THE EFFECT OF MEDICAL HOME LEGISLATION ON COLORADO’S PEDIATRIC
PRACTICES AND HEALTH SERVICES USE IN CHILDREN ON MEDICAID

by

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ABSTRACT

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The Effect of Medical Home Legislation on Colorado’s Pediatric Practices and Health Services Use in Children on Medicaid

Thesis directed by Associate Professor Elaine H. Morrato

Introduction: Colorado Senate Bill 07-130 was enacted to increase access to care for children on Medicaid. Providers received a financial incentive for well child visits if they registered with the Colorado Department of Health Care Policy and Financing (HCPF) after their practice was certified by the state as a medical home.

Objectives: Guided by the PRECEDE–PROCEED model, this study evaluated how SB130 was operationalized, the reach and uptake by practices, and changes in the rates of three health services measures before and after legislation.

Methods: Qualitative data were used to assess how SB130 was operationalized. A descriptive and quantitative comparison of practices was completed in conjunction with using administrative claims data to estimate the number of children with a well child visit and test for a difference in the rates of three health services measures before and after legislation.

Results: Colorado was ranked on four policy stages. The state exceeded expectations on the enabling environment and policy development stages, met expectations on the policy/program implementation stage, and did not meet expectation on health systems and health outcomes stage. The uptake of SB130 was by a small group of homogenous practices (n=163, 14% of all Medicaid primary care practices). Certified practices had similar survey scores. The 163 providers who received a payment increase were responsible for 22% of the children who received a well child visit in 2012. This is
37% of all children on Medicaid who received a well child visit that year (n = 499,353, 37%). Well child visits increased over time from $X = 2.9$, $SE = 0.010$ to $X = 3.4$, $SE = 0.011$. Emergency room visits remained unchanged and inpatient hospitalizations decreased slightly. Registered providers had a significant effect on the annual number of well child visits for children on Medicaid 0 to 15 months old ($F = 1745.3$, $df = 5$, $p < .001$) with $R^2 = 0.136$, $B = 1.123$. This same trend was seen for well visits in all ages, emergency room visits, and inpatient hospitalizations.

**Conclusions:** Using planning tools when developing policies is recommended to successfully translate theory into practice. Evaluation during implementation as well as after may help ensure anticipated reach and uptake are achieved. Well child visits increased and inpatient hospitalizations decreased slightly after SB130. A mixed methods approach allowed for a more nuanced evaluation of SB130 and should be considered by policy makers and researchers in the future. Controlling for environmental changes is necessary to understand the impact of legislation.

The form and content of this abstract are approved. I recommend its publication.

Approved: Dr. Elaine H. Morrato
DEDICATION

To my friend, who at 16, contracted with me not to commit suicide if I promised to do something with my life that made a difference—my work is for you.
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TABLE OF CONTENTS

CHAPTER

I. INTRODUCTION ..................................................................................................1

Purpose ...................................................................................................................3

Proposal ..................................................................................................................3

Conceptual Framework ..........................................................................................4

Human-Subjects Consideration ..............................................................................6

II. Literature Review ................................................................................................8

Search Strategy .......................................................................................................8

A History Of The Medical Home Model .............................................................10

Medical Home Model Outcomes .........................................................................12

How Medical Home Has Been Measured ............................................................14

Description Of The Conceptual Frameworks For Evaluation Of SB130 And Specific Aim 1 ........................................................................................................17

PRECEDE–PROCEED ............................................................................17

Linking Health Policy With Health Systems And Health Outcomes......18

Literature Review Summary ................................................................................19

III. METHODS .....................................................................................................20

Specific Aim 1: Evaluate How SB130 Was Operationalized. .............................20

Study Design ........................................................................................................20

Study Population ..................................................................................................20

Data Source ..........................................................................................................20

Outcomes ..............................................................................................................20

Methods ................................................................................................................21

Tools ......................................................................................................................21
Specific Aim 2: Evaluate The Uptake And Reach Of SB130 Implementation...23

   Study Design .................................................................23
   Study Population ..........................................................23
   Data Source ........................................................................23

Methods ..................................................................................24

   Intervention .........................................................................24
   Tools ...................................................................................25
   Data Recode ........................................................................26
   Analysis ...............................................................................29

Specific Aim 3: Evaluate The Impact Of SB130 On Health Services Measures
In Medicaid Children.................................................................30

   Study Design .......................................................................30
   Study Population ..................................................................30
   Data Source ..........................................................................31
   Outcomes .............................................................................31
   Methods ...............................................................................31

IV. SPECIFIC AIM 1 .................................................................36

   Introduction ..........................................................................36
   Study Design .......................................................................37
   Study Population ..................................................................37
   Data Sources .........................................................................38
   Outcomes ...............................................................................38
   Tools ...................................................................................38
   Analysis .................................................................................39
   Results ..................................................................................40
LIST OF TABLES

Table

1. Hardee Lasswell Crosswalk, Created for Colorado SB130, 2015 .............................49
2. Medical Home Index Score Transformation for Analysis........................................66
3. Medical Home Index Survey Results, 2009-2010, Colorado (Transformed).........67
4. Family Satisfaction Survey Results, 2009-2010, Colorado .....................................68
5. Transformation Algorithm for Scores on the Medical Home Index Scores used for Analysis........................................................................................................86
7. Proportions of Children on Medicaid With Health Services Measures by Federal Fiscal Year, 2008–2015, Colorado .............................................................................89
8. Health Measure Rate per 10,000 Medicaid Member Months, 2008–2015, Colorado.........................................................................................................................91
LIST OF FIGURES

Figure

1. PRECEDE–PROCEED planning model, adopted for evaluating Colorado SB130, 2015.................................................................4

2. Linking Health Policy with Health System and Health Outcomes, adopted for evaluating Colorado SB130, 2015..........................5


1. Linking Health Policy with Health System and Health Outcomes, adopted for evaluating Colorado SB130, 2015 ................................48

1. Medical home practices that completed the certification process, included in survey analysis, 2009–2010. Data Source: Medical Home Certification Database, Family Voices of Colorado.................................................................69


1. Medicaid primary care and registered medical home providers, 2008–2012, Colorado.................................................................70

2. Number of children with a Well Child Visit from a Medicaid primary care and registered medical home provider, 2008–2012, Colorado........71

1. Consort diagram for the study population, unduplicated children younger than 18 years of age with 90 to 365 days of continuous eligibility enrolled in the Aid to Families with Dependent Children or Baby Care Medicaid programs for federal fiscal years, 2008–2015, Colorado.................................................................85
LIST OF ABBREVIATIONS

AAP American Academy of Pediatrics
AJPH American Journal of Public Health
EPSDT Early and Periodic Screening, Diagnostic, and Treatment
FSS Family Satisfaction Survey
HEDIS Health Effectiveness and Information Data Set
ICD International Statistical Classification of Diseases and Related Health Problems
MCHB Maternal and Child Health Bureau
HCPF Colorado Department of Health Care Policy and Financing
MESH medical subject headings
MHAB Medical Home Advisory Board
MHCP medical home certification process
MHI Medical Home Index
MHM medical home model
MMIS Medical Management Information System
NCQA National Center for Quality Assurance
PCMH Patient-Centered Medical Home
CDPHE Colorado Department of Public Health and Environment
SB130 Concerning Medical Homes For Children, And Making An Appropriation
Therefor
LIST OF COMMON TERMS

Medicaid Colorado Department of Health Care Policy and Financing

MHCP Medical home certification process

MHI-SV Medical Home Index Short Version

CDPHE Colorado Department of Public Health and Environment

Certified practice “medical home” Practices that participated in the medical home certification process

Registered provider “medical home provider” Providers that sent their Medicaid billing identification number to Medicaid for a payment increase
CHAPTER I
INTRODUCTION

In 2001, the Institute of Medicine published guidelines to create an evidence-based, patient-centered quality healthcare system. One of the 13 guideline recommendations was to focus on improving primary healthcare. At its most comprehensive, primary care offers primary, secondary, and tertiary interventions in a holistic and cost effective way, providing individuals with disease prevention, health promotion, screening, and early detection of health problems. Disease management and treatment for conditions such as asthma, diabetes, and mental health disorders are supplied by a healthcare provider who is easily accessible and knows the individual well (Aysola, Bitton, Zaslavsky, & Ayanian, 2013; Berry et al., 2013; Cronholm, Miller-Day, & Gabbay, 2014; Derrett et al., 2014; Domino, Humble, Lawrence, & Wegner, 2009; Edwards, Webb, Scheid, Britton, & Armor, 2012; Friedberg, Schneider, Rosenthal, Volpp, & Werner, 2014; Grant, Bowen, Neidell, Prinz, & Redlener, 2010; Hyman & Johnson, 2012; Knapp et al., 2012; Pagan & Carlson, 2013; van Hasselt, McCall, Keyes, Wensky, & Smith, 2015). Because primary care is of such importance, it is imperative that primary health care and primary health care providers are easily accessible and provide quality healthcare.

Many have offered reasons as to why a lack of access to primary healthcare exists in the U.S., including a lack of adequate reimbursements for primary care services, patient and provider dissatisfaction, and fewer primary care providers. (Colorado Health Institute, 2014). A variety of projects to improve and expand primary care services as well as quality-improvement projects have been developed, tested, refined, and adopted
to improve the U.S. primary healthcare system. (Abrams, Nuzum, Mika, & Lawlor, 2011; Bailit, 2009; Shaw, Norlin, Gillespie, Weissman, & McGrath, 2013; Sternberg, Co, & Homer, 2011).

Colorado, like other states, struggles with providing access to quality primary health care; especially for individuals on public insurance (Berwick, Nolan, & Whittington, 2008; Schor, 2004; Takach, 2012). A decline in providers who accept public insurance is prevalent nationwide and in Colorado. A decrease in the number of primary care providers willing to accept Medicaid has been accompanied by a reported decrease in the quality of care provided (Berman, Armon, & Todd, 2005; Todd, Armon, Griggs, Poole, & Berman, 2006). Colorado passed Senate Bill 07-130 in 2007 to address these two issues (see Appendix A). The goals of the bill entitled Concerning Medical Homes For Children, And Making An Appropriation Therefor (SB130) were to increase access to primary care for children on Medicaid and improve the quality of care they received by adopting the medical home model (MHM).

Supported by the American Academy of Pediatrics (AAP), the MHM improves quality of care and health outcomes and increases patient and provider satisfaction while decreasing costs (Aysola et al., 2013; Wegner, Antonelli, & Turchi, 2009). When Colorado chose the MHM, it was not fully operationalized, as it is now, through the National Center for Quality Assurances Patient-Centered (NCQA) medical home standards; it only followed guidelines published by the AAP (Agency for Healthcare Research and Quality, 2010; American Academy of Family Physicians, 2008; Cooley, 2004). By enacting legislation before Patient-Centered Medical Home (PCMH) standards were available, Colorado was an early adopter of the MHM and became a test case for
improving the primary healthcare system when this model was in its infancy (Crabtree et al., 2010; Jaen et al., 2010; Nutting et al., 2009)

**Purpose**

To date, the impact of SB130 is unknown. An evaluation was planned and funded but due to Colorado’s recession, the allocated funds were reabsorbed into the state’s general fund and the evaluation was never completed. The success of SB130 and its effect on access to care for children on Medicaid is still in question.

**Proposal**

The following aims evaluated the impact of SB130:

1. **Specific Aim 1:** Evaluate how SB130 was operationalized.

2. **Specific Aim 2:** Evaluate the uptake and reach of SB130’s implementation.

   Hypothesis 2a: There is no significant difference in Medical Home Index (MHI) and Family Satisfaction Scores between practices that volunteered for the Medical Home Certification Process after legislation passed, by year of certification.

   Hypothesis 2b: There is no increase in the number of children who received a well child visit from a registered medical home provider.

3. **Specific Aim 3:** Evaluate the impact of SB130 on Health Services Measures in Children on Medicaid

   Hypothesis 3a: There is no significant difference in well child visits, emergency department use, or inpatient hospitalizations post SB130.
Hypothesis 3b: There is no significant effect on well child visits, emergency department use, or inpatient hospitalizations by registered medical home providers.

**Conceptual Framework**

The PRECEDE–PROCEED planning model by Green and Kreuter (2005) is a blueprint to evaluate and improve health policy interventions and programs (Crosby & Noar, 2011; see Figure 1).

**Figure 1.** PRECEDE–PROCEED planning model, adopted for evaluating Colorado SB130, 2015.

This model draws from epidemiology and the social sciences and has eight stages that work backward from outcomes toward assessment. This model helps identify where key decisions should be made, informs which theories should be used, and provides structure to understand the environment, resources, behaviors, and steps toward achieving
the intended outcome. The PRECEDE–PROCEED planning model focuses on the outcome of each stage and not individual activities. This model was chosen as the framework to evaluate SB130 because it has three discrete stages that address how a policy is operationalized and implemented and its impact.

Specific Aim 1 is addressed and guided by Stage 5 in the PRECEDE–PROCEED model, which identified planning gaps and opportunities for improvement in how SB130 was operationalized. A qualitative case study was completed using the *Linking Health Policy with Health Systems and Health Outcomes* policy framework by Hardee, Irani, MacInnis, and Hamilton (2012; see Figure 2). The four policy stages were scored on having distinct timelines, deliverables, named institutions and actors, and policy impact using a scoring algorithm developed for the study.

*Figure 2. Linking Health Policy with Health System and Health Outcomes, adopted for evaluating Colorado SB130, 2015.*

Specific Aim 2 is addressed and guided by Stage 6 in the PRECEDE–PROCEED model, which informs how well theory was put into practice and the uptake and reach of SB130’s implementation through a quantitative comparison of practices that participated in the medical home certification process (MHCP) assessment uptake. The number of children who received a well child visit from a registered medical home provider was estimated for the 5 years following SB130’s enactment in May 2007 to assess reach.

Specific Aim 3 is addressed and guided by Stage 7 in the PRECEDE–PROCEED model using proximal measures to assess if the policy implemented is having its intended impact. Proximal measures are used in place of outcomes when an outcome evaluation is not feasible or timely. A pre-post study design was used to compare three health services measures in two independent cohorts before and after SB130. A linear regression analysis tested for the impact of SB130 on three rates of health services measures in Children on Medicaid.

Given that policy outcomes are affected by the environment in which they are enacted, it is important to know what other Medicaid policies and programs changed during the time this study was conducted (see Figure 3).

Human-Subjects Consideration

The implementation evaluation did not include human subjects. The process evaluation used anonymous practice-level data and individual provider and claims data from a secondary source and therefore consent was not required. The impact evaluation used individual-claims data for children on Medicaid. There was minimal risk for harm to human subjects. This study, protocol #12-1073, Health Service Use Before and After Medical Home Certification, for this study titled: THE EFFECT OF MEDICAL HOME
LEGISLATION ON COLORADO’S PEDIATRIC PRACTICES AND HEALTH SERVICES USE IN CHILDREN ON MEDICAID was approved and exempt by the Colorado Institutional Review Board on October 6, 2015 (see Appendix B).

Figure 3. National and State Policies affecting Colorado Medicaid, 2007 through 2015.
CHAPTER II
LITERATURE REVIEW

The following literature review was completed in 2008 and 2015. Included is the search strategy, a history of the MHM, MHM outcomes, how a medical home is measured, and a description of the conceptual frameworks chosen to evaluate SB130 and Specific Aim 1.

Search Strategy

A search was completed in 2008 and repeated in 2015 using the following keywords and medical subject headings (MESH): medical home, framework, preventable hospitalizations; medical subject headings terms were “patient-centered medical home,” “pediatrics,” “primary health care,” “preventive health services,” “emergency services, hospital,” “Medicaid,” “children with special health care needs,” “health policy,” “legislation,” “certification,” “health services accessibility,” “quality indicators/health care,” “outcomes and process assessment,” “developmental screening,” and “child health services/well child visits.” The following Boolean criteria were used to limit the searches: medical home + patient-centered medical home + (legislation, certification, Medicaid, health services accessibility, children with special health care needs, primary health care, preventive health services, emergency services, hospital, preventable hospitalizations, and quality measures and health care).

Keywords were searched in OVID because it includes PubMed, MEDLINE, and targeted journals with medical home publications. Examples are Pediatrics, Health Affairs, and the Maternal and Child Health Journal. After limiting articles to “pediatrics” and those published in English, the search in 2008 yielded 310 articles and in 2015 another 222.
In 2015, a second search was completed that repeated the 2008 search and limited articles to those published between 2005 and 2015 to identify more current articles. The 2015 search added the keywords health policy framework, legislation, certification, framework, conceptual models, limited to primary health care, and the author Hardee to identify other studies for which the framework was used. A total of 424 citations were reviewed: 197 abstracts and 151 articles (see Appendix C). Articles were included if they addressed the history of the MHM, the specific aims in this evaluation, implementation, certification, legislation, or health and satisfaction outcomes associated with the MHM, financial incentives, and changes in health-services use.

Medical home websites specific to MHM pilot programs, demonstration projects, measurement tools, and certification were also reviewed. Websites reviewed included the following: Center for Medical Home Improvement (http://www.medicalhomeimprovement.org/), Child Health Data Resource Center (http://www.childhealthdata.org/content/Default.aspx), Maternal and Child Health Bureau (MCHB; http://www.mchb.hrsa.gov/), Patient Centered Primary Care Collaborative (http://www.pcpcc.net/content/patient-centered-medical-home), National Center for Quality Assurance (NCQA; http://www.ncqa.org/), Wikipedia (http://en.wikipedia.org/wiki/Medical_home), and the AAP (http://www.aap.org/). The Center for Medical Home Improvement, started in 1998, is a resource for providers and families to learn about the medical home model. The Child Health Data Resource Center houses data from the Centers for Disease Control and Prevention’s state local area telephone surveys, including the National Survey for Children with Special Health Care Needs and the National Survey of Children’s Health, both of which measure the medical home at the
state and national levels. The federal government created the MCHB through Title V of
the Social Security Act (1935). MCHB requires states to have a medical home for all
children with special healthcare needs as part of the receipt of federal block grant
funding. Another 94 articles were identified through references in the articles reviewed.

A History of the Medical Home Model

The term medical home has changed over time. The original definition was a
central repository for medical information for children with special healthcare needs. The
central repository, defined by Sia in 1978. This definition was important because not all
practices and providers at this time had implemented electronic medical records. The
term medical home was originally rejected by the AAP for fear physicians who were not
pediatricians would be named on billing forms that were used for care coordination
(Medical Home Initiatives for Children, 2002; Sia, Tonniges, Osterhus, & Taba, 2004).
Sia successfully led a campaign to have the medical home concept adopted into the State
Child Health Plan program in Hawaii (Sia & Stewart, 1989). This was the birth of
institutionalizing the medical home concept (Alexander, Cohen, Wise, & Green, 2013;
American Academy of Family Physicians, 2008; AAP, 2015; American Academy of
Pediatrics Committee on Pediatric Emergency Medicine, 2004; Colorado Children’s
Campaign, n.d.; Douglas, 2013; Laughlin et al., 2014; Medical Home Initiatives for
By the end of the 1990s, the National Center for Medical Home was established and
charged with (a) contributing to changes in and influencing the development of policies
to establish medical homes for all children with special healthcare needs; (b) increasing
the knowledge and skills of healthcare providers who care for children with special
healthcare needs; (c) analyzing, compiling, and disseminating outcomes of the medical home; and (d) developing and sustaining national technical-assistance programs (Centers for Medical Home Improvement, 2015; Health Care Incentives Improvement Institute, 2015).

In 1990, Sia partnered with the Director of the MCHB to guide the AAP in refining the definition and encouraged states to implement the MHM nationwide. The AAP and the MCHB began training providers and formally mandated that states provide a medical home for all children with special healthcare needs. As a result, the MHM gained momentum nationally (Cooley, McAllister, Sherrieb, & Clark, 2003; U.S. Health Resources and Services Administration, 2010).

At the same time, the AAP was promoting preventive health screening, specifically well child visits, through an initiative called Bright Futures. This initiative, in collaboration with the Department of Health and Human Services, Health Research and Service Administration, and the MCHB, comprised a set of strategies and evidence-based tools to improve the health and well-being of all children at the family, clinical practice, community, health system, and policy levels. These principles were shared with all states through the Medical Home Learning Collaborative in 1998, which began the association of preventive care with the medical home concept (Bright Futures, 2015). Colorado was part of the learning collaborative and has been involved with national and state medical home implementation since the late 1990s.

In 2002, the first medical home policy statement was published by the AAP, stating “A family-centered medical home is not a building, house, hospital, or home health care service, but rather an approach to providing accessible, continuous,
comprehensive, patient- and family-centered, coordinated, compassionate, and culturally effective primary care to all children and youth” (AAP, 2013, p. 1) [1]. The AAP did not operationalize the definition of the MHM but rather developed guidelines consisting of seven domains with 37 components (Child and Adolescent Health Measurement Initiative, 2009, p. 4).

In 2008, the NCQA published PCMH standards that operationalized the definition and included payment reform as an essential part of the model. The patient-centered medical home is operationalized through a list of practice processes. This definition includes having increased access to primary care, expanded hours, same-day scheduling, use of evidence-based medicine, a focus on quality improvement, measurable performance measures, increased use of technology, and a revised payment structure (American Academy of Family Physicians, 2008). The PCMH is not limited to children with special health care needs or pediatrics and is intended for application in all populations.

Taking the patient-centered medical home one step further, in 2011, the Institute of Medicine defined an advanced patient-centered medical home as a medical home that is also respectful of and responsive to an individual patient’s preferences. Debate persists on how well the PCMH applies to the pediatric population (Burnet et al., 2014; Cronholm et al., 2014; Fernald et al., 2011; Garg, Jack, & Zuckerman, 2013; McCarter, Jones, & Rager, 2011). Accreditation requires a lengthy and reportedly expensive process of self-evaluation and reporting that is then validated by NCQA.

