

Summary of Available Evidence and Methodology for Determining Potential Medicaid Savings from Improving Care Coordination for Medically Complex Children

A Legislative Proposal for Specialized Risk-bearing Pediatric Medical Home Programs

Dobson | DaVanzo

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Submitted to:
Children's Hospital Association (CHA)

Submitted by:
Dobson | DaVanzo

Allen Dobson, Ph.D.

Joan E. DaVanzo, Ph.D., M.S.W.

Gregory Berger, M.P.P.

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Executive Summary

The Children’s Hospital Association (CHA) is proposing legislation that would create a national system of specialized pediatric “medical homes” for medically complex children (MCC). The proposed legislation would create risk-bearing nationally designated pediatric networks that would provide and coordinate care for MCC with eligibility criteria defined by assignment to Clinical Risk Groups (CRGs) 5b-9. CRGs were developed by 3M™ in collaboration with CHA and are widely used in state Medicaid programs. The pediatric networks would reflect a national perspective, but would also incorporate local marketplace factors.

The purpose of this report is to summarize the available evidence, and the methods and assumptions that underpin the savings estimates developed for a CHA legislative proposal.

Using the CRG-based definition of MCC developed for this project, MCC currently represent approximately 6 percent of pediatric Medicaid enrollees, but comprise nearly 40 percent of Medicaid spending for children overall.^{1,2,3} Children’s hospitals are the focal point of care for many of these patients, as multiple pediatric specialists are often needed to concurrently provide expertise in treating the rare and complex clinical conditions of MCC. The networks focused on children, will include community services, as well as inpatient services.

In support of this effort, Dobson DaVanzo & Associates, LLC (Dobson | DaVanzo) was commissioned by the CHA to estimate the financial impact on the Medicaid program of its legislative proposal over a 10-year period (2014-2023).⁴ In a second related effort, CHA developed a proposal under the Centers for Medicare & Medicaid Services (CMS) Center for Medicare and Medicaid Innovation (CMMI) Health Care Innovation Challenge Award, Round 2 (HCIA) application for funding of a three year program to

¹ Berry JG, Agrawal RK, Cohen E, Kuo DZ. (2013) *The Landscape of Medical Care for Children with Medical Complexity*. Special report submitted to Children’s Hospital Association.

² Auerbach R, McAlistair J, Poppe J. (2009) *Making Care Coordination a Critical Component of the Pediatric Health System: A Multidisciplinary Framework*. The Commonwealth Fund, pub no. 1277.

³ Truven Health Analytics: Taking Risk for High Risk Medicaid Population. Presented to Children’s Hospital Association, June 6, 2013.

⁴ Dobson A, DaVanzo J, Berger G, et al. (2013) *Savings Estimate of a Legislative Proposal to Improve Care Coordination for Medically Complex Children within the Medicaid Program*. (Report submitted to Children’s Hospital Association)

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provide care under this model in nine participating children’s hospitals that have operational networks in place. Although the financial model presented in the grant application was specific to participating children’s hospitals, it relied on many of the assumptions developed for the broader legislative proposal. This HCIA financial model was reviewed by Milliman, Inc. (Milliman) for its actuarial soundness in accordance with the requirements of the HCIA grant application submitted to the CMMI.⁵

The purpose of this report is to summarize, in a single report, the available evidence from a clinical review of the literature, key informant interviews, Medicaid claims analyses by Truven Health Analytics (Truven), and actuarial review by Milliman, as well as the methodological processes and assumptions that underpin the savings estimates developed for both of the above-mentioned efforts. *See Exhibit ES-1 for a summary of how available evidence was incorporated into the overall costing effort.*

Exhibit ES-1: Summary of Evidence Sponsored by CHA

Source of Information	
Review of clinical literature by Berry , et al., 2013	Identified MCC as a distinct subgroup within the pediatric population – MCC have multidimensional clinical and social needs. Review showed how clinical needs of MCC are not met by current health care system mainly due to a lack of care coordination.
Medicaid Claims Analyses for MCC by Truven	Examined Medicaid claims from 2009-2011 from a sample of twelve states in the MarketScan databases to categorize children by CRG and assess their Medicaid expenditures by category of service - first analyses of MCCs within Medicaid
Dobson DaVanzo Model of Costs and Savings Associated with CHA proposed Legislation Creating Pediatric Networks for MCC	Used Truven analyses and Berry et al. as inputs to develop an estimate of the financial impact on Medicaid of national system of risk-bearing pediatric networks for MCC (2014-2023)
Milliman Actuarial Review of CHA HCIA	CHA developed an application for the CMS Health Care Innovation Award (HCIA)Round 2 that included a financial model based on Dobson DaVanzo assumptions – actuarial review of HCIA by Milliman
CHA Financial Workgroup and Medical Home Network Team	Worked with these groups to validate all model assumptions

⁵ Smithback EL. (2013) Actuarial Memorandum to Children’s Hospital Association. Submitted to Children’s Hospital Association for CMMI HCIA application by Milliman.

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The Dobson | DaVanzo analyses in support of both the proposed legislation and the CHA HCIA application were conducted using cost accounting methodology similar to that used by the Congressional Budget Office (CBO). As such, the parameters of our cost models are based upon the evidence contained in Exhibit ES-1 and comprise the following major topics:

- 1) An understanding of why the baseline enrollment and size of the eligible population of MCC reflect a unique population of children in need of a more effective and efficient delivery system,
- 2) Baseline utilization and Medicaid expenditures currently devoted to providing care for MCC,
- 3) Program effects or savings that could accrue under the proposed system of specialized pediatric networks (“gross savings”), and
- 4) Per-member per-month (PMPM) costs associated with the hospital infrastructure and staffing that are necessary for delivering the care coordination required to achieve the savings (“net savings”).

In terms of the CHA legislative proposal, we estimated savings for two different implementations: a) a national system of pediatric networks, and b) a state opt-in system of networks. Both are discussed in this report, as well as the independent actuarial review of the CHA HCIA grant application.

