hours and walk-in hours. Responders reported difficulty with appointment availability and scheduling, particularly in getting timely appointments. Many responders indicated that if they did not have an appointment with the PCC, they felt they were unable to go to the CHP PCC. Some reported that they defaulted to the ED without a PCC appointment because they felt that the scheduling process was too cumbersome. Responders did not appear aware of walk-in hours or may not have been able to access the current walk-in hours. While some PCC responders discussed PCC phone advice as a part of their decision making processes, phone advice was not addressed by ED responders.

The third barrier was acceptability or perceived quality of care, in which both groups generally reported more positive perceptions of PCC care than ED care. In terms of the provider and staff engagement considerations impacting decision making, responders from both ED and PCC groups were generally satisfied with the physicians at the CHP PCC and preferred them to the physicians at the ED. From two (PCC or ED?) responders' comments, the waiting time at the CHP PCC was perceived to be less compared to the ED. Finally, one PCC responder reported that the environment of the CHP PCC less stressful compared to the ED.

Table 9. CHP PCC Qualitative Analysis: Caregiver Decision-Making

Themes	ED Users	PCC Users
Health Literacy		
Perception of Child Illness	*[I] go to the emergency room first.… I have to get the medicine to treat her first.* *Son had a fever and [was] always told to go to the ED when [he had] a fever or ear infection.* *Son broke out in a rash and had a [high] temperature and a cough, really cranky – thought he needed emergency care.*	*If [my] child feels horrible at night, I take them to the ED.* *Child was throwing up – took her to ED.* *Child wasn't in an emergency state (super high fever) so the clinic seemed more appropriate.*
Access		
Hours CHP PCC is Open	*… didn't know about walk-in morning clinic...* *…didn't know that we were open on Saturday.* *It was also late at night.*	*Depends on what time of day. If PCC isn't open, [I have] no choice but to go to the ED…* *It was during the day… if it had been after hours or during the weekend Mom would have gone to the ED.*
Appointment Availability and Scheduling	*[Child] didn't have an appointment at the PCC so I took him to the ED in Lawrenceville.* *…I can't get in PCC because I have to make the appointment, it takes forever…*	*…Waiting for an appointment at PCC takes too long.*
Phone Advice	*N/A*	*I called the clinic first and they usually tell me whether to take them to the ED or not.* *Called and spoke to someone on sick-line and decided to schedule an appointment.*
Perceived Quality of Care		
Provider and Staff Engagement	*… prefers to be seen by physicians at primary care center.* *… really likes the PCC and feels that physicians treat her child as if she were their own child.*	*The care was better here, the doctors are better trained, and the doctor's in the ER treat her like "an overly paranoid grandmother."* *"Really likes the PCC and feels it does not need improvement."*
Waiting Time	*… says there is less of a wait time at the PCC than the ED…*	*Rather go to the PCC because shorter waiting time in the waiting room.* *ED takes longer, I would rather [go to a] clinic or medical express because [they're] faster.*
Environment	*N/A*	*ED is overwhelming to mom and causes a lot of anxiety and PCC doesn't cause as much anxiety.*

3.3.4   Improving the CHP PCC

When responders were asked how the PCC could improve, 9 common themes were addressed: hours, appointment availability, scheduling processes, waiting time, phone advice and communication, environment, staffing, provider and staff engagement, and transportation (Table 10). Seven of the nine themes were previously addressed in the qualitative analysis of decision-making, and 2 new themes emerged: staffing and transportation. The themes were again divided into the barriers of access and perceived quality of care. Notably, parents did not suggest any interventions that would be classified as health literacy related. All responders comments about improving the CHP PCC could be viewed in Table 10. Both groups contributed to recommendations in each of these 9 themes.

The first set of solutions addressed access. Responders of both groups wanted longer weekday hours and weekend hours. Responders wanted more timely appointments and more convenient appointments. Responders also desired greater continuity with their usual doctor. When responders addressed phone advice and communication, both ED and PCC groups expressed possible improvement strategies including ability to communicate directly with their provider, increased staffing of nurse triage line, and greater transparency with communication over the MyUPMC app, an online patient health portal that allows caregivers to access their health care information.[59] Transportation was a theme addressed among ED responders. One ED responder described how traffic, bus-ride lengths, and taxi fees to the CHP PCC were inconvenient, and receiving transportation to the ED via ambulance was more convenient; this responder suggested the potential value of a transportation service to the CHP PCC.