**Medical Home Model Outcomes**

Health outcomes associated with the MHM are fewer acute care and emergency department visits, reduced specialty visits, reduced hospital visits, decreased number of
nights in the hospital, and decreased unmet medical needs (Hamilton, Lerner, Presson, & Klitzner, 2013; Homer et al., 2008; Long, Bauchner, Sege, Cabral, & Garg, 2012; McAllister, Presler, Turchi, & Antonelli, 2009; McAllister, Sherrieb, & Cooley, 2009; Mulvihill et al., 2007; Nageswaran, Roth, Kluttz-Hile, & Farel, 2006; Penn, 2010; Strickland et al., 2004, 2009). Having a medical home also aligns with a decrease in delayed or forgone care, fewer unmet family-support needs, increased timeliness of care, and increased use of written care plans. These outcomes have mostly been found in children with special health care needs and are most likely due to increased wellness care and strong chronic-care management and care coordination (Alakeson, Frank, & Katz, 2010; Diedhiou, Probst, Hardin, Martin, & Xirasagar, 2010; Domino et al., 2009; Martin et al., 2007; Nokoff, Brunner, Linakis, & Amanullah, 2014; Pagan & Carlson, 2013; Salas, Xaverius, & Chang, 2012; Turchi & Antonelli, 2016; Wegner et al., 2008; Wood, McCaskill, et al., 2009; Wood, Winterbauer, et al., 2009). This is important to observe because poor children, children on Medicaid, Black children, and younger children required more ambulatory care for sensitive conditions (SB130, 2007; Donabedian, 1988; Larson & Chapman, 2013; Ortega, Stewart, Dowshein, & Katz, 2008; Takach, 2012).

Access to a medical home differs by individual demographics such as race/ethnicity, family federal poverty level, access to insurance, type of insurance, age, gender, and health severity (Berenson, Doty, Abrams, & Shih, 2012; Bethell et al., 2011; Bethell, Read, Blumberg, & Newacheck, 2007; Brachlow, Ness, McPheeters, & Gurney, 2007; Burnet et al., 2014; Carlo & Powers, 2010; Chen, Schrager, & Mangione-Smith, 2012; DeCamp, Choi, & Davis, 2011; DeCamp et al., 2013; Dempsey & Freed, 2010; Diedhiou et al., 2010; Garg et al., 2013; Haggerty, 2011; Hambidge et al., 2004; Juhl &
Medical homes in the pediatric population, and not only in children with special healthcare needs, are associated with decreased emergency department use, increased preventive-care visits, better compliance with well child-visit periodicity, decreased outpatient sick visits, improved provider satisfaction, decreased number of school days missed, positive health behaviors such as wearing a helmet and reading to children, decreased screen time, higher immunization rates, lower overall costs of care, and decreased number of hospitalizations (Bolin, Gamm, Vest, Edwardson, & Miller, 2011; Committee on Psychosocial Aspects of Child and Health Task Force on Mental Health, 2009; Damiano, Momany, Tyler, Penziner, & Lobas, 2006; Evans, 2011; Harbrecht & Latts, 2012; Patient Protection and Affordable Care Act, 2010; Takach, 2012; Turchi & Antonelli, 2016; Wood, McCaskill, et al., 2009; Wood, Winterbauer, et al., 2009).

How Medical Home Has Been Measured

Prior to 2008 the medical home model did not have a standard operational definition and was difficult to measure and compare across studies. Also no specific outcomes were defined as a result of adopting the MHM. Researchers defined their study outcomes differently, used different measurement tools, or created their own, if used at all. This has made summarizing consistent findings challenging (Berry et al., 2013;
The most common approach to measuring a pediatric medical home has been to use the MHI created by Cooley et al. (2003). This tool, to be used alongside the Medical Home Family Satisfaction Survey, educates practices about the MHM and assesses where the practice lies along the pediatric medical home continuum (Centers for Medical Home Improvement, 2001; Cooley et al., 2003; Sia & Stewart, 1989). This self-report survey scores practices on six domains—(a) organizational capacity, (b) chronic-condition management, (c) care coordination, (d) community outreach, (e) data management, and (f) quality improvement—thereby operationalizing five of the seven medical home domains (accessible, family-centered, community-based, continuous, comprehensive, care coordination, and culturally competent). The first level using the Cooley approach is for emerging practices. Emerging practices are ones that are new to the medical home model. At the other end of the continuum is the fourth level. These practices score at the highest level meaning the practice has incorporated all of the medical home processes, on the index, into their daily activities. To aid in a quick report, a shorter 10-question MHI–Short Version assessed practices for changes and areas for improvement (see Appendix D). Both tools were not designed to be used for accreditation, certification, or research.

Researchers have used the MHI and correlated the scores with outcomes. Most have used an arbitrary threshold of 75% on the MHI. Outcomes associated with this threshold include childhood immunizations, family satisfaction, asthma control, emergency department use, and hospitalizations (Diedhiou et al., 2010; Grant et al., 2010;
Kieckhefer, Greek, Joesch, Kim, & Baydar, 2005; Klitzner et al., 2010; Knapp et al., 2012; Long et al., 2012; McAllister, Sherrieb, & Cooley, 2009; Ortega et al., 2008; Romaire & Bell, 2010; Romaire et al., 2012; Salas et al., 2012). No studies have been published using the MHI short 10-question version and outcomes.

Measurement using the PCMH standards yields scores that range from a practice being described as excellent to commendable, accredited, provisional, interim, and denied, based on an organization’s service programs, consumer protection, quality-improvement activities, Health and Data Information Set, and Consumer Assessment of Health Plan Survey results. The processes that are scored using PCMH standards are different from the processes assessed on the MHI and are not comparable. To date, no studies have compared the same practice using both tools.

If a practice implements a medical home with technical assistance and facilitation rather than self-direction, marked differences arise (Friedberg et al., 2014; Long & Garg, 2015). Which medical home processes are adopted affects changes in how healthcare is delivered, organized, financed, satisfies patients and providers, and provides positive healthcare use and outcomes (Berry et al., 2013; Bolin et al., 2011; Burnet et al., 2014; Cooley, 2004; Crabtree et al., 2011; Cutrona & Keitz, 2015; McAllister, Cooley, Van Cleave, Boudreau, & Kuhlthau, 2013; Nutting, Crabtree, & McDaniel, 2012; A. O. Reid, Baxley, Stanek, & Newton, 2011; Schwenk, 2014; Solberg, Asche, Fontaine, Flottemesch, & Anderson, 2011). It is not always the implementation of the MHM that aligns with defined outcomes, but specific medical home domains such as organizational capacity or care coordination (Antonelli, Stille, & Antonelli, 2008; Berry et al., 2013; Boivin, Lehoux, Lacombe, Burgers, & Grol, 2014; Burnet et al., 2014; Cooley,
McAllister, Sherrieb, & Kuhlthau, 2009; Cutrona & Keitz, 2015; Friedberg et al., 2014; Long & Garg, 2015; R. J. Reid et al., 2011).

**Description of the Conceptual Frameworks for Evaluation of SB130 and Specific Aim 1**

Conceptual models and frameworks guide healthcare delivery, quality improvement initiatives, program implementation, and health-policy evaluation (Fisher, Shortell, Kreindler, Van Citters, & Larson, 2012; Frieden, 2010; Hardee et al., 2012; Polski & Ostrom, 1999; Rittenhouse, Thom, & Schmittdie1, 2010; Tollen et al., 2011; Turchi & Antonelli, 2016). Of the many frameworks reviewed, two were chosen: one to guide the evaluation of SB130 and one for Specific Aim 1.

**PRECEDE–PROCEED**

To guide the evaluation of SB130, the PRECEDE–PROCEED planning model by Green and Kreuter (2005) was chosen (see Figure 1, Chapter I). This model has eight stages that address, in reverse order, the following eight stages.

**PRECEDE.**

**Stages 1 & 2: Social and epidemiologic assessments:** Identifies the original problems through social and epidemiologic assessments.

**Stage 3: Environmental assessment:** Reviews all resources available and identifies gaps to address before intervention planning.

**Stage 4: Intervention planning:** Defines when the theory is defined and later, in the PROCEED stages, operationalized.
PROCEED.

**Stage 5: Implementation evaluation:** Defines when the intervention was operationalized.

**Stage 6: Process evaluation:** Defines when theory was put into practice. Through implementation, uptake and reach are measured and changes to the intervention can be made if needed.

**Stage 7: Impact evaluation:** Uses proximal outcomes to assess if the intervention is likely to have an impact on the outcome. This stage is completed when an outcome evaluation is either untimely or feasible or as steps during implementation to inform changes to the intervention.

**Stage 8: Outcome evaluation:** Evaluates the success of the intervention on the target population.

These factors, through predisposing, reinforcing, and enabling antecedents, help identify the need, target population, theory or theories on which the intervention is designed, and guide each step of evaluation toward the outcome. One limitation of planning models is that they are not theories and do not specify which theory needs to be used. Planning models cannot be used to test causal relationships or mechanisms of action.

**Linking Health Policy with Health Systems and Health Outcomes**

To evaluate Specific Aim 1, the *Linking Health Policy with Health Systems and Health Outcomes* by Hardee et al. (2012) was chosen (see Figure 2, Chapter I). This policy framework was chosen has been used to evaluate MCHB programs (by whom the medical home model was mandated) and did not require an outcome evaluation to be used. This was important as no formal evaluation was planned for SB130.
Literature Review Summary

Today the patient-centered MHM is now accepted as a best practice for healthcare delivery and organizational change. The MHM, implemented in Colorado through SB130, preceded the current definition of the patient-centered medical home by over 1 year and was based on the guidelines for a medical home outlined in the AAP’s 2002 health policy statement. States that adopted the MHM prior to 2008 were labeled early adopters of the model and it was up to individual states to define how the MHM would be operationalized. This flexibility was problematic when comparing outcomes across projects, populations, and states. Today an operational definition exists by which practices can be scored and meet the definition of a medical home; however, no published practice-level or individual provider-level healthcare outcomes or benchmarks have been published that are associated specifically for the medical home model’s 2002 AAP definition. Regardless of the definition, population, or tools used, specific outcomes are consistently reported to improve when the MHM is adopted (Chen et al., 2012; Homer et al., 2008; Jackson et al., 2013; Long et al., 2012; McAllister, Sherrieb, et al., 2009; Seipel, 2011; Starfield & Shi, 2004; Sternberg et al., 2011; Strickland et al., 2011, 2004, 2009).
CHAPTER III

METHODS

Specific Aim 1: Evaluate how SB130 was operationalized.

Study Design

Qualitative case study of Colorado’s SB130.

Study Population

The community involved in operationalizing SB130 included two state agencies—HCPF and PH; one external advocacy group—Family Voices of Colorado; and MHAB, which was a multi-stakeholder group convened by CDPHE as part of a mandate from the MCHB, prior to legislation.

Data Source

Meeting notes from the MHCP, personal communication with the Medicaid Early Periodic Screening, Diagnosis, and Treatment Director, and reports from HCPF and the MHCP to the Colorado legislature and the Joint Budget Commission comprised the sources of data.

Outcomes

The four health policy stages that formed the framework for this evaluation came from Linking Health Policy with Health Systems and Health Outcomes by Hardee et al. (2012; see Figure 2, Chapter I): enabling environment, policy development, policy/program implementation, and health systems and health outcomes.
Methods

Tools

A crosswalk was developed starting with the four policy stages of the *Linking Health Policy with Health Systems and Health Outcomes* by Hardee et al. (2012). A second layer was added to the policy framework stages that reflected four processes from the policy-science literature developed by Lasswell (2001). These four processes were:

1. Identification of timelines (how timelines were defined and met);
2. Identification of political institutions (agencies/actors/organizations responsible for processes, deliverables);
3. Actors and relationships (actors’ roles and how their relationships affected the process); and
4. Policy impact (how the other processes affected policy outcomes).

The final crosswalk used for this study has the four health policy stages or outcomes and the criteria by which they were ranked (see Table 1, Chapter IV).

Analysis

A single reviewer, the author, used qualitative data to rank each health policy stage and substages as exceeded expectations (√+), met expectations (√), or did not meet expectations (√−). “Exceeded expectations” was operationalized as having all outlined deliverables or processes completed and additional or unexpected deliverables or processes that supported the policy stage. “Met expectations” was operationalized as having all outlined deliverables and processes completed. “Not meeting expectations” was operationalized as not having documentation that deliverables or processes were completed or defined.
Qualitative information from the data sources were used to identify timelines, institutions, and actors. To score the policy impact of each stage, the antecedents from the PRECEDE–PROCEED planning model were referenced. These antecedents were predisposing, reinforcing, and enabling determinants. If the timelines, institutions, and actors predisposed, reinforced, or enabled a positive outcome then the policy impact was ranked as meeting expectations. If these determinants predisposed, reinforced, or enabled a negative outcome, the policy stage was ranked as not meeting expectations.

Timelines, political institutions and agencies, and actors were identified, first, using the language from SB130. Second, MHAB notes were reviewed to identify and score if timelines, political institutions and agencies, and actors that were not specified in the legislation were identified through the MHAB meetings. After these two data sources were reviewed information about any substage without information was identified.

Actors and agencies involved in the other substages were contacted by phone or email to ask for timelines, political institutions and agencies or actors that may have been assigned to that substage which had not been documented. If not information could be ascertained from these contacts the process was scored as not having documented information and not meeting expectations.

The policy impact process was scored by averaging the previous three processes: having defined timelines, political institutions and agencies being named, and actors being assigned. The four health policy stages were scored based on their policy impact substage scores.
Specific Aim 2: Evaluate the uptake and reach of SB130 implementation.

Hypothesis 1: There is no significant difference in MHI and FSS between practices that volunteered for the Medical Home Certification Process after legislation passed, by year of certification.

Hypothesis 2: There is no increase in the number of children who receive a well child visit from a registered Medicaid provider.

Study Design

A cross sectional cohort design was used to compare certified practices to assess uptake. The number of children with a well child visits from Medicaid primary care providers and providers who registered for a financial incentive was estimated to assess reach.

Study Population

One, practices certified through the MHCP. Two, Medicaid primary care providers.

Data Source

Two different data sources were used for this study. The MHCP database collected and housed by Family Voices of Colorado included all practice information (name, address, and type of practice), the results from the MHI-SV, and the FSS. The second database from which registered and Medicaid primary care providers came was the Medicaid Management Information System (MMIS) housed at HCPF, which has all fee for service claims data from the Centers for Medicare and Medicare UB-40 and 1500 claims forms, Medicaid provider information, and client enrollment and eligibility data.
Methods

Intervention

HCPF worked closely with the governor, legislators, pediatricians, and provider champions to draft SB130. Input from the MHAB influenced how the bill was written, including three important principles. First, all children, not just children with special needs, should have a medical home. Second, all providers, including mental health, oral health, and specialists, could be recognized as medical home providers. If the medical home was not a primary care provider, the provider had to coordinate care and ensure the child received primary care. Third, families and patients were at the center of the model and included in all processes.

A workgroup led by an evaluator from CDPHE and a quality-improvement expert from HCPF along with a workgroup of MHCP members and others identified as community partners developed 12 medical home standards. HCPF contracted with the state chapter of the advocacy group Family Voices of Colorado, who administered the MHCP. This process required three steps. First, practices had all providers and staff completed the MHI-SV. Second, during the time practice staff were completing the MHI-SV, families in the practice were administered the 10-question FSS developed by Family Voices of Colorado, loosely based on the Medical Home Index Family Satisfaction Survey. All information collected was synthesized, shared with the practice, and used to develop a practice quality-improvement plan.

After the quality-improvement plan was developed, it was the individual provider’s responsibility to register their Medicaid billing identification number with HCPF to receive the increased payment for well child visits. Practices that participated in
the MHCP were referenced as a medical home or certified practice. Individual providers who registered for a payment increase with HCPF were referred to as medical home providers or registered providers. It was assumed that registered providers were associated with certified practices, but this was not validated, nor was the two databases. The MHCP database and the Medicaid claims database for registered providers were not linked through a common variable.

SB130 approved a provider reimbursement of $10 to $40 per well child visit, depending on the child’s age, up to 80% from Medicare for well child visits for children on public insurance in addition to the providers’ current, individual, negotiated rate (Robinson & Marx, 2009). In return, practices were to ensure the following:

- health maintenance and preventative care;
- anticipatory guidance and health education;
- acute and chronic illness care;
- coordination of medications, specialists, and therapies;
- provider participation in hospital care; and
- 24-hour telephone care.

Tools

1. MHI-SV. The MHI is a validated self-assessment and educational survey tool developed by the Center for Medical Home Improvement to educate a practice on the MHM (Cooley, 2004). The short version has 10 questions that represent five of the six medical home domains: organizational capacity, chronic-condition management, care coordination, community, and quality improvement (see Appendix D). The state chose this version over the full 24-
question version to decrease the burden on practices and because it excluded the data management domain, so as not to discourage small practices without an electronic medical record from participating.

2. Colorado Family-Satisfaction Survey Instrument. The FSS was developed by Family Voices of Colorado using a consensus design (criteria not documented) and included 10 questions modified from the MHI Family Version Survey, developed by the same authors as the MHI (see Appendix E). The survey was administered in English and Spanish.

Well visits for children who were younger than 19 years of age and had 90 to 365 days of continuous eligibility were counted for all registered providers. Well visits were limited to children younger than 19 years of age because this was the target audience of the legislation. Well visits were identified using ICD-9 diagnosis or service codes, defined by the Early Periodic Diagnosis, Screening, and Testing program (see Appendix F) and the Health Effectiveness Data Information System proprietary technical specifications available upon request from the National Center for Quality Assurance. Both definitions were used to acquire the maximum number of children with a well child visit. Well visits were linked to registered providers through the through the Medicaid billing identification number.

**Data Recode**

The MHI-SV has a 3-point Likert-type scale, but unlike other surveys, each question has a different value for each score, depending on the question and domain. The final MHI survey score was the total average score of the 10 questions (see Appendix D). The final score placed each practice along the medical home continuum defined by the
Centers for Medical Home Improvement in one of three levels labeled as good, responsive medical home, proactive medical home, or comprehensive medical home. For this analysis, the 3-point Likert-type scale was adjusted to a 5-point scale to allow for levels with subscores to be identified. (Appendix G).

A score of “1” describes a practice that has very few medical home processes in place. A “5” means the practice has almost all medical home processes described on the instrument implemented. Only surveys with all 10 MHI questions completed were included in the analysis. All MHI questions were weighted equally, as recommended in the scoring algorithm by the survey authors (Centers for Medical Home Improvement, 2015). The survey was anonymous; therefore, no individual respondent information was available on which to impute data or calculate a response rate.

The FSS used the following 4-point Likert-type scale for eight of the 10 questions: 1 = Yes, always; 2 = Yes, most of the time; 3 = Sometimes; 4 = No, never. Two questions were worded in the negative and therefore a score of 4 = No, never was the desired outcome. These two negative questions were recoded so that all answers that reflected a positive experience with the practice were the same. 1 = a positive experience on the survey item and 4 = a negative experience on the survey item and the total survey satisfaction score.

Because more than one question was asked for three of the five medical home domains assessed by the survey, a minimum of one question per domain was needed for the survey to be included in the analysis. All FSS questions were weighted equally and the survey score was based on the total number of completed questions. The survey was
anonymous; therefore, no individual respondent information was available on which to impute data or calculate a response rate.

Practices reported their “type” during the MHCP. When practice type was not reported, it was imputed based on the practice’s name. Practices were classified into five distinct categories for analysis: pediatric, family medicine, managed care organizations (which included all locations if they were part of the same system), and mental health practices. If a practice was a pediatric practice and part of a managed care organization the practice was classified as managed care. This delineated the individual pediatric or family medicine practices from those associated with a managed care system. Medicaid primary care providers were identified in the Medicaid claims database as any provider from a list of all providers that included 97,526 practitioners. Since this list included specialists, pharmacies, and durable medical equipment companies, an algorithm to identify pediatric providers was derived for this study. Medicaid pediatric primary care provider was defined as any provider with a type code of “clinic” or “physician.” To include only providers that serve children, the provider had to also have a claim from a child who was younger than 21 years of age, thereby excluding providers that only served adults. All rural health clinics and federally qualified health centers were included in the number of Medicaid primary care providers because both of these types of safety net clinics provide primary care to children.

Registered providers from the Medicaid claims database, and not the MHCP database, were identified as any provider with a medical home begin date. The medical home begin date in Medicaid Management Information System is the date the individual provider was entered into the Medicaid claims system for an increase in payments for
well visits. This date does not correspond to the date the provider’s practice completed the certification process nor the date the provider sent HCPF their Medicaid billing identification number.

**Analysis**

A post hoc power calculation was completed. A sample size of 115 practices with a medium effect size of $f^2 = 0.15$, two-sided alpha level, $\alpha = .05$, and two predictor variables yielded a power of $1 - \beta > 0.99$ to detect significant difference between practices that certified by year after legislation passed. The result of this calculation shows that there is enough power to detect a significant difference in three of the variables compared across two years using a Mann Whitney chi squared test and hierarchical linear modeling.

The distribution of practice types that certified each year after legislation was compared using a chi squared test to account for the data’s binomial distribution. Practice county was not analyzed because many counties in Colorado do not have a Medicaid pediatric primary care provider and too few practices were included to compare the small number of practice types across all 64 counties.

Aggregate MHI and FSS survey scores for practices in 2009 and 2010 were compared using a two-level hierarchical linear regression model (Raudenbush & Bryk, 2002) using the following formula:

$$Y_{ij} = \gamma_{oo} + \nu_{oj} + r_{ij},$$

where

$Y_{ij} =$ mean MHI or FSS score for each certified practice adjusted for clustering and unequal variance for each practice within the year,
\(i = \) number of practices within cohort,

\(j = \) number of staff (MHI) or families (FSS) within a practice,

\(\gamma_{oo} = \) grand mean of MHI or FSS scores (optimal weighted average of the sample mean),

\(o = \) the individual survey score,

\(\nu_{oj} = \) practice effect,

\(r_{ij} = \) individual respondent’s effect within practice (surveys).

Well visits from a registered provider during the medical home program, 2008 through 2012, were counted and classified by calendar year using the well visit service date.