Summary of Cost Estimation Methodology

To estimate the financial impact on the Medicaid program of implementing nationally designated pediatric networks for MCC, we projected baseline Medicaid enrollment and spending for MCC in the absence of a new national program using Truven’s data analyses of Medicaid claims from 2009 to 2011 as the major input, Medicaid summary statistics from CMS, and other secondary data analyses and research literature were also used. Based on published literature and expert review, we estimated both the difference between Medicaid spending for MCC at baseline and the program effects and resulting Medicaid spending for MCC under nationally designated pediatric networks (“gross savings”). We varied spending levels across different sites of service and categories of MCC.⁶ We then subtracted the costs to the program to improve care coordination for

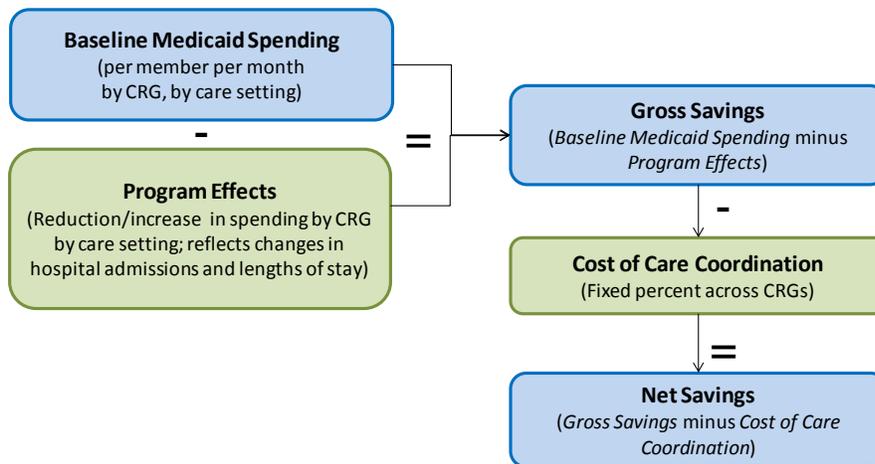
⁶ The legislative proposal defines MCC as children under the age of 18 that meet the eligibility criteria for Clinical Risk Groups (CRGs) 5b-9, which are patient risk categories developed by 3M™ in collaboration with CHA.

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these patients in order to estimate the “net savings” to the Medicaid program. See Exhibit ES-2 for the conceptual framework for our analysis.

Additionally, development of the savings estimation model was informed by several focused research activities. These activities included a series of key informant interviews with clinical and administrative representatives of several children’s hospitals currently operating care coordination programs for MCC and review by CHA standing committees (e.g., Finance and Operations). We also performed a literature review focused on the cost and outcomes of existing care coordination programs for MCC, rating the evidence by study quality to create the parameters for our model. This activity provided a picture of the increases and reductions in health care and spending by type of service that were being experienced by similar programs across the U.S.

Exhibit ES-2: Conceptual Framework for Savings Estimation Model, 2013-2024



Generally, given the literature, we assume that MCC in a program under the proposed legislation would experience fewer inpatient hospital admissions and reduced emergency room use. Furthermore, we assumed that MCC would have higher outpatient hospital, primary care physician, and prescription drug use to offset their reduced reliance on facility-based acute care.

1) *Baseline Medicaid enrollment*

A major contribution of the CHA body of research over the last several years has been the identification of a unique population of children with the greatest clinical, physical, and psychosocial needs. MCC often have chronic conditions affecting several organ systems, see multiple physician specialists, and require extensive social and community

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supports,⁷ which are very difficult to coordinate and are somewhat apart from the mainstream health care delivery system. Under the legislative proposal, MCC are defined as individuals under the age of 18 who are eligible for the Medicaid program or the Children’s Health Insurance Program who meet the inclusion criteria for Clinical Research Groups (CRG) 5b-9. Patients that fit into these CRGs have a:

- Significant lifelong chronic disease (CRG 5b),
- Significant chronic disease in multiple organ systems (CRG 6),
- Dominant chronic disease in three or more organ systems (CRG 7),
- Dominant or metastatic malignancy (CRG 8), or
- Catastrophic condition (CRG 9).

To project the total number of MCC in the Medicaid baseline from 2014 to 2023, we first identified the total number of children ages 0-18 in the Medicaid Statistical Information System (MSIS) from 2008 (the most recent year for which information is available from every state) as 28,631,430 for our base year.⁸ We then projected the relative distribution of CRGs within the Medicaid population as calculated by Truven Health Analytics (Truven) to estimate the total number of MCC within each CRG in 2008. See Exhibit ES-3 below.

Exhibit ES-3: Estimated Number of MCC by CRG, FY2008

MCC as Percent of Medicaid		
CRG	Population	Estimated Number of MCC
5b	2.07%	592,120
6	3.89%	1,113,867
7	0.07%	19,680
8	0.08%	24,319
9	0.43%	123,798
Total MCC	6.54%	1,873,784⁹

Source: Truven Health Analytics analysis of MarketScan® Multi-State Medicaid Database of Medicaid patients under 18 enrolled 2009-2011 with standardized 2011 payment data.

Once we estimated the number of MCC within each CRG in 2008, we inflated the population to 2023 using an annual growth rate for MCC of 5 percent, which was derived from an analysis of the MSIS data and literature on children with special health care needs (CSHCN). Exhibit ES-4 on the next page shows the total number of Medicaid

⁷ Gordon, J.B., Colby, H.H., Bartelt, T., Jablonski, D., Krauthoefer, M.L., Havens, P. (2007). A tertiary care primary care partnership model for medically complex and fragile children and youth with special health care needs. *Archives of Pediatric Adolescent Medicine* 161(10), 937-944.

⁸ Centers for Medicare & Medicaid Services. Medicaid Beneficiaries by Age Group, FY2008 [Table 12]. Retrieved from: <http://www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MedicaidDataSourcesGenInfo/MSIS-Tables->

⁹ A few state Medicaid programs cover children to their 21 birthday, which might add several thousand children to our point estimate.

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children ages 0-18 in 2008 and projections for 2014 and 2023, as well as the percent of Medicaid children who fit the criteria for CRGs 5b-9.