The second set of barriers was perceived quality of care within the clinic. While many PCC and ED responders expressed that CHP PCC physicians displayed better engagement than ED

physicians, some responders in both groups still expressed a desire for providers to improve their interactions with patients (i.e. "more supportive", "more sensitive and gentle"). Waiting time was also a theme. Responders in both groups wanted shorter wait times. One suggested reducing the number of patients scheduled, another suggested increased numbers of physicians may be helpful, and another suggested changes in workflow so that there was less waiting for paperwork to be completed. One PCC responder thought more nurses managing the phone line would be helpful, while one ED responder thought staff could be more efficient.

Table 10. CHP PCC Qualitative Analysis: Improving the PCC

Themes	ED Users	PCC Users
Patient Access		
Hours PCC is Open	*Longer hours.*	*Open on the weekends on Sunday, open longer so I can get there when I need to, but that's what the ED is for.* *Have a day where there was later hours.*
Appointment Availability	*Mom would like more appointment slots with her child's physician.*	*...Mom could not get an appointment that fits with her schedule conveniently with her preferred PCP because of a long waiting period and her work schedule.*
Scheduling Process	*Scheduling appointments that fit with work schedule is difficult...getting an appointment with regular PCP is difficult and requires a long wait between appointments for regular PCP.*	*Can't schedule anything more than 6 months out and if you forget it's hard to get one for months.*
Phone Advice and Communication	*[Mom suggests improving] ease of calling nurses and speaking to someone at the clinic.*	*...Mom feels they cannot get in contact with PCP for questions and has no communication with PCP and would like direct contact.*
Transportation and Location	*Rush hours in traffic make it difficult to get there.* *Prefers to come to Oakland but...it is financially inconvenient to get a taxi to Oakland and ... via bus would require a 2 hour bus ride ... so when parent went to ED, parent had a paramedic come get her... wondering if there could be a transportation service for patients that live far away...*	*Parking is difficult, the lot is weird – not enough spaces...*
Quality of Care		
Provider and Staff Engagement	*Mom would like the physicians to be more sensitive and gentle with parents...* *Mom would like PCPs to provide more thorough physical to rule out more serious illness before diagnosing minor symptoms.* *Children's in Lawrenceville know more about the problems.*	*The doctors at the PCC Oakland are "like the best."* *More supportive doctors on how [parent] wants to give treatment to their [child]...* *Mom felt tone was judgmental and directed towards her [by the ED provider].* *Felt physician at the ED was quickly trying to discharge them and was not taking her concerns seriously...*
Waiting Time	*Sometimes you schedule too many people...[it's] the waiting game, my kids are very impatient...* *Less waiting time in the exam room.*	*Try to see patients sooner...if MD is running ahead of schedule and patient is early try to get the patient seen earlier...* *Decrease wait time...especially when visit is over and staff are getting paperwork ready.*
Staffing	*[Need] more doctors, always busy and backed up...* *Physician assistants should do their work rather than lollygagging...when you see every employee standing around not doing anything it wastes my time.*	*Phone service under-staffed and need more people to help facilitate contact between patients and PCP* *Mom feels that having more staff and/or rooms to see people may make things go quicker and allow more people to be seen.*
Environment	*...maybe toys in the exam room to distract children during long wait times.*	*...some of the back rooms are really hot.* *Entertainment for kids during waiting time.*

3.4   DISCUSSION

Access – and specifically the access domains of availability and accommodation -- was the major identified barrier for responders across all analyses of survey data. Responders had problems with the scheduling process and receiving appointments at times that worked for their family. The scheduling process was too cumbersome for responders, and they were not able schedule with their provider of choice. They were not early enough or the number of available options were too few for responders. Traveling to the CHP PCC also appeared to be a challenging experience for responders. However, these barriers appeared to be consistent across both PCC and ED responders.

Quality of care was not so much of a barrier. ED and PCC responders all had high percentages of most positive response regarding the CHP PCC providers and staff. Responders largely felt respected and thought their PCP always listened, never judged, and answered their questions. ED responders' reasons for not going to the CHP PCC were not due to the physicians, staff, or quality of care. In fact, this was a strength of the CHP PCC. The CHP PCC PCPs were a highlight of many responders' experiences with their child's acute concerns. The quality of care by the CHP PCC PCPs were positively expressed by many responders, and many responders enjoyed their interactions with the PCPs.