**Specific Aim 3: Evaluate the impact of SB130 on Health Services Measures in Medicaid Children**

Hypothesis 3a: There is no significant difference in well child visits, emergency department use, or inpatient hospitalizations following SB130.

Hypothesis 3b: There is no significant effect on well child visits, emergency department use, or inpatient hospitalizations by registered providers receiving a payment increase.

**Study Design**

A pre–post study design was used to test for difference in three health services measures: well child visits, emergency department use, and inpatient hospitalizations, and to test the effect of having a registered provider on the annual number of health-services measures following the legislation.

**Study Population**

The study population consisted of children on Medicaid who were younger than 19 years of age and enrolled in the Aid to Families with Dependent Children or Baby
Care program with 90 to 365 days of continuous Medicaid eligibility (see Table 2, Chapter VI).

**Data Source**

The Medicaid claims database was the data warehouse that included information from the Centers for Medicare and Medicaid UB-92 and 1500 billing forms claims and payments. Five tables were extracted for analysis: (a) a client list of children younger than 21 years of age with demographic information and the client’s eligibility and enrollment information; (b) claims for children younger than 21 years of age; (c) a list of well child visit, emergency department visits, and hospitalization claims for all children younger than 21 to be used as a validation table for analysis; (d) a list of Medicaid providers; and (e) a list of Medicaid providers with a registration date for the financial incentive, called medical home providers.

**Outcomes**

The primary outcome measures for this specific aim were the number of well child visits, emergency department visits, and inpatient hospitalizations.

**Methods**

**Data recode**

Well visits for children who were younger than 19 years of age and had 90 to 365 days of continuous eligibility were counted for all registered providers. Well visits were limited to children younger than 19 years of age because this was the target audience of the legislation. Well visits were identified using ICD-9 diagnoses or service codes defined by the Early Periodic Diagnosis, Screening, and Testing program (see Appendix F) and the Health Effectiveness Data Information System proprietary technical
specification upon request from the National Center for Quality Assurance. Both
definitions were used to acquire the maximum number of children with a well child visit.
Emergency department visits and inpatient hospitalizations were recoded using ICD-9,
place of service, service begin and end dates, and admission begin and end dates, aligned
with HEDIS. HEDIS specifications are in the 2010 proprietary technical documentation,
2010, acquired from NCQA in May of 2014.

Age was recoded into the following strata for analysis: 0–15 months, 16 months
to 4 years, 5–12 years, and 13–18 years. Well visits were stratified to compare well visits
in the study population with the well visit clinical guidelines for each age group and to
account for use patterns based on a child’s age (Bethell et al., 2011; Chen et al., 2012;
Dempsey & Freed, 2010; Long et al., 2012; Romaine et al., 2012; Strickland et al., 2009).
Race/ethnicity was collapsed into five groups (Hispanic, White, not Hispanic; Black, not
Hispanic; other [all other reported races]; and unknown) to include the large proportion
of almost a quarter of the population (up to 24%) in the analysis. Urban was classified
aligned with the U.S. Census Bureau, Office of Management and Budget designation as
the child’s county of enrollment: having more than 50,000 people defines metropolitan
statistical areas and rural areas are those with fewer than 50,000 or if the county is not
considered a metropolitan statistical area (U.S. Census Bureau, 2016). Total number of
chronic conditions and months on Medicaid were kept as a continuous variable. Chronic
conditions were identified using diagnosis codes from any claims during the study period
and followed the algorithm previously published for immunization and preventive care
studies on the Medicaid population in Colorado (personal communication, S. Hambidge).
Medicaid primary care providers were identified in the Medicaid claims database as any provider with a type code of “clinic” or “physician.” To include only providers that serve children, the provider had to also have a claim from a child who was younger than 21 years of age, thereby excluding providers that only served adults. All rural health clinics and federally qualified health centers were included in the number of Medicaid primary care providers because both types of safety net clinics provide primary care to children. Registered providers were identified if the provider had a medical home begin date.

**Analysis.** A post hoc power calculation was completed on each well child visit age group, and for emergency department visits and inpatient hospitalizations. Using the calculated $R^2$, $df = 5$ for well child visits, $R^2$, $df = 6$ for emergency department visits and inpatient hospitalizations, and a population of 696,630, (unduplicated children across years) the power to detect a significant difference at the alpha = .05 level is $B = 1.0$ using the standard deviation of the unadjusted means.

The proportion of children with 0, 1, or more well child visits; emergency department visits; and inpatient hospitalizations were calculated and compared across all study years; 2008 through 2012. Proportions were reported to validate these data and compare results to national benchmarks for well child visits in the Medicaid population. The number of all health services measures per child per 10,000 member months was also calculated and reported. Rates are reported to facilitate comparisons of these findings with other Medicaid health and outcome studies.
To assess the difference in the number of well child and emergency department visits, and inpatient hospitalizations in children on Medicaid between 2008 and 2012 and the effect of having a registered provider multiple linear regression was used.

The following linear regression equation was used:

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \epsilon, \]

where

- \( Y \) = number of well child (stratified by age group), emergency department visits, or inpatient hospitalizations between 2012 and 2008 per child per year,
- \( \beta_0 = 2012 \) vs. 2008,
- \( \beta_1 = \) if the child had one or more well child visits from a registered provider,
- \( \beta_2 = \) number of chronic conditions each child had during the study period from 2008 through 2012,
- \( \beta_3 = \) the location (rural vs. urban) that the child enrolled in Medicaid,
- \( \beta_4 = \) the number of months > 90 days the child was continuously enrolled in Medicaid up to 12 months,
- \( \beta_5 \) (for emergency department visits and inpatient hospitalizations only) = the total number of well child visits received.

Linear regression was used to test for significant differences in the number of annual well child visits (stratified by age group), emergency department visits, and inpatient hospitalizations and the effect of having a registered provider before and following legislation: 2008 versus 2012. Well child visits were tested using the following covariates, entered into the model individually: time, registered provider, number of chronic conditions for the child, county of enrollment, and months on Medicaid for each
age strata. Emergency department visits and inpatient hospitalizations were tested using the same covariates. For emergency department visits and inpatient hospitalizations, the number of annual well child visits was added to the model after testing for the effect of having a registered provider and before the number of chronic conditions. Gender did not change over time and therefore was not entered into the model. Race/ethnicity had a large proportion of missing data and was not included because, when it was entered into the model, the model was unstable.
CHAPTER IV

SPECIFIC AIM 1

Specific Aim 1 evaluated how SB130 was operationalized. This study addressed Specific Aim 1 through a retrospective case study of Colorado using the health-policy framework Linking Health Policy with Health Systems and Health Outcomes by Hardee, Irani, MacInnis, and Hamilton (2012). This was an implementation evaluation, as described in the PRECEDE–PROCEED model to identify how the health policy, SB130, was operationalized.

Introduction

Originally a central medical information repository for medical information for children with special health care needs, the medical home model (MHM) has decades later become a best practice (Alexander, Cohen, Wise, & Green, 2013; Bolin, Gamm, Vest, Edwardson, & Miller, 2011; Crabtree et al., 2010; Garg, Jack, & Zuckerman, 2013; Jackson et al., 2013; McCarter, Jones, & Rager, 2011). Before the MHM was accepted as a best practice it was a set of guidelines described by the American Academy of Pediatrics (AAP) through their 2002 policy statement. They defined the medical home as accessible, continuous, comprehensive, family-centered, coordinated, compassionate, and culturally effective primary care.

In 2007, Colorado identified the need to increase access to Medicaid providers and improve the quality of care received by children on Medicaid (Berman, Armon, & Todd, 2005; Hambidge et al., 2004; Todd, Armon, Griggs, Poole, & Berman, 2006). Prior to this, in 2001, the mandate was that every child with special healthcare needs have access to a medical home by the Federal Maternal and Child Health Bureau (MCHB). To
address both of these issues systemically, Colorado passed Senate Bill 07-130
CONCERNING MEDICAL HOMES FOR CHILDREN, AND MAKING AN
APPROPRIATION THEREFOR (SB130) (see Appendix A).

To increase access to care for children on Medicaid and adopt the MHM for
children with special healthcare needs and on public health insurance SB130, two state
agencies collaborated. SB130 required the development of medical-home standards, as
the National Center for Quality Assurance (NCQA) Patient Centered Medical Home
(PCMH) standards had not yet been published. A process was needed by which practices
could learn and adopt the MHM, as defined by the AAP. An increase in the amount
HCPF paid a provider for a well child visit was intended to encourage more providers to
accept children on Medicaid.

The success of SB130 has not yet been evaluated; no studies have evaluated how
it was operationalized. This paper evaluates the processes used to operationalize SB130,
using Colorado as a retrospective case study with a crosswalk developed from the
Linking Health Policy with Health Systems and Health Outcomes framework by Hardee
et al. (2012), a framework that has been used to evaluate MCHB programs.

Study Design

A qualitative case study of Colorado SB130 using the Linking Health Policy with
Health Systems and Health Outcomes by Hardee et al. (2012; see Figure 1).

Study Population

The community involved in operationalizing SB130 included two state
agencies—the Colorado Department of Health Care Policy and Financing (HCPF) and
the Colorado Department of Public Health and Environment (CDPHE)—one external
advocacy group—Family Voices of Colorado—and the Medical Home Advisory (MHAB). The MHAB was a multi-stakeholder group convened by CDPHE to fulfill the MCHB mandate of building medical homes for children with special healthcare needs prior to legislation.

Data Sources

MHAB meeting notes, personal communication with the Medicaid Early Periodic Screening, Diagnosis, and Treatment Director responsible for SB130 oversight operationalization, and public reports to the Colorado legislature and the Joint Budget Commission comprised the sources of data.

Outcomes

The four health policy stages from the framework Linking Health Policy with Health Systems and Health Outcomes by Hardee et al. (2012) were (a) enabling environment, (b) policy development, (c) policy/program implementation, and (d) health systems and health outcomes.

Tools

Four policy stages from the Linking Health Policy with Health Systems and Health Outcomes by Hardee et al. (2012) were evaluated. To facilitate scoring four processes to the health policy-science literature were used to rank each policy stage. These four processes, further developed by Lasswell (1999), are

1. Identification of distinct timelines (how timelines were defined);
2. Identification of political institutions (agencies/actors/organizations involved);
3. Identification of actors (individuals, roles, and their responsibilities); and
4. Policy impact (expectations of the stage).
Analysis

A single reviewer reviewed the qualitative data and scored each health policy substage as either exceeded expectations (√+), met expectations (√), or did not meet expectations (√-). Exceeded expectations was operationalized as having distinct timelines for all outlined deliverables: agencies named, actors’ roles and responsibilities documented and fulfilled, plus additional deliverables. Deliverables were met before they were due. Meeting expectations was operationalized as having distinct timelines for all outlined deliverables, agencies named, and actors’ roles and responsibilities documented and fulfilled. Not meeting expectations was operationalized as not having distinct timelines for all outlined deliverables, agencies named, and actors’ roles and responsibilities documented and fulfilled. Policy impact was scored using the average of the scores for all the processes in the stage. The four health policy stage outcomes were scored based on the average score of all policy impact substages.

First, timelines, political institutions and agencies, and actors were identified, using the language from SB130. Second, MHAB notes were reviewed to identify and score if timelines, political institutions and agencies, and actors that were not specified in the legislation were named and documented. After these two data sources were reviewed substages without documented information were identified.

Actors and agencies named were contacted by phone or email to ask for timelines, political institutions and agencies or actors that may have been assigned to the substage which did not have documentation from the legislation or MHAB notes. If no information could be ascertained from these contacts the process was scored as not having documented information and not meeting expectations.
The policy impact process was scored by averaging the three processes: having defined timelines, political institutions and agencies being named, and actors being assigned. The four health policy stages were scored based on their policy impact substage scores.

Results

Policy Stage 1: Enabling Environment, Colorado Exceeded Expectations (see Table 1)

**Overall governance.** The infrastructure to address the goals of SB130 were already in place. Both agencies—HCPF and CDPHE—had personnel and resources allocated to similar work. CDPHE had convened and was supporting the MHAB. HCPF contracted with a local chapter of the National Organization for Cerebral Palsy—Family Voices of Colorado—thereby expanding the partners beyond the political agencies identified in the bill.

**Political/sociocultural/economic environment.** Prior to SB130, Colorado participated in the National Medical Home Learning Collaborative, which began in 1998, the forerunner of the MHAB. MHAB stakeholders included local public health departments, providers, provider organizations, family- and special-needs advocates, and representatives from the behavioral-health and oral-health systems. CDPHE financially supported the MHAB. CDPHE employed a full-time family advocate to ensure the MCHB mandate of having “families partner in health care decision making at all levels.” Colorado is one of the only states to employ a family advocate through a state agency for family advocacy (Alexander et al., 2013; Kaye, Buxbaum, & Takach, 2011; Shaljian & Neilsen, 2013; Thorpe & Ogden, 2010; Turchi & Antonelli, 2016). For this effort,
Colorado was nationally recognized as a model for cross-agency collaboration with stakeholder and family involvement by the American Academy of Health in 2010 (Robinson, 2009).

Initially, the charge of the board was to operationalize the medical-home definition for the state and support adoption through local public health departments for children with special healthcare needs. After SB130 passed, the MHAB was used as a community-based work group and advisory board to operationalize the processes outlined in legislation. Leveraged existing resources, both agencies were able to meet deadlines ahead of time, quickly redefine roles and responsibilities of the actors and activities, and required no new full-time employees.

**Policy Stage 2: Policy Development. Colorado Exceeded Expectations (see Table 1)**

**Problem identification.** In 1997, the payment structure for Medicaid changed to fee for service from managed-care (Berman, Armon, & Todd, 2005). This change allowed for greater provider access and Medicaid member choice. After HCPF changed their payment system, fewer providers served children, and healthcare quality was questioned (Phibbs, Hambidge, Steiner, & Davidson, 2006; Todd et al., 2006). In 2002 CDPHE received a mandate from the MHAB that all children with special health care needs have access to a medical home.

**Policy development/products.** Three deliverables were outlined in SB130. First, was the development of medical home standards for Colorado. Second, was development of a process by which practices could adopt the MHM and be recognized as certified medical home practices. Third, was a payment increase to registered medical home providers.
Using a workgroup from the MHAB, the 12 Colorado medical home standards were developed in less than 6 months. A voluntary process to recognize practices as certified medical home practices was developed that measured medical home processes in the practice and family satisfaction. This information and input from families led to the development of a practice quality-improvement plan that aligned with Colorado medical home standards. This process expanded the target audience for medical home from pediatric providers to all providers, as long as they provided care or coordinated with a provider that would ensure each child received the following:

- health maintenance and preventative care;
- anticipatory guidance and health education;
- acute and chronic illness care;
- coordination of medications, specialists, and therapies;
- provider participation in hospital care; and
- 24-hour telephone care.

This broad definition made Colorado unique in who could adopt the MHM, and the state became one of the early adopters of medical home and payment reform through legislation (Nutting et al., 2009; Reid, Baxley, Stanek, & Newton, 2011; Weissman, Bailit, D’Andrea, & Rosenthal, 2013). In return, individual providers were to receive a payment increase of $10 to $40 per well child visit, depending on the child’s age, over their currently negotiated rate. At the time, the AAP definition of medical home stated a pediatrician should be a child’s medical home.
It was expected that by the end of the 2008 legislative session there would be: medical home standards developed, a process by which practices could adopt the MHM, and a payment increase for Medicaid-registered medical home providers.

**Policy Stage 3: Policy/Program Implementation Met Expectations (see Table 1)**

The substages of strategic planning and policy barrier analysis and uptake and integration did not meet expectations.

**Institutions, relationships, and power dynamics.** The MHAB included more than state agencies named in SB130. The Colorado Health Foundation and the Colorado Trust were granting projects to improve access to care for children on Medicaid and vulnerable populations. Colorado was fortunate and leveraged synergy between agencies, stakeholders, foundations, and academia toward improving care for children on Medicaid and implementing the MHM statewide.

**Capacity.** HCPF and CDPHE used existing resources, including MHAB members to conduct the work outlined in SB130. Monies allocated in the bill were used to contract with the advocacy group, Family Voices of Colorado, to administer the medical home certification process (MHCP).

**Financing.** SB130 allocated $44,965 for one full-time employee, the director of the Early Periodic Screening, Diagnosis, and Testing program at HCPF, who directed the process. As a result, the focus of the intervention was on younger children on Medicaid. In addition, $73,163 was allocated for implementation of the MHCP. Because resources were used that were already funded, this money was used to contract with Family Voices of Colorado for administration of the MHCP.
The increase in payment for well child visits was absorbed by HCPF but a cost difference was not calculated by the state.

**Strategic planning and policy barriers.** For providers to receive an increase in reimbursement, they had to register with HCPF using their Medicaid billing-identification number. It was assumed these providers were from practices that volunteered to participate in the MHCP. The MHCP took place at the practice level. Payment increase was at the provider level. Tools for the certification process were chosen or developed to decrease the MHCP practice burden but at the cost of collecting minimal information. The names of individual providers from certified practices were not recorded. It was assumed all Medicaid providers would volunteer. In retrospect, this may not have been the case, as this assumption could not be validated with the data collected.

Colorado has many counties that are primary care underserved counties, meaning the counties have too few providers for the population. Some counties have no primary care providers (Basco & Rimsza, 2013; Colorado Health Institute, 2014; Henry J. Kaiser Family Foundation, 2014). No attempt was made in SB130 to increase the number of providers in the state.

**Monitoring and accountability.** No minimum threshold was set to recognize a practice as a medical home. The process developed did not plan for follow up with practices after quality improvement plan development. Families from practices were not approached a second time to assess if satisfaction had increased from the baseline assessment. Monitoring and accountability used the HCPF EPSDT 416 reports to the Centers for Medicare and Medicaid for preventive services received by children on
Medicaid. These reports were shared annually with the Colorado legislature (Medicaid.gov, 2016).

**Uptake and integration.** Participation in the MHCP was voluntary and no action was taken if a practice chose not to participate. The reason for voluntary participation was not collected, so understanding what motivated practices could not be assessed. A baseline number of practices was not collected so it is unknown what proportion of practices participated. The final deliverable of the MHCP was a practice quality improvement plan that referenced the developed medical home standards. Information about the improvement plan was not collected and no follow up regarding changes in practices processes was planned or completed.

Individual providers were responsible for registering their Medicaid billing identification number with HCPF for the payment increase. No link was established between providers in certified practices and those that registered with HCPF. One survey was completed through the Colorado chapter of the AAP asking if the provider associated with the chapter was a medical home. These results were reported to the Colorado legislature but the data collection and analysis for these results was not documented.

**Policy Stage 4: Health Systems and Health Outcomes Did Not Meet Expectations** (see Table 1).

**Strengthening of the health system/service delivery.** SB130 did not outline or develop processes to ascertain the number of Medicaid practices prior to the MCHP. Individual providers that registered for a payment increase could not be linked to the practices that participated in the MHCP. It is unknown to what extent the health systems or delivery were changed; only limited information exists about what happened in the
current infrastructure. A new business association agreement for data exchange was signed between HCPF and CDPHE that did not previously exist.

**Healthy behaviors by increased numbers of people.** The children who received well child visits from registered medical home providers were not isolated and reported. The estimated number of children affected by SB130 came from the HCPF Early and Periodic Screening, Diagnostic and Treatment 416 reports on preventive care and included all children on Medicaid.

**Improve health outcomes.** Healthcare outcome measures were not included in SB130.

**Discussion**

Qualitative data were used to retrospectively assess how Colorado SB130 was operationalized using the *Linking Health Policy with Health Systems and Health Outcomes* by Hardee et al. (2012). Two of the four health policy stages exceeded expectations, one met expectations, and one did not. Scoring took place for each health policy substage for timelines, deliverables, political institutions, and actors.

Several important findings emerged. Colorado, through their previous work to implement the MHM, had an established enabling environment. As shown in this study, including more than the political institution’s name in legislation, such as stakeholders and foundations, can be advantageous and considered for inclusion. Because partnerships take time to establish, it may be in a state’s best interest to begin this process prior to policy implementation.

When possible, using existing resources and actors is efficient and cost effective. However, this came at a cost to Colorado in that resources were not created to evaluate
outcomes to the health system and health outcomes. Monitoring and accountability are not evaluation. Colorado did not define outcomes. Because there were no defined outcomes, the effect of SB130 on practices or individuals could not be measured.

This study had several limitations. The health-policy framework does not address sustainability. No evidence of changes, continuation, or permanent implementation of the policy were planned or collected. It is unknown if doing so would have resulted in the MHCP being continued. (Carrier, Gourevitch, & Shah, 2009; Goldberg & Kuzel, 2009; Jaen et al., 2010; Miyakawa, 2001). This project depended on data collected for purposes other than evaluating the processes developed. Notes, reports, and personal communication may not have captured all the information needed and may have affected each health policy’s score. A single reviewer analyzed the qualitative data who participated in the MHAB; therefore, results may be biased by the reviewer’s experience. Having a second rater would allow for a more objective review of the data. Although this study used an established and accepted framework to score the four policy stages, it was not tested for construct validity.

A future research recommendation is to use a different framework to replicate these findings. The crosswalk used in this study could be used by other states to compare different MHCPs across states and validate this tool.

In conclusion, Colorado was recognized as an early adopter of the MHM and their collaborative partnership between HCPF and CDPHE, stakeholders, and families was nationally recognized (Kaye et al., 2011; Takach, 2012; U.S. Department of Health and Human Services, 2014; Weissman et al., 2013). Results highlight the importance of planning and data collection to assess the uptake and reach of policy interventions and
outcomes. The crosswalk developed for this study is unique and can be used by other states to help ensure all policy substages are addressed to increase successful policy implementation. It is important to address all four of the health policy stages for health policy theory to be successfully translated into practice and measured appropriately.

ACKNOWLEDGMENTS

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FIGURES

*Figure 1*. Linking Health Policy with Health System and Health Outcomes, adopted for evaluating Colorado SB130, 2015.