Exhibit ES-4: Total Number of and Percentage of Medicaid MCC Ages 0-18

CRG	Percent of Medicaid Population (2008)	MCC as Percent of Medicaid Population by Year			
		2008 (Actual)	2014 (Projected)		2023 (Projected)
		28,631,430	≈32,000,000*		≈35,000,000*
5b	2.07%	592,120	2.48%	793,497	3.52% 1,230,974
6	3.89%	1,113,867	4.66%	1,492,688	6.62% 2,315,649
7	0.07%	19,680	0.08%	26,374	0.12% 40,914
8	0.08%	24,319	0.10%	32,590	0.14% 50,557
9	0.43%	123,798	0.52%	165,901	0.74% 257,368
Total MCC	6.54%	1,873,784	7.85%	2,511,049	11.13% 3,895,462

Source: Dobson | DaVanzo analysis of FY2008 MSIS and Truven Health Analytics analysis of MarketScan® Multi-State Medicaid Database of with standardized 2011 payment data. *Congressional Budget Office (2013, February). Spending and enrollment detail for CBO's February 2013 baseline: Medicaid. Retrieved from <http://www.cbo.gov/sites/default/files/cbofiles/attachments/43885-Medicaid.pdf>

Exhibit ES-4 shows that as the growth rate of MCC in the Medicaid population is greater than the growth rate of Medicaid children overall, the proportions of children in each CRG increase over time. MCC comprise 6.54 percent of the total Medicaid population in 2008. This relative proportion increases to 7.85 percent in 2014, and 11.13 percent in 2023.

2) Baseline Medicaid Spending for MCC

After estimating the total number of Medicaid MCC within each CRG from 2014 to 2023 using the MSIS 2008 data, percentages of MCC within each CRG using Truven estimates, and annual growth rate, we calculated total Medicaid spending for this population in 2011. (All Truven estimates were for the year 2011.) To do this, we first converted the total number of Medicaid MCC by CRG by year into member-months.

We then applied PMPM Medicaid spending by site of service by CRG to the estimated number of Medicaid MCC within each year. To estimate Medicaid prices for these services from 2014 to 2023, we inflated Medicaid PMPM mean allowed payments annually from 2011 through 2023 using the Medicare market basket for each care setting (when available) or the medical urban consumer price index (CPI-U).

Exhibit ES-5 shows the total Medicaid payments from 2011 that we used as our baseline and our projections for MCC spending on each category of service in 2014 and 2023.

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Exhibit ES-5: Total Medicaid Spending and Percent Spending across CRGs for MCC Ages 0-18 (Billions)

Care Setting	2011 (Actual)		2014 (Projected)		2023 (Projected)	
	Medicaid Spending	% Medicaid Spending	Medicaid Spending	% Medicaid Spending	Medicaid Spending	% Medicaid Spending
Inpatient Facility	\$17.6	47.3%	\$22.0	46.7%	\$44.5	45.4%
Emergency Room	\$1.1	3.0%	\$1.5	3.1%	\$3.2	3.2%
Outpatient	\$11.3	30.5%	\$14.7	31.2%	\$32.2	32.9%
Home Health	\$0.4	1.1%	\$0.5	1.1%	\$1.0	1.0%
DME	\$0.3	0.7%	\$0.3	0.7%	\$0.7	0.8%
Primary Care Provider	\$0.6	1.5%	\$0.7	1.5%	\$1.4	1.4%
Specialty Providers	\$0.1	0.3%	\$0.1	0.3%	\$0.2	0.3%
Other Provider	\$0.4	1.1%	\$0.5	1.1%	\$1.0	1.1%
Prescription Drugs	\$5.4	14.4%	\$6.8	14.3%	\$13.6	13.9%
Total Medicaid Spending	\$37.2	100.0%	\$47.1	100.0%	\$97.9	100.0%

Source: Dobson | DaVanzo analysis of FY2008 MSIS and Truven Health Analytics analysis of MarketScan® Multi-State Medicaid Database of Medicaid patients under 18 enrolled 2009-2011 with standardized 2011 payment data.

3) Quantifying Program Impact

The goal of the legislative proposal is to more effectively address the complex needs of MCC patients by enhancing care coordination. Evidence suggests that broad-based implementation of best practices from care coordination programs across the U.S. can improve care quality and reduce the need for inpatient hospital and emergency room care for this population, all while providing greater budget certainty and savings.

After identifying the most relevant 11 studies that quantitatively measured the difference in utilization or spending between clinically complex children receiving usual care and similar children enrolled in a care coordination program, we rated the strength of the evidence based on three characteristics:

- 1) study design (pre/post vs. randomized controlled trials);
- 2) alignment with target population of legislative proposal (i.e. CRGs 5b-9); and
- 3) sample size.

We then ranked the studies on a scale of 1-4 (high, medium, low, very low) based on these characteristics (with a rating of one representing the strongest evidence). After ranking the studies by evidence weight, we calculated a weighted average for each site of service in which the difference between usual care and care coordination program utilization or spending was estimated, and rounded down to be conservative (estimates were weighted

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using the evidence weight 1-4). We used this weighted average approach to be inclusive of the literature while upweighting estimates from the studies with stronger evidence.

For pre-post-enrollment analyses, we calculated utilization rates/Medicaid expenditures prior to enrollment in the study as compared to utilization rates/Medicaid expenditures after being enrolled in the study, standardized for equal pre- and post-enrollment periods.¹⁰ Decreased utilization/Medicaid expenditures during enrollment in the care coordination program were reported as negative percentages (reducing expenditures compared to the baseline), while increased utilization/Medicaid expenditures during enrollment were reported as positive percentages (increasing Medicaid expenditures compared to the baseline). See Exhibit ES-6.

Exhibit ES-6: Summary of Expected Program Impact

Program Impact	
Weighted Average Utilization Change from Literature	
-40.0%	Inpatient Facility
10.0%	Outpatient Facility
-20.0%	Emergency Room
30.0%	Primary Care Provider
10.0%	Prescription Drugs

4) *Costs of Care Coordination or Hospital Infrastructure Costs and Staffing of Specialized Pediatric Networks*

As this population grows, several children’s hospitals have expanded their efforts to improve their care coordination to more effectively address the complex needs of MCC. These hospitals have implemented medical home-type programs that successfully reduce fragmentation in care delivery by improving communication between children’s and community hospitals, primary care providers, pediatric specialists, and community organizations. In order to estimate the cost of care coordination for patients enrolled in a nationally designated pediatric network, we combined estimates from the published literature with estimates obtained through key stakeholder interviews and meetings with CHA-organized advisory boards, as well as informally through private communications.