The primary reason for ED responders continuously preferring the ED over the CHP PCC appeared to be scheduling. The ED may be favorable to responders because there is no scheduling necessary. The high quality of care offered by the CHP PCC may not be effectively persuading responders to prefer the CHP PCC because responders cannot access the CHP PCC in the first place. In a situation where a caregiver is faced with a potentially serious condition in their child and the caregiver wants immediate care, access is the most important quality. Caregivers also may

not want to concern themselves with the varied hours provided by the CHP PCC when the ED accepts patients 24/7. Despite the walk-in hours in place at the CHP PCC, they may not be perceived as a better alternative to the ED's inherent walk-in system.

The advantage of the CHP PCC may be the opportunity for continuity with providers. However, the scheduling barriers may diminish potential opportunities for continuity when responders cannot see their provider of choice. Difficulty with scheduling, combined with the CHP PCC's perceived inconvenient location, high costs, and long wait times can easily dissuade responders from attending the CHP PCC. The ED eliminates the large inconvenience of scheduling and set business hours for responders and, as a result, is seen as more accessible than the CHP PCC.

When we characterized responders, we found that ED responders tended to repeatedly use the ED (Table 7). This pattern suggested that ED responders may have set site preferences, and were not necessarily deciding between the CHP PCC and the ED during a specific episode of illness. We also saw that PCC responders tended to repeatedly use the CHP PCC, despite similar complaints about CHP PCC access. Reasons for this pattern were not known, and do not seem adequately explained by the items assessed in this survey. These results tell us that ED and PCC responders have site preferences and we need to create strong solutions to change these responders' habits of repeatedly going to the same site.

The survey allowed us to evaluate the major reasons why caregivers were using the ED. This study had strengths in that survey questions regarding access and quality of care were comprehensive and the design had good external validity. However, the survey had limitations. The survey had a small sample size. We did not examine other sources of care, such as convenience clinics and urgent care centers. The survey had only questions regarding access which may conceal

other existing barriers. Results of the quantitative analysis were not statistically significant, which

may be because there are truly no differences or may be because of inadequate sample size. In the

future, a larger sample size and more comprehensive survey could yield additional insights.

4.0   RECOMMENDATIONS AND CONCLUSIONS

The literature review of interventions identified 2 barriers: 1) access and 2) health literacy. Interventions most effectively addressing access targeted scheduling processes and appointment availability. The most effective interventions for health literacy employed educators who were community members with similar backgrounds to their patient population. Populations in the literature reviews of interventions displayed characteristics similar to that of the CHP PCC population. Primary care populations were medically underserved communities: predominantly Black, publicly-insured, low annual incomes, and had post-secondary education or less.

The survey addressed 3 barriers: 1) access, 2) perceived quality of care, and 3) health literacy. Two of the 3 barriers, access and health literacy, were addressed in the literature review of interventions. Based on literature review of interventions, the most effective strategy to reduce ED utilization may be to employ community-based liaisons to administer education and assist with scheduling processes. Use of community-based personnel may be effective interventions because of their ability to connect with patients. Another effective strategy may be to increase community engagement from PCPs. Increased visibility and communication in the community can build relationships that can translate to the primary care setting and build patient-provider relationships. In the long-term, increasing diversity in the primary care system and the number of minority physicians may further improve caregiver-provider relationships.

Beyond the strategies addressed in the literature review of interventions, survey results suggest other strategies that may effectively reduce ED utilization.

Many ED responders only used the PCC for well child care (not sick care) and strategies to reach them may need to involve direct outreach or delivering through well child care. Therefore,

to address health literacy, ED responders may need to be directly contacted to deliver caregiver education. Useful interventions to address access may be further extending walk-in hours to surpass the appointment and scheduling barrier, and an awareness campaign of clinic hours. Strategies to address quality of care may be to incorporate respondent recommendations of adding new distractions or toys in the waiting room and improving ease of obtaining advice via the nurse phone line services. In the long-term, an expansion of the CHP PCC site, creation of satellite clinics, and use of mobile clinics may reduce many of the access barriers identified by responders, though our literature review did not identify any evaluations of these strategies.