### Table 1

*Hardee Lasswell Crosswalk, Created for Colorado SB130, 2015*

<table>
<thead>
<tr>
<th>Outcomes: Health policy stage</th>
<th>Processes</th>
<th>Actors (Who are the individuals that need to be involved with each policy stage and what are their roles and responsibilities?)</th>
<th>Policy impact (What is the expected policy impact at this policy stage if all the processes are addressed well? If no impact then why not?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Enabling Environment</td>
<td>Distinct timelines (Are they defined for each health policy stage?)</td>
<td>Political institutions (What agencies, organization, and stakeholders need to be involved in each policy stage?)</td>
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</tr>
<tr>
<td>Overall governance</td>
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<td>(√+)</td>
<td>(√+)</td>
</tr>
<tr>
<td>Political / sociocultural / economic environment</td>
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<td>(√+)</td>
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</tr>
<tr>
<td>2. Public Health Policy Development</td>
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<td></td>
<td>(√+)</td>
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<tr>
<td>Problem identification</td>
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<tr>
<td>Policy development / Products</td>
<td>(√)</td>
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Table 1 (cont’d)

Hardee Lasswell Crosswalk, Created for Colorado SB130, 2015

<table>
<thead>
<tr>
<th>Outcomes: Health policy stage</th>
<th>Processes</th>
<th>Actors</th>
<th>Policy impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distinct timelines (Are they defined for each health policy stage?)</td>
<td>Political institutions (What agencies, organization, and stakeholders need to be involved in each policy stage?)</td>
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<td>(✓)</td>
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<tr>
<td>Institutions, relationships, and power dynamics</td>
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<td>Financing</td>
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<tr>
<td>Strategic planning and policy barriers analysis</td>
<td>(✓)</td>
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<td>Monitoring and accountability</td>
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<tr>
<td>Uptake and Integration</td>
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Table 1 (cont’d)

*Hardee Lasswell Crosswalk, Created for Colorado SB130, 2015*

<table>
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<th>Policy impact</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Distinct timelines (Are they defined for each health policy stage?)</td>
<td>Political institutions (What agencies, organization, and stakeholders need to be involved in each policy stage?)</td>
<td>(Who are the individuals that need to be involved with each policy stage and what are their roles and responsibilities?)</td>
</tr>
<tr>
<td>4. Health Systems and Outcomes</td>
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</tr>
<tr>
<td>Strengthening of the health system / service delivery</td>
<td>(√-)</td>
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<tr>
<td>Healthy behaviors by increased number of people</td>
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<td>(√-)</td>
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<tr>
<td>Improved health outcomes</td>
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</tbody>
</table>

(√+) – exceeded expectations. Exceeded expectations is operationalized as having distinct timelines for all outlined deliverables, agencies named, actors’ roles and responsibilities documented and fulfilled plus additional deliverables, deliverables were met before they were due. (√) – met expectations. Meeting expectations is operationalized as having distinct timelines for all outlined deliverables, agencies named, actors’ roles and responsibilities documented and fulfilled. (√-) – did not meet expectations. Not meeting expectations is operationalized as not having distinct timelines for all outlined deliverables, agencies named, actors’ roles and responsibilities documented and fulfilled.
CHAPTER V
SPECIFIC AIM 2

Specific Aim 2 evaluated the uptake and reach of SB130. This study addressed Specific Aim 2 through a cross sectional cohort design comparing two independent cohorts of certified practices following legislation to assess uptake. Using a second data source and different population, the annual number of children with a well child visit from registered providers was estimated for each year SB130 was in effect. This was a process evaluation, as described in the PRECEDE–PROCEED model, to assess how theory was put into practice.

Introduction

Many states, including Colorado, struggle with having adequate primary care; especially for vulnerable populations (Berenson, Doty, Abrams, & Shih, 2012). After Colorado changed from a managed care to a fee for service system, a decrease occurred in access to care for children on Medicaid (Berman, Armon, & Todd, 2005; Todd, Armon, Griggs, Poole, & Berman, 2006). Also, the quality of care for those with a primary care provider was unsatisfactory (Berman et al., 2005; Berwick, Nolan, & Whittington, 2008; Institute of Medicine, 2001; Todd et al., 2006).

To address these two issues, Colorado passed Senate Bill 07-130 (CONCERNING MEDICAL HOMES FOR CHILDREN AND MAKING AN APPROPRIATION THEREFOR, Senate Bill 07-130 § 1 25.5-1-103 [SB130], 2007; to increase access to care for children on Medicaid (see Appendix A). Two discrete processes were mandated. First, to increase access to care, Medicaid providers were
offered a payment increase for well child visits of $10 to $40, based on the child’s age, up to 80% of the Medicare payment for an annual well visit at that time. No set rate was established, as each provider in Colorado has a different negotiated rate for a well child visit, as part of their Medicaid contract (Centers for Medicare & Medicaid Services, 2010; Robinson, 2009; U.S. Department of Health and Human Services, 2007).

Second, to address the decrease in quality of care, providers had to complete the medical home certification process (MHCP). The purpose of this process was to have practices voluntarily adopt the medical home model (MHM), as defined by Colorado. The state chose the MHM because it reportedly improves health outcomes, increases patient and provider satisfaction, decreases cost, and has been tested in vulnerable and Medicaid populations (Gill, Fagan, Townsend, & Mainous, 2005; Kempe et al., 2000; McBurney, Simpson, & Darden, 2004; Starfield & Shi, 2004). These practices were then recognized as certified medical home practices and individual providers from these practices were able to register for a payment increase.

To become a certified practice required a voluntary meeting with the advocacy group, Family Voices of Colorado, and having all providers and staff complete a survey tool that documented how many medical home processes were in place. Family or patient satisfaction was also collected at the same time, using a different survey tool. Results from these two surveys were summarized and shared with the practice to develop a practice quality-improvement plan that aligned with the medical home guidelines published by the American Academy of Pediatrics in 2002. This ended the practice-level process and the practice was recognized by the state as a certified medical home. No
minimum score was needed to be certified as a medical home. A practice was recognized as a medical home by the state if they completed the MHCP.

To receive an increased payment, individual providers from certified practices sent their Medicaid billing identification number to HCPF to be flagged in the claims database to receive a payment increase for well child visits. This study compares the unique practices which completed the MHCP each calendar year after SB130 was passed. By comparing these practices this study attempts to assess if there were differences in the practice type, number of medical home processes in place, and family satisfaction in practices that participated immediately after the bill was passed or waited to certify. In addition, using a second data source the number of children from the Medicaid-registered providers are estimated for each year SB130 was in place: 2008 through 2015.

Study Design

A cross sectional cohort design was used to compare certified practices annually following legislation to assess uptake. The number of well child visits by registered medical home providers was estimated for 2008 through 2012 to assess reach.

Study Population

Practices that completed the MHCP (see Figure 1). A convenience sample ensued of families from practices volunteering for the MHCP. Medicaid primary care and registered providers are listed (see Figure 2).

Data Source

The first data sources were the MHCP database from Family Voices of Colorado included practice information (practice name, address, and type of practice) and survey results from the survey tools administered to the practice staff, providers, and families.
Second was a list of Medicaid providers from the Medicaid Management Information System (Medicaid claims database).

**Methods**

**Intervention**

Practices volunteered to participate in the MHCP by initiating a certification meeting with Family Voices. During the certification meeting, all practice staff and providers completed the Medical Home Index–Short Version (MHI-SV). At the same time, a convenience sample of families from the practice were asked to complete the Family Satisfaction Survey (FSS) while in the waiting room. Results from the surveys were shared with the practice and, together with a family advocate, the practice completed a quality-improvement plan that referenced the medical home standards and aligned with the guidelines for medical home published by the American Academy of Pediatrics (2002). Practices that participated in the MHCP were then recognized by the state as medical homes.

After participating in the MHCP, individual providers sent their Medicaid billing identification number to HCPF and were flagged in the Medicaid Management Information Database with a medical home begin date. These providers were then referenced as medical home providers or “registered” providers. It was assumed that registered medical home providers were from certified practices but this was not validated, and no link between the practice-level certification data and the individual provider-level database was created.

Well visits were identified using International Statistical Classification of Diseases and Related Health Problems (ICD)-9 diagnosis or service codes, as defined by
the Early Periodic Diagnosis, Screening, and Testing program (see Appendix G) and the Health Effectiveness Data Information System technical specification, NCQA, 2010, proprietary information. Both definitions were used to acquire the maximum number of children with a well child visit. Well visits were linked to providers through the provider Medicaid billing identification number.

Aggregate MHI and FSS survey scores for practices in 2009 and 2010 were compared using a two-level hierarchical linear regression model (Raudenbush & Bryk, 2002). Well visits from Medicaid primary care and registered medical home provider were counted and reported for each calendar year of the medical home program; 2008 through 2015. Well visits for each year were identified by the date of service.

Tools

**MHI-SV.** The MHI-SV is a 10-question survey based on the validated 24-question MHI. The MHI is a validated self-assessment and educational tool to teach practices about the MHM, developed by Cooley, McAllister, Sherrieb, and Clark (2003) and supported by the Center for Medical Home Improvement to educate a practice on the MHM (see Appendix D). The short version’s 10 questions scored five of the six medical home domains: organizational capacity, chronic-condition management, care coordination, community, and quality improvement. The state chose the MHI-SV version to decrease the burden on practices and because it excluded the data-management domain to refrain from discouraging small practices without a medical record from participating.

**Colorado FSS.** The FSS was developed by Family Voices using a consensus design (criteria not documented) and included 10 questions modified from the MHI
Family Version Survey (Centers for Medical Home Improvement, 2016; see Appendix E).

**Data Recode**

The MHI-SV has a 3-point Likert-type scale, but unlike other surveys, each question has a different value, depending on the question and domain (see Appendix D). To account for the partial rather than complete subscores, MHI scores were transformed from a 3-point Likert scale to a 5-point Likert scale for analysis (see Table 1).

An analysis score of “1” describes a practice that has very few medical home processes in place. A “5” means the practice has implemented almost all medical home processes described on the instrument. Only surveys with all 10 MHI questions completed were included. All MHI questions were weighted equally, as no one domain is more important than another. All surveys were anonymous; therefore, no individual respondent information was available on which to impute data. No information was collected about staff or providers from the practices so a response rate could not be calculated.

The FSS used the following 4-point Likert-type: 1 = Yes, always; 2 = Yes, most of the time; 3 = Sometimes; 4 = No, never. Questions 1 through 8 were positive and Questions 9 and 10 were worded negatively, but the scale was not reversed. For this analysis the two negative questions were recoded so a score of 4 represented being highly satisfied, similar to the positively worded questions.

Because more than one question was asked for three of the five medical home domains assessed by the survey, a minimum of one question per domain was needed for the survey to be included in the analysis. All FSS questions were weighted equally and
the survey score was the average of all completed questions. The survey was anonymous; therefore, no individual respondent information was available on which to impute data. The number of families that refused or were unavailable to take the survey was not recorded so a response rate could not be calculated.

Practices reported their “type” during the MHCP. If practice type was not reported it was imputed based on the practice’s name. Practices were classified into five distinct categories for analysis: pediatric, family medicine, managed care organizations (which included all locations if they were part of the same system), and mental health practices. If a practice was a pediatric practice and part of a managed care organization the practice was classified as managed care. This delineated the practices that were not part of a managed care organization from those that were.

Certified practices were classified into six categories for analysis: pediatric, family and internal medicine, practices from two managed care organization (Kaiser and Denver Health) regardless of location, mental health, and primary care. Primary care included rural health clinics and Federally Qualified Health Centers.

The second analysis identified the population of Medicaid primary care providers using provider type code “clinic” or “physician” in the Medicaid claims database. These providers also had to have a claim from a child who was younger than 21 years of age. All rural health clinics and federally qualified health centers were included in the number of Medicaid primary care providers because both types of safety-net clinics provide primary care to children. From this population, the registered medical home providers were identified using their medical home begin date. The children with well visits billed to providers was counted.
**Analysis**

A post hoc power calculation was completed. A sample size of 115 practices with a medium effect size of $f^2 = 0.15$ and a two-sided alpha level, $\alpha = .05$, yielded a power of $1 - \beta > 0.99$ to detect significant differences between practices that certified in 2009 and 2010, for a chi squared test of significance.

Practice types were compared between years using a chi squared test to account for the data distribution and number of practices in each year. Practice county was not analyzed because many counties in Colorado do not have a Medicaid pediatric primary care provider and too few practices were included to compare the small number of practice types across all 64 counties.

**Results**

No practices volunteered for the certification process in 2008. In 2009, 12 practices completed the certification process. In 2010, another 103 completed the process. The most frequent type of practice to certify was pediatric (50% in 2009 and 58% in 2010). The percentage of practices that classified themselves as family medicine, managed care, mental health or primary care were different in 2009 and 2010 but this comparison was not statistically significant ($df = 5$, $X^2 = 2.37$, $p < .04$). No rural health clinics completed the MHCP.

A total of 1,245 MHI surveys were collected. 126 surveys were collected from the 12 practices that certified in 2009. The number of surveys per practice ranged from 3 to 23. 1,119 survey’s were collected from the 103 practices that certified in 2010. The number of surveys per practice ranged from 2 to 39. The average MHI score from practices that certified in 2009 was significantly different than the average MHI score
from practices that certified in 2010 ($\mu= 2.60, 95\% \text{ CI} = 2.40, 2.8$ & $\mu=3.26, 95\% \text{ CI} = 3.20, 3.32$) respectively (see Table 2). The average scores on all ten of the individual MHI survey questions were also compared across practices that certified in 2009 and 2010. Significant differences were found for all ten questions (see Table 2).

There were 142 FSS collected from the 12 practices that certified in 2009. The number of surveys per practice ranged from 4 to 55. There were 1,616 FSS collected from the 103 practices that certified in 2010. The number of surveys per practice ranged from 1 to 34. The average FSS score from the practices that certified in 2009 was not statistically different than the average FSS scores from the practices that certified in 2010 (see Table 3). The average FSS score for practices that certified in 2009 was $\mu=1.22, 95\% \text{ CI} = 1.16, 1.28$ and for practices that certified in 2010; $\mu=1.26, 95\% \text{ CI} = 1.24, 1.28$.

Using Medicaid claims data, the number of providers who registered for a payment increase increased from one to 163 between 2008 and 2011 (see Graph 1). No providers registered in 2012. (see Graph 1). This number represents 14% of the total number of Medicaid primary care providers identified in the Medicaid database.

The total number of children who received a well child visit from a registered provider increased consistently between 2008 and 2012 (see Graph 2). In 2012, there were 499,353 children on Medicaid and 59% of them received a well child visit. Of these children, 109,860 received a well child visit from one of the 163 registered providers. The percent of children who received a well child visit from one of the 163 registered provider in 2012 was 22%. The percent of children who received a well visit from one of the 1,148 Medicaid primary care providers that did not register was 38%.
Discussion

Colorado was one of the first states to encourage practices to voluntarily participate in an MHCP to receive a payment increase (Greenhalgh, 2012; Kaye, Buxbaum, & Takach, 2011; Nutting et al., 2009; Takach, 2012). Data were collected about a practice at the time of participation in the MHCP. No baseline data were collected nor follow up on these practices were collected. The comparison of practices that certified in 2009 and 2010 was to assess the hypothesis there were differences in practices based on how quickly they participated in the MHCP after SB130 passed. Because only two years of data were available for analysis it is not possible to answer this hypothesis.

Practices other than pediatric practices participated in the MHCP. Learning that non pediatric practices were interested in being certified as a medical home supports the current trend in expanding the MHM into non pediatric practices such as practices that serve a geriatric populations and school-based health centers (Larson & Chapman, 2013; Laughlin et al., 2014; U.S. Department of Health and Human Services, 2011).

How quickly after SB130 passed did practices start to participate in the MHCP is difficult to assess with only two years of data. The greatest number of practices certified in 2010; three years after legislation was enacted. Because it is not known exactly how many practices (not providers) are in the state the saturation of practices cannot be calculated. Due to contracting delays the certification process did not begin until the very end of 2008. This is over one year after legislation was enacted. This may be a function of the data collection process or an indication that implementation of legislation was difficult to enact immediately after being passed. Not all practices completed the MHCP
once they began the process (115 of 151). Other states and payers trying to encourage practices to adopt the MHM reported barriers and challenges (Coleman et al., 2014; Kilo & Wasson, 2010; Nutting et al., 2009; Wagner et al., 2014; Zickafoose et al., 2013). It is unknown if these barriers are the same for Colorado and to what magnitude the number of practices that chose to participate is effected by the process being voluntary and the amount of the financial incentive.

In both years, certified practices fell in the “pro active” medical home level. Even though the average score for practices that certified in year 2010 was statistically higher than the practices that certified in 2009 this does not translate into a difference that changed how the practices were classified along the medical home continuum. Practices in 2010 did not reach the next, higher, level of a medical home; a comprehensive medical home. This level would have distinguished these practices as having a greater number of processes in place than a pro active medical home.

The FSS scores for practices that certified in 2009 and 2010 did not change. In both years families reported they were almost always satisfied with the services they had received in the previous 12 months. These families were surveyed from practices that fell in the pro active medical home level which is in the middle of the medical home continuum. While not confirmed through this study, it has been reported that families are satisfied with services when receiving care in a medical home. (Coleman et al., 2014; Hamilton, Lerner, Presson, & Klitzner, 2013; Long, Bauchner, Sege, Cabral, & Garg, 2012; McAllister, Cooley, Van Cleave, Boudreau, & Kuhlthau, 2013; Reid et al., 2011; Zickafoose, Clark, Sakshaug, Chen, & Hollingsworth, 2013).
Identifying individual providers who registered for a payment incentive allowed for an assessment that was not possible using the practice level data. Providers that registered for a financial increase were responsible for a greater proportion of children with well child visits than providers that did not register for the payment increase. It is not known if registered providers had a large number of children on Medicaid and that was the motivation to seek out the financial incentive or if having a financial incentive changed the number of children for which a well visits was provided. (Halfon, Stevens, Larson, & Olson, 2011; Kieckhefer, Greek, Joesch, Kim, & Baydar, 2005; Willits et al., 2013; Wood et al., 2009).

There were many limitation to the practice level analysis. Having only two years of data did not allow for an assessment of the number of practices that certified across time. There was no practice level baseline data collected so it is not known how many Medicaid practices were in Colorado during the study and what percentage of those participated in the MHCP. Because baseline medical home levels is not known, how long the practices that certified had been at the pro active medical home level could not be assessed. (Shilow-Carrol & Bitterman, 2010). Practices were not at the lowest level, perhaps because of other programs and projects occurring in Colorado to educate and support adoption of medical home processes, such as the Colorado Children’s Health Access Program and the Assuring Better Childhood Development program. It could also be that practices needed to make changes that aligned with the MHM when Colorado HCPF expanded its criteria from 100% of the federal poverty level to 130% in 2010 to accommodate more children (Cutrona & Keitz, 2015; Kilo & Wasson, 2010; Long & Garg, 2015; Nutting, Crabtree, & McDaniel, 2012; Wagner, Gupta, & Coleman, 2014).
Another explanation is that practices were in the proactive medical home level all along and are unique in some way that was evidenced by their willingness to participate in a certification process.

Many practices were excluded from the descriptive analysis due to missing data. Excluding practices with incomplete data does not necessarily lead to more bias than other types of data exclusion but should be noted (Berenson et al., 2012; Berman et al., 2005; SB130, 2007; Todd et al., 2006). The FSS was neither validated nor pilot tested; therefore, it is unknown if the high satisfaction scores are a ceiling effect of a tool or a reflection of the satisfaction of the families that were surveyed. A high score may also be due to families not wanting to score their providers low for fear of having their scores affect their care. Given this was a convenience sample of families seeking services at the time of certification selection bias should be considered when interpreting these results. (Korn & Graubard, 2011; Litwin, 1995).

Limitations of the provider level analysis include the lack of documentation which links the individual provider with the practices from which the provider came. This may be the reason one provider registered for the payment increase in 2008 but there were not any certified practices in 2008. The annual trend of registered providers may be misleading. The dates in which the provider registered as a medical home provider is the date they were entered into the Medicaid Management Information System and not the date they sent their Medicaid billing identification number to Medicaid. This may also explain why there was one registered provider in 2008. Children with well visits were identified using administrative billing data which has known limitations.
Future research should include collecting data about why practices volunteered for the MHCP and the importance of the payment increase. Learning how the MHCP was shared with providers might identify why there was a lag in participation. Follow up on the practices’ quality-improvement plans would enhance understanding of which processes changed and would measure their well child visits (Burnet et al., 2014; McAllister et al., 2013; Valko & Wender, 2014). Establishing a link between certified practices, individual providers who registered for the financial incentive, and other health services data would allow assessment of the practices that were responsible for a disproportionate number of well child visits.

In conclusion, policy did not achieve momentum until 3 years after implementation. One hundred and fifteen practices certified or were reached. The effect of registered providers from the certified practices. The policy attracted practices that were documented to be pro active medical homes at the time of certification. (Hamilton et al., 2013; McAllister et al., 2013; Valko & Wender, 2014). The number of providers who registered for a financial incentive from the certified practices resulted in a reach of 14% of all the Medicaid primary care and affected 22% of all children on Medicaid through providing a well child visit in 2012. Providers that sought a payment increase had different service patterns for well child visits than those that did not (Burnet et al., 2014; Crabtree et al., 2011; Nutting et al., 2009).