While our estimate of 9 percent PMPM for care coordination costs is higher than the percent PMPM estimates identified in the literature and through interviews and meetings, our average across the 10-year period 2014 to 2023 of approximately \$150 PMPM is close to several published benchmarks.

¹⁰ Standardization for equal pre-/post- enrollment periods was conducted independently for each study.

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Summary Analytic Results and Discussion

Based upon information from multiple sources, we estimated that, under a range of assumptions, a legislative proposal to create nationally designated pediatric networks for MCC in the Medicaid program could reduce 10-year (2014-2023) Medicaid spending (both federal and state) by \$6 to \$26 billion if implemented as a national policy and \$5 to \$21 billion if implemented as a voluntary state opt-in policy (see Exhibit ES-6).

Exhibit ES-6: Medicaid Program Impact for National All-in and State Opt-in Policy Models, 2014-2023 (Billions)

Cost Estimate Model	Baseline Spending	National All-in Policy		State Opt-in Policy	
		Net Savings	% Net Savings	Net Savings	% Net Savings
Model A) Targeted Efficiencies	\$698.7	-\$26.3	-3.8%	-\$20.6	-2.9%
Model B) Moderate	\$698.7	-\$6.2	-0.9%	-\$4.8	-0.7%
Model C) Moderate with Targeted Efficiencies	\$698.7	-\$16.7	-2.4%	-\$13.1	-1.9%

Source: Dobson | DaVanzo analysis of FY2008 MSIS and Truven Health Analytics analysis of MarketScan® Multi-State Medicaid Database of Medicaid patients under 18 enrolled 2009-2011 with standardized 2011 payment data.

By organizing the delivery and payment of health care for MCC into pediatric networks based on the patient centered medical home concept and placing providers at risk for their care, the legislative proposal would lead to better coordination and improved quality of care for this population. If children’s hospitals are able to invest sufficiently in the infrastructure to improve care coordination, the Medicaid program could see further reductions in hospital spending over the long term. This will require new and innovative Medicaid payment systems that provide for the required investment in care coordination infrastructure.

Introduction

Dobson DaVanzo & Associates, LLC (Dobson | DaVanzo) was commissioned by the Children's Hospital Association (CHA) to develop this technical memorandum directed toward summarizing the evidence, data, and assumptions that were used to estimate the financial impact on the Medicaid program of a CHA legislative proposal. The legislative proposal aims to create a system of risk-bearing nationally designated pediatric medical homes to serve children with ongoing and complex medical conditions (MCC).¹¹ The pediatric networks would reflect a national perspective, but would also incorporate local marketplace factors.

As defined in this study effort, MCC currently represent approximately 6 percent of all children enrolled in the Medicaid program, but comprise nearly 40 percent of Medicaid spending for children overall. These acutely ill children often have complex acute and chronic conditions, numerous comorbidities, a broad range of mental health and psychosocial needs, and can be technology-dependent (e.g., require a ventilator).¹²

Within the existing health care system, the care MCC receive is often fragmented and uncoordinated, leading to long inpatient hospital stays, preventable hospital admissions and readmissions, and unnecessary emergency room (ER) visits. Today's health care system does not provide the best and most efficient care to MCC and their families because there is often a diffusion of responsibility, as care is provided separately by multiple physician specialties. Without a single provider overseeing the care, poor coordination and gaps in care result.

By organizing the delivery and payment of health care for MCC into specialized pediatric networks that place providers at risk for their care, the CHA legislative proposal would lead to improvements in care quality and reductions in the need for inpatient hospital care for this population. Furthermore, the proposal could achieve decreased spending for the

¹¹ Under the legislative proposal, MCC are defined as individuals under the age of 18 who are eligible for the Medicaid program or the Children's Health Insurance Program who meet the inclusion criteria for CRGs 5b-9.

¹² Berry JG, Agrawal RK, Cohen E, Kuo DZ. (2013) *The Landscape of Medical Care for Children with Medical Complexity*. Special report submitted to Children's Hospital Association.

Medicaid program (both at the federal and state levels) as well as providing greater budget certainty.

CHA Legislative Proposal

To address the highly specialized needs of MCC, CHA has proposed to establish a system of nationally designated pediatric networks that are anchored by children's hospitals but integrate a broad range of providers within the community.

The networks will be required to meet eligibility criteria established by the Centers for Medicare & Medicaid Services (CMS) in order to provide and coordinate services across the continuum of care for MCC. The networks will form a health care delivery system implemented either at the national level or through a state opt-in policy in order to achieve four primary goals:

- 1) Improve regional access to care for MCC across state lines;
- 2) Enhance continuity of care between patients, their families, multidisciplinary teams of health care providers, and community service providers;
- 3) Advance the creation of a national Medicaid claims database linked across states and across settings of care to inform the implementation of best practices and support quality improvement activities; and
- 4) Allow for local market variability reflecting diverse market configurations.

The nationally designated pediatric networks would transition from a negotiated fee-for-service reimbursement with an additional care coordination fee in the first two years to a form of risk-based payment beginning in the third year of implementation. If CMS is able to collect and analyze the patient claim data in more or less real time, this two-year transition will allow for calculation of accurate, risk-adjusted rates based on a national Medicaid database.

Nationally designated pediatric networks present an opportunity for the Medicaid program to improve quality for some of its most vulnerable enrollees by improving care co-ordination and reducing unnecessary inpatient hospital care. In addition, we estimate that a program to implement these networks could achieve approximately \$17 billion in savings to the Medicaid program (both federal and state spending) over the 10-year period 2014 to 2023 if hospitals are able to successfully coordinate care across primary care providers, specialists, social services, and other community-based supports.

National Designation

National designation will follow a rigorous set of criteria established by CMS that will require participating networks to:

- Submit plans to CMS for care management and coverage of services based on medical home-type delivery models using shared best practices,
- Participate in national collaboratives to define and adopt pediatric-focused network adequacy and care coordination standards and pediatric quality measures (e.g. CHIPRA, HEDIS) in coordination with the Secretary,
- Support national database development by reporting claims in a standardized format as outlined by CMS, and
- Accept at-risk reimbursement after the initial phase-in period.