Strategies to improve scheduling is necessary, based on results of the survey, and a potential solution may be to increase walk-in hours to minimize scheduling. Since scheduling is currently done by phone, the phone tree could be streamlined and made easier for navigation. Long-term, digital scheduling could be implemented. An application for easy scheduling that also displays waiting times in real-time could encourage same-day scheduling.

To increase awareness of CHP PCC hours, an awareness campaign with targeted advertising in high-risk ED populations may be useful. Refrigerator magnets and postcards with CHP PCC hours are some examples of objects that can be mailed to responders' homes. In addition to hours, including caregiver education on appropriate uses of the ED on these items may improve health literacy and encourage ED responders use the CHP PCC instead. Advertisements in public spaces (public transit, bus stops, parks, etc.) may be a more effective way to increase awareness of CHP PCC hours. Our study did not observe groups of responders by location; future research should include mapping which neighborhoods have the most ED responders and target interventions specifically in those neighborhoods. More likely, the current CHP PCC business hours may not meet responders' needs and, in the long-term, business hours may need to be further

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extended. A possible solution may be that providers stagger their starting times to accommodate for later hours.

Responders may prefer the ED to the CHP PCC for the location (Figure 1). The current geographic location of the CHP PCC is not within the 10 largest patient zip-codes which represent almost 50% of their patients. Responders reported difficulty with transporting to the CHP PCC, receiving time off of work, and covering costs associated with visits. Potential strategies may be fundraising for a CHP PCC vehicle, installment of shuttle services, partnerships with rideshare services like Lyft and Uber, and free bus tickets and cab service vouchers to improve transportation for caregivers. In the long-term, creating satellite campuses or mobile clinics may improve access for responders, especially where current extended hours may not sufficiently account for lost time due to transportation.

The long waiting times for visits and for phone advice suggest that attention to personnel resources may be needed. Interventions to revise the phone script with best hospitality principles may improve phone experiences. In the long-term, a clinic flow study may be beneficial for identifying the potential causes of inefficiencies in staffing and wait times. However, the long waiting times, low staff numbers, and high demand for appointments are suggestive of the CHP PCC's need for additional staff to meet demand more efficiently. The CHP PCC has 25 physicians and 10,729 unique patients, as of last year (2018). Expanding the size of the CHP PCC site and increasing the number PCPs and staff may be a necessary long-term solution to meet demand and ultimately reduce ED visits.

Responders felt that the CHP PCC physicians were well-qualified, communicated well, and respected them. However, the high perceived quality of care may be counteracted by the lack of perceived access. Access appeared to be the most important quality for responders when

deciding whether to go to the CHP PCC or the ED for acute respiratory infections. Health literacy appeared to be the other side of the decision-making coin. Improving clinic access can encourage caregivers to use the CHP PCC while improving health literacy can encourage caregivers to refuse the ED. Health literacy and access barriers are a part of why caregivers choose the ED over primary care setting and both barriers may need to be targeted at once for an effective decrease in ED utilization. Future research is necessary to comprehensively identify perceived barriers of unique populations and to develop effective patient-centered interventions.

APPENDIX A: DETAILED KEYWORD SEARCH

AGE: (pediatric*[Title/Abstract] OR child*[Title/Abstract] OR infant[Title/Abstract] OR toddler[Title/Abstract] OR newborn[Title/Abstract] OR adolescent[Title/Abstract] OR teen*[Title/Abstract] OR preteen* [Title/Abstract] OR pre-teen*[Title/Abstract] OR young[Title/Abstract])

ED: AND (ER[Title/Abstract] OR ED[Title/Abstract] OR "emergency room"[Title/Abstract] OR "emergency department"[Title/Abstract])

USE: AND (utiliz*[Title/Abstract] OR visits[Title/Abstract] OR use[Title/Abstract])

NON-URGENCY: AND (non-urgent[Title/Abstract] OR nonurgent[Title/Abstract] OR low-acuity[Title/Abstract] OR "low acuity"[Title/Abstract] OR unnecessary[Title/Abstract] OR avoidable[Title/Abstract] OR preventable[Title/Abstract] OR excess[Title/Abstract] OR "upper respiratory infection*"[Title/Abstract] OR URI[Title/Abstract] OR URI-related[Title/Abstract] OR URIs[Title/Abstract] OR complaints[Title/Abstract] OR "subsequent visits"[Title/Abstract] OR nonemergen*[Title/Abstract] OR non-emergen*[Title/Abstract] OR "acute illness" [Title/Abstract])