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### TABLES

#### Table 1

*Medical Home Index Score Transformation for Analysis*

<table>
<thead>
<tr>
<th>Medical home level</th>
<th>Medical Home Index score</th>
<th>Analysis score</th>
<th>Practice description based on score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 point</td>
<td>1</td>
<td>Good, responsive care</td>
</tr>
<tr>
<td>2</td>
<td>2 partial</td>
<td>2</td>
<td>Proactive</td>
</tr>
<tr>
<td>2</td>
<td>2 complete</td>
<td>3</td>
<td>Proactive</td>
</tr>
<tr>
<td>3</td>
<td>3 partial</td>
<td>4</td>
<td>Comprehensive</td>
</tr>
<tr>
<td>3</td>
<td>3 complete</td>
<td>5</td>
<td>Comprehensive</td>
</tr>
</tbody>
</table>

*Note.* Adapted from The Medical Home Index-SV, by Centers for Medical Home Improvement, 2016, retrieved February 29, 2016, from http://www.medicalhomeimprovement.org/knowledge/mhi-fv_instructions.html
### Table 2

**Medical Home Index Survey Results, 2009-2010, Colorado (Transformed)**

<table>
<thead>
<tr>
<th>Medical Home Index Survey Question</th>
<th>2009 µ (95% CI)</th>
<th>2010 µ (95% CI)</th>
<th>Mean Change (95% CI)</th>
<th>df=1,244</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Family Feedback**</td>
<td>2.06 (1.82, 2.29)</td>
<td>2.69 (2.61, 2.76)</td>
<td>0.63 (0.61, 0.64)</td>
<td></td>
</tr>
<tr>
<td>2. Identification of children in the practice with special health care needs**</td>
<td>2.55 (2.27, 2.84)</td>
<td>3.40 (3.32, 3.49)</td>
<td>0.85 (0.83, 0.86)</td>
<td></td>
</tr>
<tr>
<td>3. Care Continuity**</td>
<td>2.58 (2.28, 2.87)</td>
<td>3.45 (3.37, 3.54)</td>
<td>0.87 (0.85, 0.88)</td>
<td></td>
</tr>
<tr>
<td>4. Cooperative management between primary care provider (PCP) &amp; specialist**</td>
<td>3.22 (2.93, 3.52)</td>
<td>3.69 (3.62, 3.77)</td>
<td>0.47 (0.45, 0.48)</td>
<td></td>
</tr>
<tr>
<td>5. Supporting the transition to adulthood**</td>
<td>2.31 (2.07, 2.54)</td>
<td>3.05 (2.98, 3.13)</td>
<td>0.74 (0.72, 0.75)</td>
<td></td>
</tr>
<tr>
<td>6. Care coordination / role definition**</td>
<td>2.67 (2.43, 2.91)</td>
<td>3.42 (3.34, 3.49)</td>
<td>0.75 (0.73, 0.76)</td>
<td></td>
</tr>
<tr>
<td>7. Assessment of needs / plan of care**</td>
<td>2.64 (2.40, 2.88)</td>
<td>3.52 (3.19, 3.35)</td>
<td>0.88 (0.86, 0.89)</td>
<td></td>
</tr>
<tr>
<td>8. Community assessment for children with special health care needs**</td>
<td>2.32 (2.06, 2.58)</td>
<td>3.26 (2.97, 3.13)</td>
<td>0.94 (0.92, 0.95)</td>
<td></td>
</tr>
<tr>
<td>9. Quality standards**</td>
<td>2.87 (2.55, 3.18)</td>
<td>3.06 (2.52, 3.60)</td>
<td>0.19 (0.17, 0.20)</td>
<td></td>
</tr>
<tr>
<td><strong>Total Practice MHI Scores for each Cohort</strong></td>
<td><strong>2.60 (2.40, 2.80)</strong></td>
<td><strong>3.26 (3.20, 3.32)</strong></td>
<td><strong>0.66 (0.64, 0.67)</strong></td>
<td></td>
</tr>
</tbody>
</table>

Data Source: Medical Home Practice Survey Database, Family Voices of Colorado, Denver, CO. Note: 1 = Good, responsive primary care, 5 = Comprehensive primary care. A hierarchical linear model was used to test for the difference in transformed Medical Home Index score means between years to adjust for clustering and unequal practice variance. 2009: practice n=12, survey n=126, min=3, max=23. 2010: practice n=103, survey n=1,119, min=2, max=39. A two-sided alpha level = 0.05. *p < .05. **p < .01.
Table 3

*Family Satisfaction Survey Results, 2009-2010, Colorado*

<table>
<thead>
<tr>
<th>Family Satisfaction Survey Question</th>
<th>2009 µ (95% CI)</th>
<th>2010 µ (95% CI)</th>
<th>Mean Change (95% CI)</th>
<th>df = 1,757</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you feel your provider creates a Medical Home for your child?**</td>
<td>1.24 (1.13, 1.35)</td>
<td>1.32 (1.29, 1.35)</td>
<td>0.08 (0.076, 0.084)</td>
<td></td>
</tr>
<tr>
<td>2. Do you feel your provider values you and your child’s family?**</td>
<td>1.20 (1.12, 1.28)</td>
<td>1.24 (1.21, 1.27)</td>
<td>0.04 (0.036, 0.044)</td>
<td></td>
</tr>
<tr>
<td>3. Do you feel you are linked to available support services when appropriate? For example: therapy, early intervention, supplies and equipment.**</td>
<td>1.33 (1.22, 1.45)</td>
<td>1.33 (1.30, 1.36)</td>
<td>0 (-0.004, 0.004)</td>
<td></td>
</tr>
<tr>
<td>4. Do you feel your calls are returned within a reasonable amount of time?**</td>
<td>1.32 (1.22, 1.43)</td>
<td>1.36 (1.33, 1.39)</td>
<td>0.04 (0.036, 0.044)</td>
<td></td>
</tr>
<tr>
<td>5. Does your provider meet your cultural differences?***</td>
<td>1.20 (1.09, 1.30)</td>
<td>1.18 (1.15, 1.20)</td>
<td>-0.02 (-0.024, -0.016)</td>
<td></td>
</tr>
<tr>
<td>6. Would you say your provider is concerned for your child’s well being?**</td>
<td>1.15 (1.08, 1.23)</td>
<td>1.15 (1.13, 1.17)</td>
<td>0 (-0.004, 0.004)</td>
<td></td>
</tr>
<tr>
<td>7. Do you feel your concerns about your child are heard?**</td>
<td>1.18 (1.09, 1.26)</td>
<td>1.24 (1.21, 1.27)</td>
<td>0.06 (0.004, 0.064)</td>
<td></td>
</tr>
<tr>
<td>8. Do you get referrals to specialist or other providers when needed?**</td>
<td>1.29 (1.18, 1.40)</td>
<td>1.26 (1.23, 1.29)</td>
<td>-0.03 (-0.034, -0.026)</td>
<td></td>
</tr>
<tr>
<td>9. Do you have any difficulty getting appointments?**</td>
<td>1.18 (1.08, 1.28)</td>
<td>1.30 (1.27, 1.33)</td>
<td>0.12 (0.116, 0.124)</td>
<td></td>
</tr>
<tr>
<td>10. Do you have any difficulty getting to appointments?**</td>
<td>1.15 (1.06, 1.23)</td>
<td>1.19 (1.16, 1.21)</td>
<td>0.04 (0.036, 0.044)</td>
<td></td>
</tr>
<tr>
<td>Total Practice FSS Scores for each Cohort**</td>
<td>1.22 (1.16, 1.28)</td>
<td>1.26 (1.24, 1.28)</td>
<td>0.04 (0.036, 0.044)</td>
<td></td>
</tr>
</tbody>
</table>

Data Source: Family Voices Certification Database, Family Voices of Colorado, Denver, CO. *Note.* 1 = Yes, always, 4 = No, never. Questions (9 & 10) were reversed for analysis. A hierarchical linear model was used to test for the difference in Family Satisfaction Survey score means between years to adjust for clustering and unequal practice variance. 2009: practice n=12, survey n=142, min=4, max=55. 2010: practice n=103, survey n=1,616, min=1, max=34. *p < .05. **p < .01.
FIGURES

Figure 1. Medical home practices that completed the certification process, included in survey analysis, 2009–2010. Data Source: Medical Home Certification Database, Family Voices of Colorado.

151 Practices
(Table 1: Family Voices Practice Information Database)

(+ 9) Table 2 & 3: Merge practices from the Medical Home Index and Family Survey

160 Practices
(Unique Practice Identification Numbers)

(-) 12 Practices missing practice information
(-) 11 Practices with incomplete Medical Home Index Surveys
(-) 7 practices with erroneous (0s or 9s or blanks) Medical Home Index and Family Satisfaction Survey responses
(-) 3 Practices missing at least one Medical Home Index Survey
(-) 12 Practices missing at least one Family Satisfaction Survey

115 Practices
(Practices with complete practice information (type and location), at least one Medical Home Index Survey and at least on Family Satisfaction Survey for analysis)
Figure 2. Medicaid primary care providers by year, 2008–2012. Source: Medicaid Claims Data.


Data Source: Medicaid Management Information System, Colorado Department of Health Care Policy and Financing, Denver, CO. Note. Medicaid primary care providers are Medicaid provider with provider type code = clinic or physician that have a claim from a child younger than 21 years of age and rural health clinics and federally qualified health centers. Registered Medicaid providers are identified by their medical home begin date.
Graph 2. Number of children with a Well Child Visit from a Medicaid primary care and registered medical home provider, 2008–2012, Colorado.

Data Source: Medicaid Management Information System, Colorado Department of Health Care Policy and Financing, Denver, CO. Note. Medicaid primary care providers are Medicaid provider with provider type code = clinic or physician that have a claim from a child younger than 21 years of age and rural health clinics and federally qualified health centers. Registered Medicaid providers are identified by their medical home begin date. Children on Medicaid are younger than 21 years of age and well child visits include visits as defined by the Early Periodic Screening, Testing, and Diagnosis and the Health Effectiveness Data and Information System.
CHAPTER VI

SPECIFIC AIM 3

Specific Aim 3 evaluated the impact of SB130 on three Health Services Measures in Children on Medicaid. This was a retrospective cohort study using Medicaid claims data from years 2008 and 2012. Three health services measures were tested pre-post legislation: the annual average number of well child visits, emergency department visits, and inpatient hospitalizations. This study was an impact evaluation and used proximal measures to assess if the policy addressed the outcome of interest. Researchers use proximal measures when an outcome evaluation may not be feasible or timely. If completed during the policy intervention, results may identify where the PRECEDE stages (social, epidemiologic, and environmental assessments) or implementation may be adjusted.

Introduction

Over the past decade, most states have adopted the medical home model (Abrams, Nuzum, Mika, & Lawlor, 2011; Abrams et al., 2015; Berwick, Nolan, & Whittington, 2008; Colorado Health Institute, 2014; Institute of Medicine, 2001). Colorado was one of the early adopters of the medical home model and passed legislation to increase access to care through Concerning Medical Homes for Children, and Making an Appropriation Therefor (SB130; Takach, 2012). To do so SB130 allowed Colorado Medicaid to offer a payment increase for well child visits if a provider participated in a practice-level certification process.

The medical home certification process was voluntary and initiated by practices. Staff and providers completed the short version of the Medical Home Index Tool (MHI)
that educated practices on the medical home model. This model was defined by the American Academy of Pediatrics and guidelines published for practices to follow in 2002 (Agency for Healthcare Research and Quality, 2010). During administration of the MHI a convenience sample of families in the waiting room of the practice were asked to complete a state developed family satisfaction survey. Information from these two surveys was used to develop a practice-level quality-improvement plan. Individual providers, from these practices, were then asked to send their Medicaid billing identification number to HCPF to receive an increase in reimbursements for well child visits.

Individual providers who registered with HCPF received a $10 to $40 increase, based on the child’s age. This rate was in addition to providers’ individual contracted rate, not to exceed 80% of Medicare payment (Friedberg, Schneider, Rosenthal, Volpe, & Werner, 2014; Shaw, Norlin, Gillespie, Weissman, & McGrath, 2013; Zickafoose, Clark, Sakshaug, Chen, & Hollingsworth, 2013). Providers were then flagged for a payment increase as registered medical home providers (Robinson & Marx, 2009).

To evaluate the success of SB130, HCPF relied on the Early Periodic Screening and Testing (EPSDT) 416 report. This annual report to the Centers for Medicare and Medicaid counts the number of children on Medicaid receiving preventive services. The EPSDT report does not separate children with and without a registered medical home provider nor does it identify children with special health care needs. (Crabtree et al., 2010; Jackson et al., 2013; Starfield & Shi, 2004).

Children with special health care needs have been documented to have different utilization patterns and better outcomes when associated with a medical home. Colorado
is reported to have 15% of households with a child with a special health care need and close to 60% of these are on Medicaid. {Strickland, 2009 #178;Kelly, 2008 #414;Martin, 2007 #117;Palfrey, 2004 #130;Strickland, 2004 #176} (Ben-Isaac, Schrager, Keefer, & Chen, 2010; Carlo & Powers, 2010; Cooley, McAllister, Sherrieb, & Kuhlthau, 2009; Diedhiou, Probst, Hardin, Martin, & Xirasagar, 2010; Florida Center for Health Information Policy Analysis, 2008; Friedberg et al., 2014; Gadomski, Jenkins, & Nichols, 1998; Harbrecht & Latts, 2012; McBurney, Simpson, & Darden, 2004; Nokoff, Brunner, Linakis, & Amanullah, 2014; Valko & Wender, 2014).

This study assesses the changes in the average number of well visits, emergency department visits, and inpatient hospitalization per child on Medicaid between 2008 and 2012. The difference in the number of visits affected by having a registered medical home provider and child level demographics was also tested.

**Study Design**

Linear regression analysis was used to test for differences in three health services measures: well child visits, emergency department visits, and inpatient hospitalizations. The effect of having a registered provider and child level demographics on this change were also tested.

**Study Population**

Children on Medicaid younger than 19 years of age enrolled in the Aid to Families with Dependent Children or the Baby Care program with 90 to 365 days continuous Medicaid eligibility comprised the study population (see Figure 1).
Data Source

The Medicaid Management Information System, which is the Medicaid fee for service claims database was the source of data. Two tables were extracted: demographic, Medicaid eligibility, claims, enrollment, and eligibility for all members younger than 21 years of age and the Medicaid provider table.

Outcomes

The primary outcome measures for this study were the number of well child visits, emergency department visits, and inpatient hospitalizations.

Data Recode

Well visits were identified using International Statistical Classification of Diseases and Related Health Problems (ICD)-9 diagnosis or service codes, defined by the Early Periodic Diagnosis, Screening, and Testing program (see Appendix F) and the Health Effectiveness Data Information System (see Appendix G). Both definitions were used to acquire the maximum number of well child visits. Well child visits were linked to providers through the provider’s Medicaid billing identification number. Emergency department visits and inpatient hospitalizations were recoded using ICD-9, place of service, service begin and end dates, and admission begin and end dates as per the Health Effectiveness and Information Data Set (HEDIS) specifications in the proprietary technical documentation, 2010 (Acquired from National Committee for Quality Assurance, May 2014).

Age was recoded into the following strata for analysis: 0–15 months, 16 months to 4 years, 5–11 years, and 12–18 years. Well visits were stratified because the annual number of well visits recommended is different based on age and use patterns in
adolescents and young adults (Bethell et al., 2011; Chen, Schrager, & Mangione-Smith, 2012; Dempsey & Freed, 2010; Long, Bauchner, Sege, Cabral, & Garg, 2012; Romaire, Bell, & Grossman, 2012; Strickland et al., 2009). Race/ethnicity was collapsed into five groups (Hispanic, White, not Hispanic; Black, not Hispanic; other [all other reported races]; and unknown) which includes the large proportion of missing data (24%). The child’s county of enrollment was classified as urban or rural using the U.S. Census Bureau, Office of Management and Budget designation. Urban means having more than 50,000 people in a metropolitan statistical areas and rural is a county with fewer than 50,000 or one not considered a metropolitan statistical area (U.S. Census Bureau, 2016). Total number of chronic conditions and months on Medicaid were kept as a continuous variable. Chronic conditions were identified using diagnosis codes from all claims during the study period and followed a previously published algorithm for children on Medicaid (personal communication, S. Hambidge, August 15, 2015). Registered medical home providers were identified by their medical home begin date.

Analysis

A post hoc power calculation was completed using the following: calculated $R^2$, $df = 5$ for well child visits, $R^2$, $df = 6$ for emergency department visits and inpatient hospitalizations, and an $n = 696,630$, (unduplicated children across years). The power to detect a significant difference for all three measures at the alpha = .05 level is $B = 1.0$.

Study population characteristics were compared using a $t$ test to compare means and a chi squared test to compare proportions. The proportions of children with 0, 1, or 2 or more well child visits were calculated and reported for all study years; 2008 through 2012. For emergency department visits and inpatient hospitalization, the total number in
the population of children with 1 or more emergency department visits and inpatient hospitalizations was calculated. Proportions are reported to compare results to national benchmarks reported in the Medicaid population. Rates per 10,000 member months were also calculated and reported. Rates are reported to facilitate comparing the results from this study with other Medicaid health-outcome studies.

To assess the effect of a registered medical home provider on the average number of well child visits, emergency department visits, and inpatient hospitalizations at the end of the medical home program, linear regression was used. Independent variables were not entered into the model individually. Gender did not change over time and therefore was not entered the model. When race/ethnicity was entered, the model became unstable, due to the large proportion of missing data and so was excluded. All data were recoded using both structured query language and statistical analytic program (SAS) and analyzed using SAS version 9.2 (SAS Institute, Inc., Cary, NC).

Results

Study Population

Significant differences emerged in the study populations between 2008 and 2012 (see Table 2). Age, number of chronic conditions, and months on Medicaid all increased significantly. None of these significant changes were by more than one unit of analysis. The racial breakdown changed by more than one unit of analysis. Hispanic decreased from 42% to 38% while Other increased from 5 to 8%.

Unadjusted Analysis

The proportion of children receiving annual well visits are shown for all years and changed significantly between 2008 and 2012 in all age groups (see Table 3). In the 0- to
15-months age group, the proportion of children having one well visit decreased from 12% (95% CI = 12.03, 12.27) to 9% (95% CI = 9.30, 9.48) between 2008 and 2012. The proportion of children having two or more visits increased from 77% (95% CI = 77.25, 77.55) to 82% (95% CI = 81.84, 82.08).

In the 16-month to 4-year age group, the percentage of children having one well visit changed from 34% (95% CI = 34.13, 34.49) to 38% (95% CI = 38.47, 38.62). A significant difference arose in the proportion with greater than one visit but once rounded, the proportion was consistent at 18% for both years.

In the 5- to 11-year age group, the proportion of children with one well visit increased from 26% (95% CI = 25.71, 26.03) to 30% (95% CI =30.28, 30.56). The proportion of children with two or more visits decreased, but when rounded was consistent at 1%.

In the 12- to 18-year age group, the proportion of children with one visit increased from 21% (95% CI = 21.36, 21.66) to 25% (95% CI = 25.14, 25.40). The proportion of children with two or more well visits decreased statistically, but once rounded remained at 1%.

For emergency room visits, the proportion was calculated for having more than one visit in all age groups. No significant difference emerged between 2008 and 2012.

For inpatient hospitalizations, the proportion was calculated for having more than one visit in all age groups. A significant decrease emerged in the proportion of children with inpatient hospitalization between 2008 and 2012, but once rounded remained at 1%.

**Adjusted Analysis**

Well Child Visits
In the 0-to-15-months age group, the adjusted average number of well child visits changed per child changed from $X = 2.9$ to $X = 3.4$ (see Table 5). Having a registered medical home provider had a small but significant effect on this increase ($\beta = 1.112$, $p < 0.01$). All other characteristics affected this change significantly but in different directions. Months enrolled in Medicaid had a favorable effect on the average number of annual well child visit whereas chronic conditions and enrollment in a rural county had a negative effect.

In the 16-month to 4-year age group, the adjusted average number of well child visits per child changed from $X = 0.82$ to $X = 0.88$. Having a registered medical home provider had a small but significant favorable effect ($\beta = 1.081$, $p < 0.01$). The number of chronic conditions for a child, and the number of months continuously enrolled in Medicaid had a significant favorable effect whereas enrollment in a rural county had a significant negative effect.

In the 5- to 11-year age group, the adjusted average number of well child visits per child changed from $X = 0.29$ to $X = 0.33$. Having a registered medical home provider had a small but significant favorable effect ($\beta = 0.883$, $p < 0.01$). Small significant favorable effects were shown for all other characteristics: the number of chronic conditions per child, the number of months enrolled in Medicaid, and being enrolled in a rural county.

In the 12- to 18-year age group, the adjusted average number of well child visits per child changed from $X = 0.25$ to $X = 0.28$. Having a registered medical home provider had a small but significant favorable effect ($\beta = 0.864$, $p < .01$). Small significant favorable effects were shown for all other characteristics: the number of chronic
conditions per child, the number of months enrolled in Medicaid, and being enrolled in a rural county.

Emergency Department Visits

In the study population, the adjusted average number of emergency department visits per child did not change between 2008 and 2009; \( X = 0.429 \) for both years (see Table 5). All predisposing and enabling characteristics had significant effects on this number. Having a registered medical home provider had a small but significant favorable effect \((\beta = 0.027, p<0.01)\). The number of well visits had a slightly greater favorable effect than having a registered medical home provider \((\beta = 0.032, p < 0.01)\). Characteristics that also had a significant favorable effect, even though the number of visits per child did not change, are the number of chronic conditions per child, the number of months enrolled in Medicaid, and being enrolled in a rural county.

Inpatient Hospitalizations

In the study population, the adjusted average number of inpatient hospitalizations visits per child decreased significantly \( X = 0.039 \) to \( X = 0.027 \) for both years (see Table 5). Having a registered medical home provider had a small but significant effect \((\beta = -0.012, p < 0.01)\) in the opposite direction of the change. One other small but significant effects in the opposite direction of the decrease in inpatient hospitalizations was the child being enrolled in a rural county. Significant favorable effects were shown for the number of well child visits, the number of chronic conditions per child, and months enrolled in Medicaid.

Discussion

The demographics of the Medicaid study population changed over time as well as increased. One notable difference was an increase in the average age during the study
period by one year. The proportion of children under 16 months who had at least one well child visit per year was higher in this study than reported in the total Medicaid population. This may be due to the study population being limited to children in the aid to families with dependent children and baby care program or the continuous enrollment inclusion criteria.