These criteria will ensure that any participating pediatric network has the clinical and administrative capacity to deliver health care services to MCC that will meet the goals of the legislative proposal outlined above, but be sensitive to local market conditions.

There are a range of options for implementation of the legislative proposal. In the following report, we present analyses of two alternative policy options:

- 1) A National All-in Policy for all MCC
- 2) A State Opt-in Policy for MCC under which states voluntarily opt in

If implemented as a National All-in policy, all eligible children across the country meeting these criteria will be enrolled in a nationally designated series of pediatric networks; if implemented as a State Opt-in policy, all eligible children living within the states that opt into the program will be enrolled in one of the networks. Under either policy option, participation of providers in nationally designated pediatric networks will be voluntary.

This report does not address operational issues that will arise during implementation, such as when and how children are enrolled/disenrolled from a network, how networks will be formed within and across states and market areas, or how patient care will be coordinated or reimbursed across state lines.

Eligible MCC Population

A major contribution of the CHA research over the last several years has been the formulation of a definition for the population of children with the greatest clinical, physical, and psychosocial needs. MCC often have chronic conditions affecting several organ systems, see multiple physician specialists, and require extensive social and

community supports,¹³ which are very difficult to coordinate and are somewhat apart from the mainstream health care delivery system. The MCC population is characterized as having a range of conditions, needs, limitations, and medical fragility.

Under the legislative proposal, MCC are defined as individuals under the age of 18 who are eligible for the Medicaid program or the Children's Health Insurance Program who meet the inclusion criteria for CRGs 5b-9.

Patients that fit into these CRGs have a:

- Significant lifelong chronic disease (CRG 5b),
- Significant chronic disease in multiple organ systems (CRG 6),
- Dominant chronic diseases in three or more organ systems (CRG 7),
- Dominant or metastatic malignancy (CRG 8), or
- Catastrophic condition (CRG 9).

The CRG classification system is used widely to measure a population's burden of chronic illness and to assign individuals to mutually exclusive risk groups. CRGs are claims based, and they relate historical demographic and clinical characteristics of an individual to the health care resources that he or she will need in the future. CRGs are currently used by state Medicaid programs as risk adjusters, for example in New York, Texas, Maine, Vermont, New Hampshire, and Massachusetts. In other states CRGs are being used for the development of population based quality indicators (New York Department of Health) and for public reporting (Utah Department of Health).

While fragmented care can negatively impact all pediatric patients, patients in the MCC population are the most vulnerable when care is not well coordinated among primary care physicians, specialists, and community-based supports and services.¹⁴ Anecdotal evidence also suggests that many parents are forced to leave the job market in order to become full-time caregivers for their children, who may require hundreds of hours of appointments, transportation, and phone calls with clinicians and community organizations each year.

Information Sources for the Study

Information sources for this report include both qualitative and quantitative studies. Qualitative sources of information include a comprehensive special study concerning the

¹³ Gordon, J.B., Colby, H.H., Bartelt, T., Jablonski, D., Krauthoefer, M.L., Havens, P. (2007). A tertiary care primary care partnership model for medically complex and fragile children and youth with special health care needs. *Archives of Pediatric Adolescent Medicine* 161(10), 937-944.

¹⁴ Casey, P.H., Lyle, R.E., Bird, T.M., Robbins, J.M., Kuo, D.Z., Brown, C., et al. (2011). Effect of hospital-based comprehensive care clinic on health costs for Medicaid-insured medically complex children. *Archives of Pediatric Adolescent Medicine* 165(5), 392-398.

Introduction

multidimensional clinical and social needs of MCC by Berry and colleagues,¹⁵ a set of key informant interviews, work with the CHA Financial Workgroup and Medical Home Network Team to validate the assumptions in the model, and a focused literature review conducted by Dobson | DaVanzo comprised of the savings and infrastructure and other costs of 11 recent care coordination programs at children's hospitals.

Quantitative information included our analysis of the 2008 MSIS, and an analysis by Truven Health Analytics (Truven) that was commissioned by CHA. Truven was asked to conduct a retrospective claims analysis of the costs and utilization associated with the Medicaid MCC population, defined as pediatric patients under age 18 in CRGs 5b-9. To do this, Truven used a proprietary episode grouper developed by 3M™ to categorize Medicaid enrollees ages 0 to 18 into CRGs based on Medicaid claims data from a 12-state sample for all sites of service for the three-year period 2009 to 2011.¹⁶

To maximize the accuracy of the CRG grouper, 3M™ recommends using three years of historical claims data. Truven determined that using six months of claims data produced enrollment and spending distributions within the MCC population that were similar to using three years of claims data, but increased the overall sample size and improved the generalizability of the distribution of MCC within the overall Medicaid population. Truven also employed a proprietary methodology to geographically standardize estimates of average PMPM Medicaid allowed charges, such that prices across states were not distorted by geographic location within the 12-state sample.

After grouping the Medicaid claims data by CRG, Truven analyzed the average spending and utilization patterns associated with each site of service, including distribution and variability in spending by percentile. The following bullet points summarize Truven's key findings:

- The Medicaid population has a higher proportion of MCC than the commercially-insured population, indicating the influence of this population on overall Medicaid pediatric spending
- A payment system targeted to MCC could achieve savings through reduced hospital admissions and shorter length of stay, as inpatient care is the dominant spending driver (particularly in the underage one population)

¹⁵ Berry JG, Agrawal R, Cohen E, Kuo DZ. (2013) The Landscape of Medical Care for Children with Medical Complexity. (Special report submitted to the Children's Hospital Association.)

¹⁶ Note: Due to the proprietary nature of the claims data, Truven was unable to disclose the 12 states. Data from 10 of the states was provided directly by the state Medicaid agency, while data from the remaining two states was provided by select Medicaid managed care organizations within those states.

- Utilization varies more widely than spending among states, suggesting opportunities to shift utilization patterns and care delivery at the local level

The estimates calculated by Truven for Medicaid MCC are the most rigorous and comprehensive to date, and are representative estimates of utilization and spending for this population. Furthermore, these estimates reflect the definition of MCC carefully developed over several years by CHA (in collaboration with 3M™) which is included in the legislative proposal. These estimates also suggest that, given the high level of inpatient hospital spending and variability in utilization among states, that a global payment system for Medicaid MCC could achieve significant savings through better care coordination and increased primary and ambulatory care.