INTERVENTION: AND (intervention[Title/Abstract] OR initiative[Title/Abstract] OR collaborative[Title/Abstract] OR protocol[Title/Abstract] OR "quality improvement"[Title/Abstract] OR QI[Title/Abstract] OR model[Title/Abstract] OR program[Title/Abstract] OR training[Title/Abstract] OR education[Title/Abstract] OR prevention[Title/Abstract])

EXCLUDE: NOT (asthma[Title] OR brain[Title] OR mental[Title] OR vaccine[Title] OR disease[Title] OR dental[Title] OR imaging[Title] OR elderly[Title] OR mortality[Title] OR injur*[Title] OR surg*[Title])

TIME PERIOD: AND ("last 10 years"[PDat])

Hello, My name is _____ I am calling from your child's primary care office, the Children's Hospital primary care clinic in Oakland. We are trying to learn how we can make the clinic better for our patients and their families. I am calling to ask if you would be willing to be part of a short survey to provide feedback to make the clinic better for you and your child. Would you be willing to participate in a brief survey about our clinic?

The survey should last no more than 10 minutes. If we are interrupted we can continue at another time. I will not record your name with your answers, and you can skip any questions you don't want to answer. Do you have any questions?

"Thank you for agreeing to participate. I will start with questions about your child's medical care. "

[Availability]
1. Do you have a clinic you think of as the place you go for medical care?
    * Yes
    * No

2. Do you have a doctor you think of as your child's doctor?
    * Yes
    * No

3. How many times have you been to the Children's Hospital of Pittsburgh Primary Care Center in the last 12 months?
    If 0: Proceed, but ask them to think about the last time they came to PCC?
    If >1 : proceed, asking them to think about their visits over the past year

 4.   How many times have you called the office for medical advice in the last 12 months, either during office hours or after hours?
    * 0
    * 1-3
    * 4-6
    * >6

[Accommodation]
"For the next several questions, please think about your experience receiving care at the Primary Care Center in Oakland in the past."

5. Is it easy or difficult to reach someone at the office to make an appointment when your child is sick? EASY or DIFFICULT?
- Very Easy
- Somewhat Easy
- Somewhat Difficult
- Very Difficult
- NA

6. Is it easy or difficult to get an appointment as soon as you would like?
- Very Easy
- Somewhat Easy
- Somewhat Difficult
- Very Difficult
- NA

7. Is it easy or difficult to get an appointment that is convenient and fits with your other responsibilities (i.e. work, caring for other kids, etc.).
- Very Easy
- Somewhat Easy
- Somewhat Difficult
- Very Difficult
- NA

8. Is it easy or difficult to get an appointment with the doctor you want to see?
- Very Easy
- Somewhat Easy
- Somewhat Difficult
- Very Difficult
- NA

9. Is it easy or difficult to reach someone in the office when you have a question about a sick child?
- Very Easy
- Somewhat Easy
- Somewhat Difficult
- Very Difficult
- NA

[Accessibility]
10. Is it easy or difficult to get to your clinic?
- Very Easy
- Somewhat Easy
- Somewhat Difficult
- Very Difficult
- NA

11. Is it easy or difficult to get time off work to get to your appointment?
- Very Easy
- Somewhat Easy
- Somewhat Difficult
- Very Difficult
- NA

[Affordability]
12. Is it financially easy or difficult to visit to the doctor's office?
- Very Easy
- Somewhat Easy
- Somewhat Difficult
- Very Difficult
- NA

13. Is it easy or difficult to deal with other costs of your visit, such as bus fare, missed work, babysitters?
- Very Easy
- Somewhat Easy
- Somewhat Difficult
- Very Difficult
- NA

[Acceptability]
"The following set of questions will refer your experience with the doctor at the clinic. These questions will have a different set of answer choices. The answer choices will change for these questions to include: always, usually, sometimes, never"

read answer choices for at least the first 3 questions

14. Does your doctor answer your questions?
- Always
- Usually
- Sometimes
- Never
- NA

15. Does your doctor explain things in a way you can understand?
- Always
- Usually
- Sometimes
- Never
- NA

16. Does your doctor listen to you?
    - Always
    - Usually
    - Sometimes
    - Never
    - NA

17. Does your doctor encourage you to be part of plan to treat your child?
    - Always
    - Usually
    - Sometimes
    - Never
    - NA