Consistent with the goal of SB130, an increase in well child visits was seen between 2008 and 2012; however due to temporal changes, which were not controlled for, and other programs that targeted primary care for children on Medicaid during the study period this increase cannot be directly correlated with SB130 alone. As children aged, the number of well child visits decreased, as seen in other studies (Bethell et al., 2011; Sternberg, Co, & Homer, 2011; Turchi & Antonelli, 2014; Department of Health and Human Services, 2014). The largest proportion of children to have more than one well visit was in the 0 to 15 age group. This is important because clinical guidelines recommend this age group receive six per year (Basco & Rimsza, 2013; Bright Futures, 2015; Colorado Department of Public Health and Environment, 2014; The Henry J. Kaiser Family Foundation, 2014). This was also the age group to which HCPF targeted their efforts. All other age groups should receive one annual well visit per year. The 16-month to 4-year age group came close but did not receive the target number of visits. Although the well visits did not meet clinical guidelines, the average annual number increased over time while the Medicaid population was increasing and the same number of providers were documented (see Graph 1 and Graph 2 on pages 70 and 71).

Eight percent of the study population did not seek any services during the year. While these children may not have sought services because they did not need acute care
they should be receiving the appropriate number of well visits each year for their age group and did not. (Carlo & Powers, 2010; Gill, Fagan, Townsend, & Mainous, 2005; Harbrecht & Latts, 2012; Starfield & Shi, 2004; Todd, Armon, Griggs, Poole, & Berman, 2006; Tom et al., 2010; University of Minnesota Rural Health Research Center, 2007; Valko & Wender, 2014).

Emergency department visits did not change significantly over time. A decrease in emergency department visits has been seen in other studies where practices adopted the medical home model (Berger, 2008; Cooley et al., 2009; Diedhiou et al., 2010; Friedberg et al., 2014; Reid et al., 2009; Roby et al., 2010; Valko & Wender, 2014). It may be the positive effect of the annual number of well child visits and the association with a registered provider kept this number consistent.

Inpatient hospitalizations decreased between 2008 and 2012. The number of well child visits had a small but significant positive effect while having a registered provider had a negative effect, more than having a registered provider. It is noteworthy that having a registered medical home provider and enrolling in a rural county increased the number of inpatient hospitalizations between years. This may be a reflection on the number of rural counties in Colorado that are documented to lack access to providers and are medically underserved (Basco & Rimsza, 2013; Bolin, Gam, Vest, Edwardson, & Miller, 2011; Health Resources and Services Administration, 2015; The Henry J. Kaiser Family Foundation, 2014).

Limitations include how registered medical home providers linked with children in the study population. Unlike other studies where individuals were assigned a medical home provider and only saw that one provider, children on Medicaid are able to seek
services from any provider. This free choice may have decreased the effect of having a registered provider on these outcomes if children were receiving care from both registered and unregistered providers. Using the standard alpha level of .05 on the large study population may have identified significant differences when a more conservative alpha level would not. Temporal trends and health policies and programs implemented between 2008 and 2012 may have been the cause of difference seen. An alternative explanation is that this study was not sensitive enough to identify the magnitude of change, especially in emergency room visits, that may have been associated with an increase primary health care.

Future research includes further understanding of the association of the individual child with a registered provider. Breaking down the types of emergency department visits into avoidable and unavoidable may illuminate changes over time not seen when all types of visits were analyzed together. The same may be true for avoidable hospitalizations. Understanding the investment of enacting legislation and the increased payment for well child visits versus the estimated cost savings is an important unassessed factor to identify the financial impact of increasing a provider payment at the state level.

In conclusion, after SB130, an increase in the number of well visits received by children on Medicaid was seen in all age groups. The 0 to 5 month age group showed the largest increase and was effected by having a registered provider more than the other age groups (16 months to 4 years, 5 to 11 years, and 12 to 18 years). Emergency department visits were consistent throughout the study period and a decrease in inpatient hospitalizations was small but statistically significant. Other policy and regulatory changes during the study period may have diluted the magnitude to which registered
providers affected study outcomes. HCPF increase the Federal Poverty Level from 100% to 130% and again to 133% during the study period. In addition, HCPF began continuous eligibility which means once a child is enrolled in Medicaid they stay enrolled for a continuous 12 months. These results are encouraging in that increasing well child visits and decreasing inpatient hospitalizations are movement in the right direction and are consistent with the medical home model and the goals of SB130. This movement took place while at the same time the Medicaid population was growing and no increase in providers had been documented.

Colorado moved from a payment incentive to providers for well child visits to a new payment model in 2012. This model incentivizes groups of providers who work together and offers a pay for performance incentive if population benchmarks are met. Since these benchmarks have not yet been established this study may be used to inform the development of this new payment system.

ACKNOWLEDGEMENTS

The authors would like to thank Gina Robinson and Kristin Breslin, MS, and Miki Suga, MS in support of this study. “This project/publication is supported in part by NIH/NCATS Colorado CTSA Grant Number UL1 TR001082. Contents are the authors’ sole responsibility and do not necessarily represent official NIH views.” HEDIS measures are reproduced with permission from *HEDIS 2010, Volume 2: Technical Specifications for Health Plans* by the National Committee for Quality Assurance. HEDIS® is a registered trademark of the National Committee for Quality Assurance.
Figure 1. Consort diagram for the study population, unduplicated children younger than 18 years of age with 90 to 365 days of continuous eligibility enrolled in the Aid to Families with Dependent Children or Baby Care Medicaid programs for federal fiscal years, 2008–2015, Colorado.

Data Source: Medicaid Management Information System, Colorado Department of Health Care Policy and Financing, Denver, CO. Federal Fiscal Year is defined as September 31 of the first year to October 1 of the following year.
## TABLES

Table 1

*Transformation Algorithm for Scores on the Medical Home Index Scores used for Analysis.*

<table>
<thead>
<tr>
<th>Certified practices Medical Home Index Likert scale score and description</th>
<th>Medical Home Index score on tool</th>
<th>Transformed score and description</th>
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<td>2 = Proactive</td>
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*Note.* Adapted from The Medical Home Index, by Centers for Medical Home Improvement, 2016, retrieved February 29, 2016, from http://www.medicalhomeimprovement.org/knowledge/mhi-fv_instructions.html
Table 2

Medicaid Study Population Demographics by Federal Fiscal Year, 2008–2015, Colorado

<table>
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<tr>
<th>Demographic characteristics</th>
<th>2008</th>
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<td>450,172</td>
<td>499,096</td>
<td>558,822</td>
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<td>7.92</td>
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<td>(7.59, 7.62)**</td>
<td>(7.91, 7.94)**</td>
<td>(8.21, 8.24)**</td>
<td>(8.41, 8.43)**</td>
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Table 2 (cont’d)

Medicaid Study Population Demographics by Federal Fiscal Year, 2008–2015, Colorado

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<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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<td>Urban/rural† % (95% CI)</td>
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<td>Urban</td>
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<td>18.51</td>
<td>18.62</td>
<td>18.51</td>
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<td>Months eligible X (95% CI)</td>
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<td>10.81</td>
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<td>11.24</td>
<td>11.30</td>
<td>11.21</td>
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<tr>
<td></td>
<td>(10.85, 10.87)</td>
<td>(10.80, 10.82)**</td>
<td>(11.05, 11.06)**</td>
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<td>(11.23, 11.24)**</td>
<td>(11.29, 11.30)**</td>
<td>(11.21, 11.22)**</td>
<td>(11.40, 11.41)**</td>
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<tr>
<td>Chronic condition†† % (95% CI)</td>
<td>7.25</td>
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<td>7.90</td>
<td>7.94</td>
<td>7.80</td>
<td>7.94</td>
<td>8.74</td>
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<td>(7.39, 7.57)</td>
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<td>(7.86, 8.02)**</td>
<td>(8.67, 8.82)**</td>
<td>(8.96, 9.11)**</td>
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Data Source: Medicaid Management Information System, Colorado Department of Health Care Policy and Financing, Denver, CO. Study Population: Children on Medicaid younger than 19 years of age with 90 to 365 days continuous eligibility and enrolled in the Aid to Families with Dependent Children or Baby Care Program, at the end of the Federal Fiscal Year (October 1 to September 30 of the year reported). †Urban/rural is based on the county of enrollment and is defined using the Office of Management and Budget definition from the U.S. Census Bureau, 2016. ††Children with chronic conditions include cognitive impairment, Downs syndrome, cerebral palsy, muscular dystrophy, chronic lung disease, autism spectrum disorders, arthritis, congenital heart disease, seizures, asthma, sickle cell anemia, chromosomal anomalies, other genetic disorders, spina bifida, central nervous system anomalies, HIV, hearing loss, G tube, drug exposure, organ transplants, metabolic disorders, attention deficit hyperactivity disorder, kidney disorders, endocrine problems, skeletal problems, cleft lip/palate, vision loss, and malignancies. **p < .01, *p < .05.
Table 3

Proportions of Children on Medicaid With Health Services Measures by Federal Fiscal Year, 2008–2015, Colorado

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<td>n =</td>
<td>282,248</td>
<td>321,125</td>
<td>356,127</td>
<td>382,891</td>
<td>414,382</td>
<td>450,172</td>
<td>499,096</td>
<td>558,822</td>
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</table>

X (95% CI)

0–15 months

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<td>9.46</td>
<td>8.70</td>
<td>8.53</td>
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<tr>
<td>(10.34, 10.56)</td>
<td>(9.36, 9.56)**</td>
<td>(8.61, 8.79)**</td>
<td>(8.44, 8.62)**</td>
<td>(8.56, 8.74)</td>
<td>(9.05, 9.21)**</td>
<td>(9.90, 10.06)**</td>
<td>(10.03, 10.19)</td>
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<tr>
<td>(12.03, 12.27)</td>
<td>(10.82, 11.04)**</td>
<td>(9.03, 9.21)**</td>
<td>(9.28, 9.46)**</td>
<td>(9.30, 9.48)</td>
<td>(9.26, 9.44)</td>
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<td>(8.01, 8.15)**</td>
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<tr>
<td>&gt;1 visit</td>
<td>77.40</td>
<td>79.61</td>
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<td>81.96</td>
<td>81.51</td>
<td>80.94</td>
<td>81.81</td>
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<tr>
<td>(77.25, 77.55)</td>
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<td>(82.05, 82.31)**</td>
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16 months–4 years

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5–11 years

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**12–18 years**

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<td>1.89</td>
<td>1.82</td>
<td>1.85</td>
<td>1.41</td>
<td>1.39</td>
<td>1.52</td>
<td>1.60</td>
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<tr>
<td></td>
<td>(1.65, 1.75)</td>
<td>(1.84, 1.94)**</td>
<td>(1.78, 1.86)</td>
<td>(1.81, 1.89)</td>
<td>(1.37, 1.45)**</td>
<td>(1.36, 1.42)**</td>
<td>(1.49, 1.55)**</td>
<td>(1.57, 1.63)**</td>
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</tbody>
</table>

**ED visits n**

<table>
<thead>
<tr>
<th>&gt;1 visit</th>
<th>25.45</th>
<th>26.78</th>
<th>26.65</th>
<th>26.00</th>
<th>25.57</th>
<th>25.45</th>
<th>26.00</th>
<th>25.57</th>
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</table>

**IP visits n (95% CI)**

<table>
<thead>
<tr>
<th>&gt;1 visit</th>
<th>3.32</th>
<th>3.07</th>
<th>2.99</th>
<th>2.7</th>
<th>2.39</th>
<th>2.45</th>
<th>2.36</th>
<th>2.29</th>
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</thead>
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<tr>
<td></td>
<td>(3.25, 3.38)</td>
<td>(3.01, 3.13)</td>
<td>(2.93, 3.04)</td>
<td>(2.65, 2.76)**</td>
<td>(2.34, 2.43)**</td>
<td>(2.40, 2.49)</td>
<td>(2.32, 2.41)</td>
<td>(2.25, 2.32)</td>
</tr>
</tbody>
</table>

Data Source: Medicaid Management Information System, Colorado Department of Health Care Policy and Financing, Denver, CO. Study Population: Children on Medicaid younger than 19 years of age with 90 to 365 days continuous eligibility and enrolled in the Aid to Families with Dependent Children or Baby Care Program, at the end of the Federal Fiscal Year (October 1 to September 30 of the year reported). ED = emergency department visit. IP = inpatient hospitalizations. *p < .01, **p < .05. Annual comparisons between years.
Table 4

Health Measure Rate per 10,000 Medicaid Member Months, 2008–2015, Colorado

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</thead>
<tbody>
<tr>
<td>n =</td>
<td>282,248</td>
<td>321,125</td>
<td>356,127</td>
<td>382,891</td>
<td>414,382</td>
<td>450,172</td>
<td>499,096</td>
<td>558,822</td>
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<tr>
<td><strong>Well child visits</strong></td>
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<tr>
<td>0–15 months</td>
<td>3,574 (29, 754)</td>
<td>3,879 (30, 333)</td>
<td>4,139 (3, 233)</td>
<td>4,127 (29, 251)</td>
<td>4,155 (28, 337)</td>
<td>4,219 (29, 147)</td>
<td>4,330 (31, 999)</td>
<td>4,391 (33, 717)</td>
</tr>
<tr>
<td>16 months–4 years</td>
<td>733 (47, 216)</td>
<td>763 (54, 540)</td>
<td>774 (60, 819)</td>
<td>784 (64, 220)</td>
<td>765 (64, 737)</td>
<td>756 (63, 225)</td>
<td>798 (67, 013)</td>
<td>821 (73, 891)</td>
</tr>
<tr>
<td>12–18 years</td>
<td>262 (71, 823)</td>
<td>259 (85, 987)</td>
<td>258 (94, 917)</td>
<td>266 (99, 534)</td>
<td>247 (105, 971)</td>
<td>247 (105, 971)</td>
<td>268 (129, 657)</td>
<td>277 (151, 475)</td>
</tr>
<tr>
<td>ED visits</td>
<td>395 (71, 823)</td>
<td>414 (85, 987)</td>
<td>409 (94, 917)</td>
<td>388 (99, 534)</td>
<td>382 (105, 971)</td>
<td>388 (116, 607)</td>
<td>391 (129, 657)</td>
<td>406 (151, 475)</td>
</tr>
<tr>
<td>IP visits</td>
<td>36 (9, 359)</td>
<td>33 (9, 852)</td>
<td>31 (10, 636)</td>
<td>31 (10, 352)</td>
<td>28 (9, 885)</td>
<td>24 (11, 025)</td>
<td>24 (11, 794)</td>
<td>23 (12, 771)</td>
</tr>
</tbody>
</table>

Data Source: Medicaid Management Information System, Colorado Department of Health Care Policy and Financing, Denver, CO. Study Population: Children on Medicaid younger than 19 years of age with 90 to 365 days continuous eligibility and enrolled in the Aid to Families with Dependent Children or Baby Care Program, at the end of the Federal Fiscal Year (October 1 to September 30 of the year reported). Rates are the numbers of well child visits/the total number of member months for children times 10,000. ED = emergency department visit. IP = inpatient hospitalizations. **p < .01, *p < .05. Annual comparisons between years.
Table 5

Linear Regression Health Services Measures for Children on Medicaid, 2008–2012, Colorado

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Unadjusted health services measure</th>
<th>Adjusted for time</th>
<th>Adjusted for registered provider</th>
<th>Adjusted for well child visits</th>
<th>Adjusted for child demographics</th>
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<tbody>
<tr>
<td></td>
<td>Intercept ($B$)</td>
<td>SE</td>
<td>Intercept ($B$)</td>
<td>SE</td>
<td>Intercept ($B$)</td>
</tr>
<tr>
<td>Age group = 0–15 months: $N = 29,754, \mu = 2.93, SE = 0.010$; 2012: $N = 28,337, \mu = 3.42, SE = 0.011$</td>
<td>Well visits*</td>
<td>2.93</td>
<td>0.01</td>
<td>2.93</td>
<td>0.01</td>
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<tr>
<td></td>
<td>Legislation</td>
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<td></td>
<td>2008 versus 2012</td>
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<td></td>
<td>Registered provider++</td>
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<td></td>
<td>Child demographics</td>
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<td></td>
<td>Number of chronic conditions††</td>
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<td>County of enrollment = Rural†</td>
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<td></td>
<td>Months on Medicaid</td>
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<tr>
<td>Age group = 16 months–4 years: $N = 89,245, \mu = 0.824, SE = 0.003$; 2012: $N = 112,965, \mu = 0.880, SE = 0.003$</td>
<td>Well visits*</td>
<td>0.82</td>
<td>0.00</td>
<td>0.82</td>
<td>0.00</td>
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<tr>
<td></td>
<td>Legislation</td>
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<td>2008 versus 2012</td>
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<td>Number of chronic conditions††</td>
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<td></td>
<td>Months on Medicaid</td>
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<tr>
<td>Age group = 5–11 years: $N = 102,732, \mu = 0.29, SE = 0.001$; 2012: $N = 167,965, \mu = 0.33, SE = 0.001$</td>
<td>Well visits*</td>
<td>0.29</td>
<td>0.00</td>
<td>0.29</td>
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<tr>
<td></td>
<td>Legislation</td>
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<td>2008 versus 2012</td>
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<tr>
<td></td>
<td>Registered provider++</td>
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</table>
Table 5 (cont’d)

**Linear Regression Health Services Measures for Children on Medicaid, 2008–2012, Colorado**

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Unadjusted health services measure</th>
<th>Adjusted for time</th>
<th>Adjusted for registered provider</th>
<th>Adjusted for well child visits</th>
<th>Adjusted for child demographics</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Intercept ((B))</td>
<td>SE</td>
<td>Intercept ((B))</td>
<td>SE</td>
<td>Intercept ((B))</td>
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<tr>
<td>Child demographics</td>
<td></td>
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</tr>
<tr>
<td>Number of chronic conditions(††)</td>
<td>0.25 0.00</td>
<td>0.25 0.00</td>
<td>0.15 0.00</td>
<td>0.15 0.00</td>
<td>0.15 0.00</td>
</tr>
<tr>
<td>County of enrollment = Rural(†)</td>
<td>0.03 0.00</td>
<td>0.00 0.00</td>
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<td>0.00 0.00</td>
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<tr>
<td>Months on Medicaid</td>
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<tr>
<td>Age Group = 12–18 years:</td>
<td>N = 60,511, (\mu = 0.250, SE = 0.001); 2012: N = 105,381, (\mu = 0.282, SE = 0.001)</td>
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<tr>
<td>Well visits(^+)</td>
<td>0.25 0.00</td>
<td>0.25 0.00</td>
<td>0.15 0.00</td>
<td>0.00 0.00</td>
<td>0.00 0.00</td>
</tr>
<tr>
<td>Legislation 2008 versus 2012</td>
<td>0.03 0.00</td>
<td>0.00 0.00</td>
<td>&lt;0.01 0.00</td>
<td>0.00 0.00</td>
<td>0.00 0.00</td>
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<tr>
<td>Registered provider(++)</td>
<td>0.91 0.00</td>
<td>0.00 0.00</td>
<td>0.86 0.00</td>
<td>0.00 0.00</td>
<td>0.00 0.00</td>
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<tr>
<td>Child demographics</td>
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<tr>
<td>Number of chronic conditions(††)</td>
<td>0.03 0.00</td>
<td>0.00 0.00</td>
<td>0.01 0.00</td>
<td>0.00 0.00</td>
<td>0.00 0.00</td>
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<tr>
<td>County of enrollment = Rural(†)</td>
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<td>0.00 0.00</td>
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<tr>
<td>Months on Medicaid</td>
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<tr>
<td>All ages:</td>
<td>N = 282,248, (\mu = 0.42901, SE = 0.0018); 2012: N = 414,382, (\mu = 0.42946, SE = 0.0015)</td>
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<tr>
<td>ED visits(^+)</td>
<td>0.42 0.00</td>
<td>0.42 0.00</td>
<td>0.36 0.00</td>
<td>0.30 0.00</td>
<td>0.30 0.00</td>
</tr>
<tr>
<td>Legislation 2008 versus 2012</td>
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<td>&lt;0.01 0.00</td>
<td>&lt;0.01 0.00</td>
<td>&lt;0.01 0.00</td>
<td>&lt;0.01 0.00</td>
</tr>
<tr>
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<td>0.04 0.00</td>
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<tr>
<td>Utilization  Well child visits(^+)</td>
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<td>0.17 0.00</td>
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<tr>
<td>Child demographics</td>
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<tr>
<td>Number of chronic conditions(††)</td>
<td>0.03 0.00</td>
<td>0.00 0.00</td>
<td>0.01 0.00</td>
<td>0.00 0.00</td>
<td>0.00 0.00</td>
</tr>
<tr>
<td>County of enrollment = Rural(†)</td>
<td>0.01 0.00</td>
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<td>Months on Medicaid</td>
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</table>
Table 5 (cont’d)

*Linear Regression Health Services Measures for Children on Medicaid, 2008–2012, Colorado*

<table>
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<tr>
<th>Independent variables</th>
<th>Unadjusted health services measure</th>
<th>Adjusted for time</th>
<th>Adjusted for registered provider</th>
<th>Adjusted for well child visits</th>
<th>Adjusted for child demographics</th>
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<td>Intercept (B) SE</td>
<td>Intercept (B) SE</td>
<td>Intercept (B) SE</td>
<td>Intercept (B) SE</td>
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<tr>
<td>All ages (N = 282,248, μ = 0.039, SE = 0.0004), 2012 = (N = 414,382, μ = 0.027, SE = 0.0003)</td>
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<tr>
<td>IP visits*</td>
<td>0.04 0.00</td>
<td>0.03 0.00</td>
<td>0.19 0.00</td>
<td>0.01 0.00</td>
<td>0.08 0.00</td>
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<td>-0.01 0.00</td>
<td>-0.01 0.00</td>
<td>-0.01 0.00</td>
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<td>0.12 0.00</td>
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<td>Well child visits†</td>
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<td>Child demographics</td>
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<tr>
<td>Number of chronic conditions††</td>
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</table>

Data Source: Medicaid Management Information System, Colorado Department of Health Care Policy and Financing, Denver, CO. Study Population: Children on Medicaid younger than 19 years of age with 90 to 365 days continuous eligibility and enrolled in the Aid to Families with Dependent Children or Baby Care Program, at the end of the Federal Fiscal Year (October 1 to September 30 of the year reported). Urban/rural is based on the county of enrollment and is defined using the Office of Management and Budget definition from the U.S. Census Bureau, 2016. Children with chronic conditions include cognitive impairment, Downs syndrome, cerebral palsy, muscular dystrophy, chronic lung disease, autism spectrum disorders, arthritis, congenital heart disease, seizures, asthma, sickle cell anemia, chromosomal anomalies, other genetic disorders, spina bifida, central nervous system anomalies, HIV, hearing loss, G tube, drug exposure, organ transplants, metabolic disorders, attention deficit hyperactivity disorder, kidney disorders, endocrine problems, skeletal problems, cleft lip/palate, vision loss, and malignancies. Well visits: 0–15 months: \( F = 1,745.3, df = 5, R^2 = 0.136, p < .05^{*}, p < .01^{**} \), 16 months–4 years: \( F = 14,678.7, df = 5, R^2 = 0.266, p < .05^{*}, p < .01^{**} \), 5–11 years: \( F = 44,609.1, df = 5, R^2 = 0.448, p < .05^{*}, p < .01^{**} \), 12–18 years: \( F = 386,935.0, df = 5, R^2 = 0.921, p < .05^{*}, p < .01^{**} \), ED visits: \( F = 7,009.7, df = 6, R^2 = 0.056, p < .05^{*}, p < .01^{**} \), IP visits: \( F = 11,277.9, df = 6, R^2 = 0.089, p < .05^{*}, p < .01^{**} \). ++Child with a medical home provider is defined as having one or more well visits by a provider that registered for a financial incentive with Health Care Policy and Financing during the study period. ED = emergency department visit. IP = inpatient hospitalizations. **p < .01, *p < .05.
CHAPTER VII
DISCUSSION

Summary

This dissertation evaluated Colorado Senate Bill 130. Guided by the PRECEDE–PROCEED planning model, this study addressed the following:

Specific Aim 1: Evaluate how SB130 was operationalized.