Organization of Report

The next chapter of this report presents a discussion of the evidence supporting each of the above topics relevant to developing a cost estimate for the proposed CHA legislation. The topics include the following: 1) baseline enrollment, or size of the eligible population of MCC, 2) baseline utilization and Medicaid expenditures devoted to providing care for MCC, 3) the program effects or savings that could accrue under the proposed system of specialized pediatric networks (“gross savings”), and 4) costs of care coordination or the per member per month (PMPM) costs associated with the hospital infrastructure and staffing that are requisite to delivering the care coordination required to achieve the savings (“net savings”). We then present our analytic results, and the final chapter discusses the actuarial review of HCIA model assumptions by Milliman.

Baseline Medicaid Enrollment

An important contribution of the research supported by CHA during the past year has been the identification of a defined population of children that are “medically complex” or MCC. Over the past several years, clinicians, researchers, and policymakers have developed multiple definitions for the population of children with the greatest clinical, physical, and psychosocial needs. The other point of discussion has been whether conceptually MCC is a distinct group separate from children with special health care needs (CSHCN). The work discussed herein supports the premise that MCC are a distinct and identifiable group apart from CSHCN.

The MCC population is characterized as having a range of conditions, needs, limitations, and medical fragility. One study defines MCC as, “children with a congenital or acquired multisystem disease, a severe neurological condition with marked functional impairment, and/or technology dependence for activities of daily living.”¹⁷ Researchers have more recently identified four cardinal domains that characterize MCC:¹⁸

- Chronic, severe health conditions,
- Substantial health service needs,
- Severe functional limitations, with some children being dependent upon technologies such as ventilators, and
- High resource utilization.

Due to improvements in technology and medical treatments for both chronic and severe pediatric conditions, as well as increased survival rates for neonatal intensive care unit

¹⁷ Cohen, A., Kuo, D., Agrawal, R., Berry, J., Bhagat, S., et al. (2011). Children with medical complexity: An emerging population for clinical and research initiatives. *Pediatrics* 127, 529-538.

¹⁸ Berry JG, Agrawal RK, Cohen E, Kuo DZ. (2013) The Landscape of Medical Care for Children with Medical Complexity. Children’s Hospital Association, Alexandria, VA, Overland Park, KS. June.

Baseline Medicaid Enrollment

(NICU) patients, the population of MCC within the Medicaid program has increased substantially over the last decade^{19,20}.

Study Definition of Eligible MCC Population

The legislative proposal definition of MCC uses administrative claims data from the Medicaid program, clinically classified using Clinical Risk Groups (CRGs), which are patient categorization groups developed by 3M™. As noted above, under the proposal, MCC are defined as individuals under the age of 18 who are eligible for the Medicaid program or the Children's Health Insurance Program who meet the inclusion criteria for CRGs 5b-9.

Size of Eligible MCC Population

To project the total number of MCC in the Medicaid baseline from 2014 to 2023, we first identified the total number of children ages 0-18 in the Medicaid Statistical Information System (MSIS) from 2008 (the most recent year for which information is available from every state) as our base year.²¹

To estimate the proportion of the total Medicaid pediatric population that meets the inclusion criteria for CRGs 5b-9, we multiplied the total number of Medicaid children in 2008 by the proportions estimated by Truven Health Analytics (Truven) for each CRG.

We then inflated the population at an annual growth rate of 5 percent from 2008 through 2023.²² Exhibit 1 shows the total number of Medicaid children ages 0-18 in 2008 and projections for 2014 and 2023, as well as the percent of Medicaid children who fit the criteria for CRGs 5b-9 (MCC). As the growth rate of MCC in the Medicaid population is greater than the growth rate of Medicaid children overall, the proportions of children in each CRG increase over time. For example, in 2014, MCC comprise 7.85 percent of the Medicaid population, and in 2023 MCC comprise 11.13 percent of the Medicaid population.

¹⁹ Casey, P.H., Lyle, R.E., Bird, T.M., Robbins, J.M., Kuo, D.Z., Brown, C., et al. (2011). Effect of hospital-based comprehensive care clinic on health costs for Medicaid-insured medically complex children. *Archives of Pediatric Adolescent Medicine* 165(5), 392-398.

²⁰ Hawkins, M.R., Diehl-Svrjcek, B., Dunbar, L.J. (2006). Caring for children with special healthcare needs in the managed care environment. *Lippincotts Case Management* 11, 216-223.

²¹ Centers for Medicare & Medicaid Services. Medicaid Beneficiaries by Age Group, FY2008 [Table 12]. Retrieved from: <http://www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MedicaidDataSourcesGenInfo/MSIS-Tables-Items/CMS1229912.html?DLPage=4&DLSort=0&DLSortDir=descending>

²² The annual growth rate of 5 percent represents a point in between the historical growth rate of the Medicaid population ages 0-18 from 1999 to 2009 (4.4 percent) and the growth rate of children with special health care needs (CSHCN) from 2001 to 2009 (6.4 percent).

Baseline Medicaid Enrollment

Exhibit 1: Total Number of Medicaid Children Ages 0-18 and Medicaid MCC Percent

CRG	Percent of Medicaid Population (2008)	MCC as Percent of Medicaid Population by Year			
		2008 (Actual)	2014 (Projected)		2023 (Projected)
		28,631,430	≈32,000,000		≈35,000,000*
5b	2.07%	592,120	2.48%	793,497	3.52% 1,230,974
6	3.89%	1,113,867	4.66%	1,492,688	6.62% 2,315,649
7	0.07%	19,680	0.08%	26,374	0.12% 40,914
8	0.08%	24,319	0.10%	32,590	0.14% 50,557
9	0.43%	123,798	0.52%	165,901	0.74% 257,368
Total MCC	6.54%	1,873,784	7.85%	2,511,049	11.13% 3,895,462

Source: Dobson | DaVanzo analysis of FY2008 MSIS and Truven Health Analytics analysis of MarketScan® Multi-State Medicaid Database of Medicaid patients under 18 enrolled 2009-2011 with standardized 2011 payment data.