18. Does your doctor spend enough time with you?
    - Always
    - Usually
    - Sometimes
    - Never
    - NA

19. Do you feel judged by your doctor?
    - Always
    - Usually
    - Sometimes
    - Never
    - NA

20. Do office and staff treat you and your child with respect?
    - Always
    - Usually
    - Sometimes
    - Never
    - NA

21. Do you trust that your doctor has the knowledge needed to treat your child?
    - Always
    - Usually
    - Sometimes
    - Never
    - NA

22. How easy is it to get your questions answered when you call the clinic?
    - Always
    - Usually

- Sometimes
- Never
- NA

23. Do you trust that the doctors have your child's best interest at heart?
- Always
- Usually
- Sometimes
- Never
- NA

24. Do you have confidence that you will receive good advice if you call for advice over the phone?
- Always
- Usually
- Sometimes
- Never
- NA

25. Are the required forms and paperwork overwhelming at your doctor's office?
- Always
- Usually
- Sometimes
- Never
- NA

26. Are written materials provided at the end of a visit written in a way that is useful to you?
- Always
- Usually
- Sometimes
- Never
- NA

27. Is there a language other than English that you prefer to use?
- No
- Yes

28. If YES: If English is not your primary language: does your doctor offer to speak the language you prefer or use a translator?
- Always
- Usually
- Sometimes
- Never
- NA

29. Do you have to wait too long in the waiting room or exam room?
   - Always
   - Usually
   - Sometimes
   - Never
   - NA

30. *If Always, Usually, or Sometimes proceed to next question:* Which area to do you have to wait too long?
   - Waiting Room
   - Exam Room
   - Both
   - Never
   - NA

EMERGENCY ROOM:
"The following questions will refer to past emergency department visits with your child"

31. Is it easy or difficult to get to the emergency room or urgent care?
   - Very Easy
   - Somewhat Easy
   - Somewhat Difficult
   - Very Difficult
   - NA

32. Does the doctor in the emergency room encourage you to be part of the plan to treat your child?
   - Always
   - Usually
   - Sometimes
   - Never
   - NA

33. Do you trust that the doctor in the emergency room has the knowledge needed to treat your child?
   - Always
   - Usually
   - Sometimes
   - Never
   - NA

" The next question is slightly different, I am going to say two statements, please choose the one that best fits your experience."

34. When my child has a cough, cold, or fever....
    - I trust the emergency room physicians to provide the best care
    - I trust the PCC/Primary Care physician to provide the best care
      *** If commentary, note in the section below***

35. If your child has a cough or cold, to which emergency room, urgent care or clinic would you take them?
    _____

36. If your child has a fever, to which emergency room, urgent care or clinic would you take them?
    _____

37. On average how long do you wait before seeing a doctor in the Emergency room including time in the waiting room?
    _____

38. On average how long does it take you to travel to the Emergency Room?
    _____

39. On average how long do you wait to be seen by a doctor in the PCC including time in the waiting room?
    _____

40. On average how long does it take you to travel to the PCC?
    _____

Open ended:
41. When you went to the (clinic/ed) last week, how did you decide whether to go to the clinic versus the ED?
    _____

42. What diagnosis did the doctors give your child at your visit last week?
    _____

43. Are there any issues we didn't ask about that make bringing your child to the Primary Care Center difficult for you?

_____

44. What can we do to make the Primary Care Center work better for you?

_____

"The LAST 5 QUESTIONS are to learn more about you. As always if you want to skip any questions please let me know. "

Demographic questions

45. Child age
   - <1y
   - 2
   - 3
   - 4
   - 5
   - >5

46. Parent age
   - 18-24
   - 25-44
   - >45

47. Race/ethnicity
   - Caucasian
   - African American or Black
   - Hispanic
   - Asian
   - Other: ____

48. What is your highest level of education
   - Less than HS
   - HS
   - Some college
   - College or more

49. How many children are in your household?
   - 1
   - 2-3
   - 4 or more

50. Do you have one or more adult you can rely on to help you when issues arise in your life?
    - Yes
    - No

51. What is your child's insurance?
    - Medicaid
    - Commercial
    - Other

Any other comments/questions?

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