Specific Aim 2: Evaluate the uptake and reach of SB130’s implementation.

Hypothesis 2a: There is no significant difference in Medical Home Index and Family Satisfaction Scores between practices that volunteered for the Medical Home Certification Process after legislation passed, by year of certification.

Hypothesis 2b: There is no increase in the number of children who received a well child visit from a registered medical home provider.

Specific Aim 3: Evaluate the impact of SB130 on Medicaid health services measures.

Hypothesis 3a: There is no significant difference in well child visits, emergency department visits, or inpatient hospitalizations post SB130.

Hypothesis 3b: There is no significant effect on well child visits, emergency department visits, or inpatient hospitalizations by registered medical home providers.

Discussion

SB130 attempted to address a decline in providers who accepted public insurance and poor quality of care for children on Medicaid (Berman et al., 2005; Todd et al., 2006). The state chose the medical home model because it is associated with improved health outcomes, increased patient and provider satisfaction, and decreasing costs
Colorado followed the medical home guidelines published by the AAP and therefore was an early adopter as PCMH standards were not yet published. (American Academy of Family Physicians, 2008; Agency for Healthcare Research and Quality, 2010; Cooley et al., 2003; Crabtree et al., 2010; Jaen et al., 2010; Nutting et al., 2009).

Colorado’s collaborative environment permitted SB130 to be operationalized quickly and aligned with differing agendas. Not planning for a formal evaluation or collecting baseline data led to difficulty measuring the policy’s impact (Crabtree et al., 2010; Fisher et al., 2012; Polski & Ostrom, 1999; Tollen et al., 2011; Walt et al., 2008). The intervention’s target population were providers. It was assumed if providers received a payment increase, this would increase access to care for children on Medicaid. This hypothesis could not be tested due to the type of data collected, not having practice level follow up on medical home processes, and how practices were informed of the certification opportunity.

Participating practices were described using the limited data collected during the MHCP. Due to not collecting practice-level data prior to legislation, it is unknown what proportion of practices this group represents. The greatest number of practices volunteered three years after legislation. No practices participated in 2008; 12 practices participated in 2009 and 103 in 2010. Data collection stopped due to funding so it is unknown if more practices participated. From these data, it appears that policy implementation can and may take longer to implement than planned. Since a target date was not stated for practices to participate it is not known if the uptake of the legislation happened at the rates intended by the policy makers. Forty-five practices began the
MHCP but did not complete it. It is unknown why these practices did not complete the certification process. Other states have reported barriers and challenges to medical home adoption that may offer insight (Coleman et al., 2014; Kilo & Wasson, 2010; Nutting et al., 2009; Wagner et al., 2014; Zickafoose et al., 2013). Participating practices appeared to be similar to each other. Given that these practices volunteered to complete the MHCP and were similar on the MHI-SV and FSS surveys, this group appears to be homogenous. It is unknown if these practices differ from the ones that chose not to participate (Coleman et al., 2014; Hamilton et al., 2013; Long et al., 2012; McAllister et al., 2013; A. O. Reid et al., 2011; Zickafoose, Clark, Sakshaug, Chen, & Hollingsworth, 2013).

It was assumed that providers who registered for a payment increase were from the certified practices, but this was not validated. Registered providers represented 14% of all Medicaid primary care providers in 2012. These providers were responsible for a disproportionate number of all well child visits. It makes sense that the payment increase would cause higher service provision, as has been shown in other studies, but this could not be confirmed in Colorado (Edwards et al., 2012; Merrell & Berenson, 2010; Takach, 2012; Thorpe & Ogden, 2010).

Having different types of practices volunteer for the MHCP is important. Family physicians provide health care to children, especially in rural areas, and should be included in future analyses. Having mental health providers interested in learning about the medical home model is exciting as systems integrate behavioral, oral, and physical health. This holistic approach is being encouraged at the national level and supports the current trend of expanding the MHM to other populations [3-8] (Alakeson et al., 2010; Earls & Hay, 2006; King et al., 2010; Larson & Chapman, 2013; Laughlin et al., 2014;
Providers who registered for the payment increase could be linked to Medicaid claims data and therefore the effect of a registered provider could be tested. During the MHCP, from 2008 to 2012, well child visits increased and inpatient hospitalizations decreased. Study population demographics affected each outcome differently but two consistent themes emerged. Registered providers had a significant effect on all three health services measures as did Medicaid enrollment in a rural county. Other Medicaid policies and regulations occurred during the study period that may have confounded this finding (Basco & Rimsza, 2013; Health Resources and Services Administration, 2015; The Henry J. Kaiser Family Foundation, 2014). The Colorado fee-for-service payment structure allows children on Medicaid to choose their own provider. The effect of a registered medical home provider may have been impacted because children can seek care from providers who may or may not be registered (Berman et al., 2005; Dempsey & Freed, 2010; Federico, Steiner, Beaty, Crane, & Kempe, 2007; McCarter et al., 2011; Newacheck, Pearl, Hughes, & Halfon, 1998; Petersen, Bronstein, & Pass, 2002).

**Health Policy Recommendations**

By using three distinct evaluation stages from the PRECEDE–PROCEED planning model to evaluate SB130 the following recommendations were compiled.

1. Begin with a planning model to ensure all policy stages are met and can be adjusted when needed.
2. Clearly define the target audience, including how they will be engaged and monitored.
3. Recognize the need for behavior change and implement regulatory action as needed. As has been shown through implementation of the Affordable Care Act, a decrease in health insurance cost depended on having more people insured and having a larger number of healthy individuals in the risk pool to drive down the cost of health insurance. This could only happen with the individual mandate and not voluntary participation (Abrams et al., 2015; Berenson et al., 2012; Berwick et al., 2008; Fisher et al., 2012; Scholle, Saunders, Tirodkar, Torda, & Pawlson, 2011; van Hasselt et al., 2015; Vats, Ash, & Ellis, 2013).

4. Expect and plan for delays in implementation.

5. Clearly define measurable outcomes.

6. Ensure there are adequate resources to impact the outcome. SB130 was predicated on incenting providers to serve all children on Medicaid. Colorado does not have enough primary care providers to serve the state currently (Bolin et al., 2011; Colorado Department of Public Health and Environment, 2014; Kaiser Family Foundation, 2014). An adequate number of primary care providers is necessary before access and quality can be fully realized.

7. Plan for data collection.

8. Evaluate early and continuously. Although real-time data collection and analysis are challenging, incorporating mini-evaluations or public health Plan-Do-Study-Act cycles may identify where PRECEDE stages can be readdressed or PROCEED stages can be changed to improve the policy intervention.
Limitations

Limitations of this study included having to change study methodology due to missing data. Missing data included information about all the providers in a certified practice, practice changes documented in the quality-improvement plan, and a link between practices and claims data through the registered provider. This information would have allowed for a more robust analysis or identified quality-improvement barriers (Burnet et al., 2014; McAllister et al., 2013; Valko & Wender, 2014).

The MHI-SV is not recommended to measure the practice level of the medical home nor for research (Cooley et al., 2003). The FSS was neither validated nor pilot tested, so its content and construct validity are in question. The high satisfaction scores reported could have been due to a ceiling effect or response bias (Korn & Graubard, 2011; Litwin, 1995).

The date of provider registration used in the analysis may be misleading. Medical home registration dates are those when the provider was entered by HCPF into their database and not the date the provider sent their Medicaid billing identification number or their associated practice completed the MHCP.

Future Research

Future research should include collecting data from certified practices to assess differences between the two groups. Recoding the data to identify children with a registered medical home provider from which they received all of their care would allow for a case control study. Linking practice processes with use outcomes might identify, like many medical home studies, specific medical home domains that are associated with
improved health outcomes (Burnet et al., 2014; Crabtree et al., 2011, 2010; Goldberg & Kuzel, 2009; Jackson et al., 2013; McAllister et al., 2013; Nutting et al., 2009).

Using the standard alpha level of .05 in a study with a large population would most likely identify significant differences (type 1 errors). Using a more conservative approach, significant difference may be replicated. Temporal trends, health policies changes, and program implementation for the Medicaid population may have confounded these results (see Figure 3, Chapter 1).

Future research includes identifying avoidable and unavoidable emergency department visits to be associated with well child visits. The same is true of avoidable inpatient hospitalizations. A cost-saving analysis should be conducted to assess SB130’s return on investment and identify the financial investment needed to implement statewide payment increases.

**Conclusion**

SB130 successfully brought together state agencies, stakeholders, families, and advocates to implement SB130. As the bill was written, it did not require taxpayer approval, as required by Colorado’s Taxpayer Bill of Rights. Nonpediatric practices participated in the MHCP. Using other types of providers may be an option to increase access to care for children on Medicaid in a state with too few primary care providers. The increase over time in the proportion of children with more than one well child in the 0- to 15-month age group for the study population, along with a decrease in inpatient hospitalizations, aligns with national improvement and cost savings goals (Chen et al., 2012; Rittenhouse et al., 2010; Shaw et al., 2013; Sternberg et al., 2011). An increase in access to care for children on Medicaid was not directly supported by these results.
Through a mixed method approach guided by the PRECEDE–PROCEED model, it was shown that SB130 was successful in operationalizing the MHM before PCMH standards were published, introducing practices, including nonpediatric, to the MHM, identifying a homogenous group of providers that were responsible for a disproportionate number of well child visits. These methods can be replicated to evaluate how other states implement the MHM and Medicaid payment changes to increase their chances of success or compare results across states.

Acknowledgements

Contents are the authors’ sole responsibility and do not necessarily represent official NIH views.” HEDIS measures are reproduced with permission from *HEDIS 2010, Volume 2: Technical Specifications for Health Plans* by the National Committee for Quality Assurance. HEDIS® is a registered trademark of the National Committee for Quality Assurance.

**REFERENCES**


Page 103 of 159


Concerning Medical Homes for Children and Making an Appropriation Therefor, Senate Bill 07-130 § 1 25.5-1-103 (2007).


APPENDIX A: SENATE BILL 130

NOTE: This bill has been prepared for the signature of the appropriate legislative officers and the Governor. To determine whether the Governor has signed the bill or taken other action on it, please consult the legislative status sheet, the legislative history, or the Session Laws.

An Act

SENATE BILL 07-130

BY SENATOR(S) Boyd, Bacon, Fitz-Gerald, Gordon, Groff, Hagedorn, Keller, Mitchell S., Morse, Romer, Sandoval, Schwartz, Shaffer, Spence, Tochtrop, Tupa, Williams, Windels, and Ward; also REPRESENTATIVE(S) Carroll M., Borodkin, Casso, Fischer, Frangas, Gibbs, Hicks, Hodge, Kefalas, Kerr A., Labuda, Madden, McGihon, Primavera, Riesberg, Roberts, Solano, Stafford, Stephens, Todd, and White.

CONCERNING MEDICAL HOMES FOR CHILDREN, AND MAKING AN APPROPRIATION THEREFOR.

Be it enacted by the General Assembly of the State of Colorado:

SECTION 1. 25.5-1-103, Colorado Revised Statutes, is amended BY THE ADDITION OF A NEW SUBSECTION to read:

25.5-1-103. Definitions. As used in this title, unless the context otherwise requires:

(5.5) "MEDICAL HOME" MEANS AN APPROPRIATELY QUALIFIED MEDICAL SPECIALTY, DEVELOPMENTAL, THERAPEUTIC, OR MENTAL HEALTH CARE PRACTICE THAT VERIFIABLY ENSURES CONTINUOUS, ACCESSIBLE, AND COMPREHENSIVE ACCESS TO AND COORDINATION OF COMMUNITY-BASED

Capital letters indicate new material added to existing statutes; dashes through words indicate deletions from existing statutes and such material not part of act.
MEDICAL CARE, MENTAL HEALTH CARE, ORAL HEALTH CARE, AND RELATED SERVICES FOR A CHILD. A MEDICAL HOME MAY ALSO BE REFERRED TO AS A HEALTH CARE HOME. IF A CHILD'S MEDICAL HOME IS NOT A PRIMARY MEDICAL CARE PROVIDER, THE CHILD MUST HAVE A PRIMARY MEDICAL CARE PROVIDER TO ENSURE THAT A CHILD'S PRIMARY MEDICAL CARE NEEDS ARE APPROPRIATELY ADDRESSED. ALL MEDICAL HOMES SHALL ENSURE, AT A MINIMUM, THE FOLLOWING:

(a) HEALTH MAINTENANCE AND PREVENTATIVE CARE;
(b) ANTICIPATORY GUIDANCE AND HEALTH EDUCATION;
(c) ACUTE AND CHRONIC ILLNESS CARE;
(d) COORDINATION OF MEDICATIONS, SPECIALISTS, AND THERAPIES;
(e) PROVIDER PARTICIPATION IN HOSPITAL CARE; AND
(f) TWENTY-FOUR-HOUR TELEPHONE CARE.

SECTION 2. Part 1 of article 1 of title 25.5, Colorado Revised Statutes, is amended BY THE ADDITION OF A NEW SECTION to read:

25.5-1-123. Medical homes for children - legislative declaration - duties of the department - reporting requirements. (1) The general assembly hereby finds and declares that:

(a) THE BEST MEDICAL CARE FOR INFANTS, CHILDREN, AND ADOLESCENTS IS PROVIDED THROUGH A MEDICAL HOME, AS DEFINED IN SECTION 25.5-1-103, AND THAT IS CONSISTENT WITH THE JOINT PRINCIPLES OF A PATIENT-CENTERED MEDICAL HOME. THESE PRINCIPLES SHALL INCLUDE A WHOLE PERSON ORIENTATION, CARE THAT IS COORDINATED AND INTEGRATED ACROSS ALL ELEMENTS OF THE COMPLEX HEALTH CARE SYSTEM AND THE PATIENT'S COMMUNITY, AND CARE THAT PROVIDES FOR QUALITY AND SAFETY OF THE PATIENT WHERE QUALIFIED HEALTH CARE PRACTITIONERS PROVIDE PRIMARY CARE AND HELP MANAGE AND FACILITATE ALL ASPECTS OF MEDICAL CARE;

(b) INFANTS, CHILDREN, AND ADOLESCENTS AND THEIR FAMILIES WORK BEST WITH A HEALTH CARE PRACTITIONER WHO KNOWS THE FAMILY
AND WHO DEVELOPS A PARTNERSHIP OF MUTUAL RESPONSIBILITY AND TRUST;

(c) MEDICAL CARE PROVIDED THROUGH EMERGENCY DEPARTMENTS, WALK-IN CLINICS, AND OTHER URGENT-CARE FACILITIES IS OFTEN MORE COSTLY AND LESS EFFECTIVE THAN CARE GIVEN BY A PHYSICIAN WITH PRIOR KNOWLEDGE OF THE CHILD AND HIS OR HER FAMILY; AND

(d) THE STATE DEPARTMENT SHOULD STRIVE TO FIND A MEDICAL HOME FOR EACH CHILD RECEIVING SERVICES THROUGH THE STATE MEDICAL ASSISTANCE PROGRAM, ARTICLES 4, 5, AND 6 OF THIS TITLE, OR THE CHILDREN'S BASIC HEALTH PLAN, ARTICLE 8 OF THIS TITLE.

(2) ON OR BEFORE JULY 1, 2008, THE STATE DEPARTMENT, IN CONJUNCTION WITH THE COLORADO MEDICAL HOME INITIATIVE IN THE DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT, SHALL DEVELOP SYSTEMS AND STANDARDS TO MAXIMIZE THE NUMBER OF CHILDREN ENROLLED IN THE STATE MEDICAL ASSISTANCE PROGRAM OR THE CHILDREN'S BASIC HEALTH PLAN WHO HAVE A MEDICAL HOME. THE SYSTEMS AND STANDARDS DEVELOPED SHALL INCLUDE, BUT NEED NOT BE LIMITED TO, WAYS TO ENSURE THAT A MEDICAL HOME SHALL OFFER FAMILY-CENTERED, COMPASSIONATE, CULTURALLY EFFECTIVE CARE AND SENSITIVE, RESPECTFUL COMMUNICATION TO A CHILD AND HIS OR HER FAMILY.

(3) ON OR BEFORE JANUARY 30, 2008, AND EVERY JANUARY 30 THEREAFTER, THE STATE DEPARTMENT SHALL REPORT TO THE HEALTH AND HUMAN SERVICES COMMITTEES OF THE HOUSE OF REPRESENTATIVES AND THE SENATE, OR ANY SUCCESSOR COMMITTEES, ON PROGRESS MADE TOWARD MAXIMIZING THE NUMBER OF CHILDREN WITH A MEDICAL HOME WHO ARE ENROLLED IN THE STATE MEDICAL ASSISTANCE PROGRAM OR THE CHILDREN'S BASIC HEALTH PLAN.

SECTION 3. Appropriation. In addition to any other appropriation, there is hereby appropriated, out of any moneys in the general fund not otherwise appropriated, to the department of health care policy and financing, for allocation to the executive director's office, for the fiscal year beginning July 1, 2007, the sum of forty-four thousand nine hundred sixty-five dollars ($44,965) and 1.0 FTE, or so much thereof as may be necessary, for the implementation of this act. Said sum shall be subject to the "(M)" notation as defined in the general appropriation act. In
addition to said appropriation, the general assembly anticipates that, for the fiscal year beginning July 1, 2007, the department of health care policy and financing will receive the sum of seventy-three thousand one hundred sixty-three dollars ($73,163) in federal funds for the implementation of this act. Although the federal funds are not appropriated in this act, they are noted for the purpose of indicating the assumptions used relative to these funds in developing state appropriation amounts.

SECTION 4. Effective date. (1) This act shall take effect only if:

(a) House Bill 07-1021 is enacted at the first regular session of the sixty-sixth general assembly and becomes law;

(b) The final fiscal estimate for House Bill 07-1021, determined from the appropriations enacted in said bill, shows a net reduction in the amount of general fund expenditures appropriated for the state fiscal year 2007-08, that is equal to or greater than the amount of the general fund appropriation made for the implementation of this act for the state fiscal year 2007-08, as reflected in section 3 of this act; and

(c) The staff director of the joint budget committee files written notice with the revisor of statutes no later than July 15, 2007, that the requirement set forth in paragraph (b) of this subsection (1) has been met.

SECTION 5. Safety clause. The general assembly hereby finds,
determines, and declares that this act is necessary for the immediate preservation of the public peace, health, and safety.

________________________________________  ______________________________________
Joan Fitz-Gerald                        Andrew Romanoff
PRESIDENT OF                           SPEAKER OF THE HOUSE
THE SENATE                             OF REPRESENTATIVES

________________________________________  ______________________________________
Karen Goldman                          Marilyn Eddins
SECRETARY OF                           CHIEF CLERK OF THE HOUSE
THE SENATE                             OF REPRESENTATIVES

APPROVED________________________________________________________

_______________________________________________________________
Bill Ritter, Jr.
GOVERNOR OF THE STATE OF COLORADO

PAGE 5-SENATE BILL 07-130
APPENDIX B: CERTIFICATE OF APPROVAL

Certificate of Approval

Not Approved to Enroll Subjects! Recruiting of new subjects will require new COMIRB approval

13-Oct-2015

Investigator: KaraAnn Clouse
Subject: COMIRB Protocol 12-1073 Continuing Review
Review Date: 10/6/2015
Effective Date: 06-Oct-2015
Expiration Date: 05-Oct-2016
Sponsor(s):
Title: Health Service Utilization Before and After Medical Home Certification
Expedited Category: 5
Submission ID: CRV003-1

SUBMISSION DESCRIPTION:

CRV005-1
Status: Data analysis only

Your COMIRB Continuing Review submission CRV003-1 has been APPROVED until the expiration date listed above. The investigator will need to submit this research for Continuing Review at least 45 days prior to the expiration date.

Study personnel are approved to conduct the research as described in the documents approved by COMIRB, which are listed below the REVIEW DETAILS section.

Please carefully review the REVIEW DETAILS section because COMIRB may have made red-line changes (i.e. revisions) to the submitted documents prior to approving them. The investigator can submit an amendment to revise the documents if the investigator does not agree with the red-line changes. The REVIEW DETAILS section may also include important information from the reviewer(s) and COMIRB staff.