* Congressional Budget Office (2013, February). Spending and enrollment detail for CBO's February 2013 baseline: Medicaid. Retrieved from CBO website: <http://www.cbo.gov/sites/default/files/cbofiles/attachments/43885-Medicaid.pdf>

As this report was going to press, CBO updated its projection of the number of children in Medicaid in 2023 to 38 million, which is slightly higher than our projection of 35 million. Thus, our estimate of 3.9 million MCC in 2023 is likely somewhat conservative, suggesting our savings are underestimated.

Baseline Medicaid Spending for MCC

Caring for MCC requires a disproportionate share of health resources. Researchers maintain that this disproportionate share of resources is needed because MCC require health care from a myriad of inpatient, outpatient, and community providers and rely on expensive medications, equipment, procedures, and therapies to maintain their health.²³ Furthermore, MCC often rely on a medical device or technology to manage and/or treat a chronic condition (e.g., a ventricular shunt to treat hydrocephalus) or to maintain basic bodily functions necessary to maintain life (e.g., a tracheotomy tube for breathing). MCC experience frequent illness and chronic exacerbations of conditions leading to recurring hospitalization.

The literature contains evidence of high growth in MCC in recent years relative to other pediatric populations, as well as an increase in care intensity. For example, a 2012 study found that children with significant chronic conditions affecting 2 or more body systems accounted for 19.2 percent of patients; accounting for 27.2 percent of hospital discharge, 28.9 percent of hospital days, and 53.2 percent of hospital charges in 2009.²⁴ In another example showing care intensity, researchers found that children with medical complexity saw a median of 13 outpatient physicians and 6 distinct subspecialists, and 36 percent receive home care services. Thirty-day readmission varied from 12.6 percent (single complex chronic conditions without technology dependence) to 23.7 percent (multiple complex chronic conditions with technology dependence). Children with multiple complex chronic conditions and technology dependence had costs 3.5 times higher than children with a single complex chronic condition without technology dependence.²⁵

²³ Simon TD, Mahant S, Cohen E. (2012). Pediatric hospital medicine and children with medical complexity: past, present, and future. *Curr Probl Pediatr Adolesc Health Care*; 42(5): 113-119.

²⁴ Berry JG, Hall M, Hall DE, et al. (2013) Inpatient growth and resource use in 28 children's hospitals: a longitudinal, multi-institutional study. *JAMA Pediatr*; 167(2): 170-177.

²⁵ Cohen E, Berry GJ, Camacho X, et al. (2012). Patterns and costs of health care use of children with medical complexity.

Baseline Medicaid Spending for MCC

Our Methodology

We first estimated a baseline for the total number of MCC that would be enrolled in the Medicaid program between 2014 and 2023. As was shown in the last chapter, we estimated that there would be 2.5 million Medicaid MCC in 2014, growing to 3.9 million in 2023. As shown above in Exhibit 1, MCC comprised 6.54 percent of the Medicaid population in 2008, and we project that MCC will comprise 11.13 percent in 2023. We next estimated total baseline Medicaid spending for this population over the 10-year period of 2014-2023. This spending represents the current costs of caring for MCC. We used per-member per-month (PMPM) Medicaid spending by care setting (e.g. inpatient hospital, outpatient hospital, physician, etc.) for each CRG. We used PMPM because many children are not enrolled in Medicaid for a full year or are born mid-year.

Exhibit 2 shows the total geographically standardized payments from 2011 that we used as our baseline. We inflated these payments by the Medicare market basket for each care setting (when available) or the medical urban consumer price index (CPI-U).

Exhibit 2: Total Medicaid Spending and Percent Spending across CRGs for MCC Ages 0-18 (Billions)

Care Setting	2011 (Actual)		2014 (Projected)		2023 (Projected)	
	Medicaid Spending	% Medicaid Spending	Medicaid Spending	% Medicaid Spending	Medicaid Spending	% Medicaid Spending
Inpatient Facility	\$17.6	47.3%	\$22.0	46.7%	\$44.5	45.4%
Emergency Room	\$1.1	3.0%	\$1.5	3.1%	\$3.2	3.2%
Outpatient	\$11.3	30.5%	\$14.7	31.2%	\$32.2	32.9%
Home Health	\$0.4	1.1%	\$0.5	1.1%	\$1.0	1.0%
DME	\$0.3	0.7%	\$0.3	0.7%	\$0.7	0.8%
Primary Care Provider	\$0.6	1.5%	\$0.7	1.5%	\$1.4	1.4%
Specialty Providers	\$0.1	0.3%	\$0.1	0.3%	\$0.2	0.3%
Other Provider	\$0.4	1.1%	\$0.5	1.1%	\$1.0	1.1%
Prescription Drugs	\$5.4	14.4%	\$6.8	14.3%	\$13.6	13.9%
Total Medicaid Spending	\$37.2	100.0%	\$47.1	100.0%	\$97.9	100.0%

Source: Dobson | DaVanzo analysis of FY2008 MSIS and Truven Health Analytics analysis of MarketScan® Multi-State Medicaid Database of Medicaid patients under 18 enrolled 2009-2011 with standardized 2011 payment data.

Estimate of Potential Savings to Medicaid

Conceptual Framework for Savings Estimation

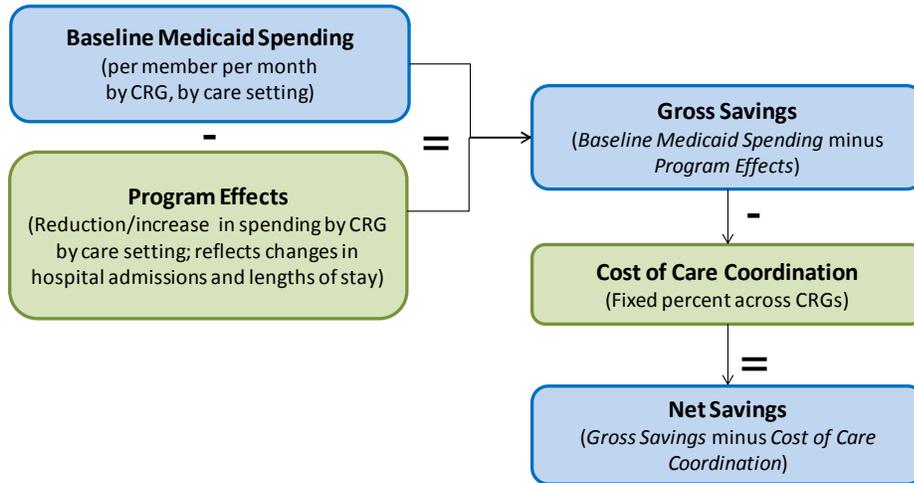
In order to estimate the impact on the Medicaid program of creating nationally designated pediatric networks for MCC, we used a cost accounting methodology similar to the process the Congressional Budget Office (CBO) uses to “score” legislation. The scoring window is 2014-2023. As noted above, we first estimated the number of eligible MCC, then the baseline costs to care for them under current law. Projected Medicaid spending is estimated to be \$47.1 billion in 2014 and \$97.9 billion in 2023.