COMIRB stamps the approved versions of documents in the top right hand corner. Stamped copies of documents are available for download through COMIRB’s electronic submission website, eRA(InfoEd).
## APPENDIX C: LITERATURE REVIEW

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Literature databases: OVID, PubMed, and Google Scholar
APPENDIX D: MEDICAL HOME INDEX – SHORT VERSION TOOL

Instructions, Tool, and Scoring Instructions

The Medical Home Index–Short Version:

Measuring the Organization and Delivery of Primary Care for Children with Special Health Care Needs

The Medical Home Index–Short Version (MHI-SV) represents ten indicators which have been derived from the Center for Medical Home Improvement’s (CMHI) original Medical Home Index (MHI). This short version can be used as an interval measurement in conjunction with the original MHI or it can be used as a quick “report card” or snapshot of practice quality. CMHI recommends the use of the full MHI for practice improvement purposes but offers this short version for interval or periodic measurement and/or when it is not feasible to use the full MHI.

The Medical Home Index is a nationally validated self-assessment tool designed to quantify the “medical homeness” of a primary care practice. The MHI contains twenty-five indicators which detail excellent, pro-active, comprehensive pediatric primary care. It functions both as a quality improvement tool and as a self-education medium relevant to the medical home.

The Medical Home Index: Short Version (MHI-SV) is a brief representation of the more complete measurement tool. It scores a practice on a continuum of care across three levels:

- Level 1 is good, responsive pediatric primary care.
- Level 2 is pro-active pediatric primary care (in addition to Level 1)
- Level 3 illustrates pediatric primary care at the most comprehensive levels (it is in addition to Levels 1 and 2).

As the reporter for your entire practice and in response to each of the ten indicators—please score your medical home at: Level 1, Level 2 “partial”, Level 2 “complete”, Level 3 “partial”, or Level 3 “complete”.

Both the full 25-item Medical Home Index and this 10-item Medical Home Index – Short Version can be downloaded from the CMHI website at www.medicalhomeimprovement.org.
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<th>Level 2 (in addition to level 1)</th>
<th>Level 3 (in addition to level 2)</th>
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<td>#1 Family Feedback</td>
<td>Pediatric primary care</td>
<td>Feedback from families of CSHCN regarding their perception of care is gathered through systematic methods (e.g. surveys, focus groups, or interviews); there is a process for staff to review this feedback and to begin problem solving.</td>
<td>An advisory process is in place to identify needs and implement creative solutions; there are tangible supports to enable families to participate in activities (e.g. childcare or parent stipends).</td>
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<tr>
<td>Requires both MD &amp; key non-MD staff member's perspective.</td>
<td>Partial Complete</td>
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<td>(#1.5 MHI-Full Version)</td>
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<td>Partial Complete</td>
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<td>#2 Cultural Competence</td>
<td>Pediatric primary care without the elements detailed in levels 2 and 3.</td>
<td>Materials are available and appropriate for non-English speaking families, those with limited literacy; these materials are appropriate to the developmental level of the child/young adult.</td>
<td>Family Assessments include pertinent cultural information, particularly about health beliefs; this information is incorporated into care plans; the practice uses these encounters to assess patient &amp; community cultural needs.</td>
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<td>Partial Complete</td>
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<td>Question</td>
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<td>Level 2 (in addition to level 1)</td>
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<td><strong>#3 Identification of Children in the practice with Special Health Care Needs.</strong></td>
<td>Pediatric primary care without the elements detailed in levels 2 and 3.</td>
<td>A CSHCN list is generated by applying a definition (see pg. 6), the list is used to enhance care +/- define practice activities (e.g. to flag charts and computer databases for special attention or identify the population and its subgroups).</td>
<td>Diagnosis codes for CSHCN are documented, problem lists are current, and complexity levels are assigned to each child; this information creates an accessible practice database.</td>
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<td><strong>#4 Care Continuity.</strong></td>
<td>Pediatric primary care without the elements detailed in levels 2 and 3.</td>
<td>The team (including PCP, family, and staff) develops a plan of care for CSHCN which details visit schedules and communication strategies; home, school and community concerns are addressed in this plan. Practice back up/cross coverage providers are informed by these plans.</td>
<td>The practice/teams use condition protocols; they include goals, services, interventions and referral contacts. A designed care coordinator uses these tools and other standardized office processes which support children and families.</td>
</tr>
<tr>
<td>(#2.2 MHI-Family Voices)</td>
<td>☐ Level 1 ☐ Partial ☐ Complete</td>
<td>☐ Partial ☐ Complete</td>
<td>☐ Partial ☐ Complete</td>
</tr>
<tr>
<td><strong>#5 Cooperative Management Between Primary Care Provider (PCP) and Specialist.</strong></td>
<td>Pediatric primary care without the elements detailed in levels 2 and 3.</td>
<td>The PCP and family set goals for referrals and communicate these to specialists; together they clarify co-management roles among family, PCP and specialists and determine how specialty feedback to the family and PCP is expressed, used and shared.</td>
<td>The family has the option of using the practice in a strong coordinating role; parents as partners with the practice manage their child’s care using specialists for consultations and information (unless they decide it is prudent for the specialist to manage the majority of their child’s care).</td>
</tr>
<tr>
<td>(#2.4 MHI-Family Voices)</td>
<td>☐ Level 1 ☐ Partial ☐ Complete</td>
<td>☐ Partial ☐ Complete</td>
<td>☐ Partial ☐ Complete</td>
</tr>
<tr>
<td><strong>#6 Supporting the Transition to Adulthood.</strong></td>
<td>Pediatric primary care without the elements detailed in levels 2 and 3.</td>
<td>Pediatric and adolescent PCPs support youth &amp; family to manage their health using a transition timeline &amp; offer culturally effective guidance related to: - health &amp; wellness - education &amp; vocational planning - guardianship and legal &amp; financial issues - community supports &amp; recreation When youth transition from pediatric to adult provider:</td>
<td>Progressively from age 12, youth, family, and PCP develop a written transition plan within the care plan; it is made available to families and all involved providers. Youth and families receive coordination support to link their adult providers/services/agencies (e.g. sub-specialists, educational, financial, insurance, housing, recreation, employment and legal assistance).</td>
</tr>
<tr>
<td>(#2.4 MHI-Family Voices)</td>
<td>☐ Level 1 ☐ Partial ☐ Complete</td>
<td>☐ Partial ☐ Complete</td>
<td>☐ Partial ☐ Complete</td>
</tr>
<tr>
<td>Question</td>
<td>Level 1</td>
<td>Level 2 (in addition to level 1)</td>
<td>Level 3 (in addition to level 2)</td>
</tr>
<tr>
<td>----------</td>
<td>---------</td>
<td>---------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>#2.5.1 MHI-Family Voices</td>
<td>Level 1</td>
<td>Partial Complete</td>
<td>Partial Complete</td>
</tr>
<tr>
<td>#7 Care Coordination/Role Definition</td>
<td>Pediatric primary care without the elements detailed in levels 2 and 3.</td>
<td>Care coordination activities are based upon ongoing assessments of child and family needs; the practice partners with the family (and older children) to accomplish care coordination goals.</td>
<td>Practice staff offer a set of care coordination activities, their level of involvement fluctuates according to family needs/wishes. A designated care coordinator ensures the availability of these activities including written care plans with ongoing monitoring.</td>
</tr>
<tr>
<td>#3.1 MHI-Family Voices</td>
<td>Level 1</td>
<td>Partial Complete</td>
<td>Partial Complete</td>
</tr>
<tr>
<td>#8 Assessment of Needs/Plans of Care</td>
<td>Pediatric primary care without the elements detailed in levels 2 and 3.</td>
<td>The child with special needs, family and PCP review current child health status and anticipated problems or needs; they create/revise action plans and allocate responsibilities at least 2 times per year or at individual intervals.</td>
<td>The PCP/staff and families create a written plan of care that is monitored at every visit; they office care coordinator is available to the child and family to implement, updates and evaluate the care plan.</td>
</tr>
<tr>
<td>#3.4 MHI-Family Voices</td>
<td>Level 1</td>
<td>Partial Complete</td>
<td>Partial Complete</td>
</tr>
<tr>
<td>#9 Community Assessment of Needs for CSHCN.</td>
<td>Pediatric primary care without the elements detailed in levels 2 and 3.</td>
<td>Providers raise their own question regarding the population of CSHCN in their practice community(ies); they seek pertinent data and information form families and local/state sources and use data to inform practice care activities.</td>
<td>At least on clinical practice provider participates in a community-based public health need assessment about CSHCN, integrates results into practice policies, and shares conclusions about population needs with community &amp; state agencies.</td>
</tr>
<tr>
<td>#4.1MHI-Family Voices</td>
<td>Level 1</td>
<td>Partial Complete</td>
<td>Partial Complete</td>
</tr>
<tr>
<td>#10 Quality Standards (structures)</td>
<td>Pediatric primary care without the elements detailed in levels 2 and 3.</td>
<td>The <em>practice</em> has its own systematic quality improvement mechanism for CSHCN; regular provider and staff meetings are used for input and discussions on how to improve care and treatment for this</td>
<td>The practice actively utilizes quality improvement (QI) processes; staff and parents of CSHCN are supported to participate in these QI activities; resulting quality standards are integrated into the</td>
</tr>
</tbody>
</table>
The Medical Home Index – Short Version (MHI-SV) represents ten indicators which have been derived CMHI’s original Medical Home Index-Full Version (MHI-Family Voices). This short version can be used as an interval measurement in conjunction with the original MHI or it can be used as a quick “report card” or snapshot of practice quality. CMHI recommends the use of the MHI-Family Voices for practice improvement purposes but offers this short version for interval or periodic measurement and/or when it is not feasible to use the MHI-Family Voices.

The Medical Home Index is a nationally validated self-assessment tool designed to quantify the “medical homeness” of a primary care practice. The MHI contains twenty-five indicators which detail excellent, pro-active, comprehensive pediatric primary care. It functions both as a quality improvement tool and as a self education medium relevant to the medical home.

The Medical Home Index: Short Version (MHI-SV) is a brief representation of the more complete measurement tool and available in both Pediatric and Adult Primary Care versions. It scores a practice on a continuum of care across three levels:

<table>
<thead>
<tr>
<th>Question</th>
<th>Level 1</th>
<th>Level 2 (in addition to level 1)</th>
<th>Level 3 (in addition to level 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(#6.1 MHI-Family Voices)</td>
<td>□ Level 1</td>
<td>□ Partial □ Complete</td>
<td>□ Partial □ Complete</td>
</tr>
</tbody>
</table>

Note. CSHCN = Children With Special Health Care Needs. MHI = Medical Home Index. PCP = primary care physician. CMHI = Center for Medical Home Improvement. QI = quality improvement.

Scoring

Instructions for the Pediatric and Adult Primary Care Medical Home

Medical Home Index–Short Version

As the reporter for your entire practice and in response to each of the ten indicators—please score your medical home at: Level 1, Level 2 “partial”, Level 2 “complete”, Level 3 “partial”, or Level 3 “complete”.

Click to link to:

CMHI Medical Home Index Pediatric-Short Version

CMHI Medical Home Index Adult Primary Care-Short Version
Guidelines

When using the MHI tools we request that you:

Inform CMHI in writing (CMHI@crotch mountain.org) of your intent.

Make every effort to gain family feedback with our tool or one of your choosing. We believe that “medical homeness” cannot be fully measured without an analysis of the family perspective.

Consider sharing your practice and family data with us (confidential, de-identified) in order to benchmark. Please remove all practice and personal identifiers.

Instructions to Complete

First: Determine whether your practice primarily cares for pediatric or adult patients and select either the Pediatric or Adult Medical Home Index. Practices with separate provider teams and processes may want to consider completing the MHI for each team.

Second: Read each theme across its progressive continuum from Level 1 to Level 3.

Third: Score your medical home at: Level 1, Level 2 “partial”, Level 2 “complete”, Level 3 “partial”, or Level 3 “complete” which best describes how your practice currently provides care.

How to Measure the MHI – Family Voices

To measure medical home baseline and improvements, we have created a “MHI-SV Scoring Template“ Excel spreadsheet to easily score and track practice MHI results.

Follow these steps to enter data into the “MHI-SV Scoring Template“ excel spreadsheet.

Complete the Adult/Pediatric Medical Home Index—Short Version and have available to enter results into the Excel “MHI-SV Scoring Template“.

For each level selected in the MHI, a point system is applied to score the MHI.

*Point System for the MHI*

<table>
<thead>
<tr>
<th>Level</th>
<th>Partial</th>
<th>Complete</th>
<th>Medical homeness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 point</td>
<td></td>
<td>Good, responsive care</td>
</tr>
<tr>
<td>2</td>
<td>2 points</td>
<td>3 points</td>
<td>Proactive</td>
</tr>
<tr>
<td>3</td>
<td>4 points</td>
<td>5 points</td>
<td>Comprehensive</td>
</tr>
</tbody>
</table>

Example: MHI-SV #1 Family Feedback if “Level 2: Complete” selected, score is 3 points.
Open Excel file “MHI-SV Scoring Template“.

Open tab for either Adult or Pediatric per the completed MHI-SV.

Each column starting from left to right applies to responses in the MHI. (Note: the first three far left columns “A, B, and C” can be used to differentiate multiple MHI entries per date. Use a separate row for each entry.)

Next starting with column “D” refers to an indicator in the MHI (see tab “Column Description” for abbreviation explanation).

Example: 1.5 refers to Organizational Capacity 1.5 (MHI-Family Voices) Family Feedback

Enter the Level score into each column (refer to Table 2 for scoring).

At the end of each entry, the “MHI-SV Scoring Template“ will auto calculate the sum (total points scored), Column N: “mhis_raw”

The “MHI-SV Scoring Template” will auto calculate a standard deviation score, Column M: “mhis_std.”

The higher the score, the higher the Level of reported medical “homeness”.

## APPENDIX E: COLORADO FAMILY SATISFACTION SURVEY

**Family Voices Family Satisfaction Survey Tool**

**Medical Home Index Family Survey**

A Medical Home is not a building, house or hospital but rather an approach to providing health care services in a high quality and cost effective manner. Children and their families who have a medical home receive the care that they need from a pediatrician or physician (pediatric health professional) whom they trust. The pediatric health professional and parents act as partners in a medical home to identify and access all the medical and non-medical services needed to help children and their families achieve their maximum potential.

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you feel your provider creates a Medical Home for your child?</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>2. Do you feel your provider values you and your child’s family?</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>3. Do you feel you are linked to available support services when appropriate? For example: therapy, early intervention, supplies and equipment.</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>4. Do you feel your calls are returned within a reasonable amount of time?</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>5. Does your provider meet your cultural differences?</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>6. Would you say your provider is concerned for your child’s well being?</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>7. Do you feel your concerns about your child are heard?</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>8. Do you get referrals to specialist or other providers when needed?</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>9. Do you have any difficulty getting appointments?</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>10. Do you have any difficulty getting appointments?</td>
<td>1, 2, 3, 4</td>
</tr>
</tbody>
</table>

**Children with Special Health Care Needs:** Children who have or are at risk for a chronic physical, developmental, behavioral or emotional condition and who also require health related services of a type or amount beyond that required by children generally.

Does your child have a diagnosed special health need? If yes, please check all that apply below: __physical __medical __mental health __learning __behavioral

Specific diagnosis:________

Has your child been hospitalized? NO If, YES…

- Past 3 months
- Past 6 months
- Past year
- In lifetime

Would you like more information about Medical Home? If yes, please provide us your name and phone number

______(______)________-__________

**Yes, most**

Yes, always of the time

Sometimes

No, never
## APPENDIX F: EPSDT ICD-9 CODES, WELL VISITS

*Early Periodic Screening, Diagnostic, and Testing ICD-9 Codes for Well Visits*

### Early and Periodic Screening, Diagnostic, and Treatment well child visit codes

**Procedure Codes:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>99381</td>
<td>New Patient under one year</td>
</tr>
<tr>
<td>99382</td>
<td>New Patient (ages 1–4 years)</td>
</tr>
<tr>
<td>99383</td>
<td>New Patient (ages 5–11 years)</td>
</tr>
<tr>
<td>99384</td>
<td>New Patient (ages 12–17 years)</td>
</tr>
<tr>
<td>99385</td>
<td>New Patient (ages 18–39 years)</td>
</tr>
<tr>
<td>99391</td>
<td>Established Patient under one year</td>
</tr>
<tr>
<td>99392</td>
<td>Established Patient (ages 1–4 years)</td>
</tr>
<tr>
<td>99393</td>
<td>Established Patient (ages 5–11 years)</td>
</tr>
<tr>
<td>99394</td>
<td>Established Patient (ages 12–17 years)</td>
</tr>
<tr>
<td>99395</td>
<td>Established Patient (ages 18–39 years)</td>
</tr>
<tr>
<td>99460</td>
<td>Initial hospital or birthing center care for normal newborn infant</td>
</tr>
<tr>
<td>99461</td>
<td>Initial care in other than a hospital or birthing center for normal newborn infant</td>
</tr>
<tr>
<td>99463</td>
<td>Initial hospital or birthing center care of normal newborn infant (admitted/</td>
</tr>
</tbody>
</table>

**OR**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>99202–99205</td>
<td>New Patient</td>
</tr>
<tr>
<td>99213–99215</td>
<td>Established Patient</td>
</tr>
<tr>
<td>V20</td>
<td>HEALTH SUPERVISION OF INFANT OR CHILD</td>
</tr>
<tr>
<td>V20.0</td>
<td>HEALTH SUPERVISION OF FOUNDLING</td>
</tr>
<tr>
<td>V20.1</td>
<td>OTHER HEALTHY INFANT OR CHILD RECEIVING</td>
</tr>
<tr>
<td>V20.2</td>
<td>ROUTINE INFANT OR CHILD HEALTH CHECK</td>
</tr>
<tr>
<td>V20.3</td>
<td>NEWBORN HEALTH SUPERVISION</td>
</tr>
<tr>
<td>V20.31</td>
<td>HEALTH SUPERVISION NEWBORN UNDER 8 DAYS</td>
</tr>
<tr>
<td>V20.32</td>
<td>HEALTH SUPERVISION NEWBORN 8 TO 28 DAYS</td>
</tr>
<tr>
<td>V70.0</td>
<td>ROUTINE GENERAL MEDICAL EXAMINATION AT A</td>
</tr>
<tr>
<td>V70.3</td>
<td>OTHER GENERAL MEDICAL EXAMINATION FOR AD</td>
</tr>
<tr>
<td>V70.4</td>
<td>EXAMINATION FOR MEDICOLEGAL REASONS</td>
</tr>
<tr>
<td>V70.5</td>
<td>HEALTH EXAMINATION OF DEFINED SUBPOPULATION</td>
</tr>
<tr>
<td>V70.6</td>
<td>HEALTH EXAMINATION IN POPULATION SURVEYS</td>
</tr>
<tr>
<td>V70.7</td>
<td>EXAM PARTICIPANT IN CLIN TRIAL</td>
</tr>
<tr>
<td>V70.8</td>
<td>OTHER SPECIFIED GENERAL MEDICAL EXAMINATION</td>
</tr>
</tbody>
</table>
V70.9 UNSPECIFIED GENERAL MEDICAL EXAMINATION

OR Deviation from Federal Guidelines for the Early and Periodic Screen, Diagnostic, and Treatment 416 reports

Provider Type  FQHC or RHC

V20 HEALTH SUPERVISION OF INFANT OR CHILD
V20.0 HEALTH SUPERVISION OF FOUNDLING
V20.1 OTHER HEALTHY INFANT OR CHILD RECEIVING
V20.2 ROUTINE INFANT OR CHILD HEALTH CHECK
V20.3 NEWBORN HEALTH SUPERVISION
V20.31 HEALTH SUPERVISION NEWBORN UNDER 8 DAYS
V20.32 HEALTH SUPERVISION NEWBORN 8 TO 28 DAYS
V70.0 ROUTINE GENERAL MEDICAL EXAMINATION AT A
V70.3 OTHER GENERAL MEDICAL EXAMINATION FOR AD
V70.4 EXAMINATION FOR MEDICOLEGAL REASONS
V70.5 HEALTH EXAMINATION OF DEFINED SUBPOPULAT
V70.6 HEALTH EXAMINATION IN POPULATION SURVEYS
V70.7 EXAM PARTICIPANT IN CLIN TRIAL
V70.8 OTHER SPECIFIED GENERAL MEDICAL EXAMINAT
V70.9 UNSPECIFIED GENERAL MEDICAL EXAMINATION

OR

DX codes

Y00.0 EPSDT SCREENING EXAM 123
Y000 EPSDTS SCREENING EXAM
Y000.0 Variation of Y000

Note. EPSDT = Early and Periodic Screening, Diagnostic, and Treatment.
APPENDIX G: MEDICAL HOME INDEX – SHORT VERSION – SCORING

RUBRIC

Transformation Algorithm for Scores on the Medical Home Index Scores used for Analysis.

<table>
<thead>
<tr>
<th>Certified practices Medical Home Index Likert scale score and description</th>
<th>Medical Home Index score on tool</th>
<th>Transformed score and description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = Good, responsive</td>
<td>Score = 1</td>
<td>1 = Good, responsive</td>
</tr>
<tr>
<td>2 = Proactive</td>
<td>Score = 2, partial</td>
<td>2 = Proactive</td>
</tr>
<tr>
<td></td>
<td>Score = 2, complete</td>
<td>3 = Proactive</td>
</tr>
<tr>
<td>3 = Comprehensive</td>
<td>Score = 3, partial</td>
<td>4 = Comprehensive</td>
</tr>
<tr>
<td></td>
<td>Score = 3, complete</td>
<td>5 = Comprehensive</td>
</tr>
</tbody>
</table>

Note. Adapted from The Medical Home Index, by Centers for Medical Home Improvement, 2016, retrieved February 29, 2016, from http://www.medicalhomeimprovement.org/knowledge/mhi-fv_instructions.html