Our next step was to determine how Medicaid spending could change for MCC participating in the nationally designated pediatric networks (program effect). The program effect comprises the “gross savings” accruing from care improvement processes. Published literature on existing care coordination programs for children was the primary data source we used to estimate program effects, or the potential differences in Medicaid spending between the baseline and the proposed new program of nationally designated pediatric networks.

We then calculated the difference between Medicaid spending at baseline and Medicaid spending under the nationally designated pediatric network to estimate “gross savings.” Finally, we subtracted the cost of care coordination incurred to achieve the program impact to estimate a “net savings” to the Medicaid program (both federal and state spending). This conceptual framework is presented in Exhibit 3 below.

Estimate of Potential Savings to Medicaid

Exhibit 3: Conceptual Framework for Savings Estimation Model, 2013-2024



Quantifying Program Effects

After we calculated the baseline spending for MCC, we subtracted the estimated Medicaid payments for MCC enrolled in the nationally designated pediatric networks. As discussed previously, these rates of reduction are called the “program effects.”

We performed a focused literature review to identify studies of care coordination interventions that demonstrated changes in utilization or costs for complex pediatric patients. Studies were included that measured differences between the utilization or health care spending for patients under a care coordination program compared to utilization or costs for patients receiving usual care. While the criteria for enrollment of children in these programs differed across studies, all selected studies investigated the effect of care coordination programs on a population of children with clinically complex or severe health conditions. Although numerous studies have shown implications of care coordination among the adult population, we excluded these studies due to the well-documented clinical differences between the pediatric and adult populations.

Results from the most relevant studies—in terms of the care coordination program, study design, and target population—are included in our evidence table (Appendix A) and are used to inform our cost estimation model. To be included in our evidence table, studies were required to report a change in costs by specific care setting. Additional utilization measures that could be directly tied to cost estimates, such as inpatient days PMPM, were also used as a proxy to estimate changes in costs under a care coordination program. All of the studies published to date have been pre/post designs, but randomized controlled experiments are underway in both Seattle and Houston (results not yet available).

Estimate of Potential Savings to Medicaid

Changes in utilization or costs under a care coordination program were calculated as percent change using the following formula

$$\text{Percent Change (\%)} = \frac{(\text{Utilization or Cost})_{\text{Program}} - (\text{Utilization or Cost})_{\text{Usual Care}}}{(\text{Utilization or Cost})_{\text{Usual Care}}}$$

A weighted average of reported changes in payment/utilization by each program was then calculated to reach our final assumptions used in the savings model. Exhibit 4 presents the fully implemented, weighted average percent change in Medicaid spending by care setting compared to baseline used in our model (see Appendix A for more detail).

Exhibit 4: Program Effects by Care Setting, Weighted by the Strength of the Evidence

Study Weight	High (1)				Medium (2)				Low (3)		Very Low (4)	Weighted Average
Reference Number	1	2	3	4	5	6	7	8	9	10	11	
Program Utilization Impact (% Change)												
Inpatient Facility	-51.7%	-59.0%			-43.0%			-79.7%	-31.5%	-36.1%	-33.3%	-40.0%
Outpatient Facility		3.1%						17.1%				10.0%
Emergency Room	14.7%	-12.0%	-0.3%	3.8%	-15.0%	-35.0%	10.8%	-34.8%		-49.2%	-37.3%	-20.0%
Primary Care Provider	72.1%			-0.2%								30.0%
Prescription Drugs		18.2%	3.8%	-12.3%						15.3%		10.0%

Source: Dobson | DaVanzo analysis of the published literature. See Exhibit A-7 for references.

Generally, we assumed that MCC in a pediatric network under the proposed legislation would have lower inpatient hospital and emergency room use, and would have higher outpatient hospital, primary care physician, and prescription drug use to offset their reduced reliance on facility-based acute care.

We assume that the program will not be operating at full efficiency until the fourth year (2017) and cannot immediately realize the full impact of care coordination, reductions in hospital and emergency room use, and increases in ambulatory care. We therefore phase in the impact of the nationally designated pediatric networks over four years according to the schedule presented in Exhibit 5.

Estimate of Potential Savings to Medicaid

Exhibit 5: Phase-in Schedule of Program Impact

Year	Percent of Program Impact Realized
Year 1 (2014)	10%
Year 2 (2015)	30%
Year 3 (2016)	60%
Year 4 (2017)	100%

The phase-in schedule in the model is intentionally conservative, as we believe that, if implemented at a national level, savings could be accelerated by the program as best practices are developed, disseminated, and adopted in nationally designated pediatric networks across the country.

Cost of Care Coordination

The difference between baseline Medicaid spending and the program effects represents “gross savings.” We offset gross savings with the increased cost to the Medicaid program of coordinating care for these patients, comprised of hiring nurse care coordinators to manage transitions across settings, medications, and communication with providers, as well as the clinical and administrative infrastructure necessary to support the program.

Characteristics of Successful Care Coordination Programs

In addition to understanding how much of an effect each program has on utilization and health care spending, we identified common aspects of the programs to which their success was attributed. Gordon et al. states that lack of care coordination leads to duplicative and inadequate care, patient/family stress, decreased safety, and increased costs; the key interventions of a successful care coordination program for pediatric patients with chronic medical complexities are: “(1) Partnering with the family and PCP, (2) familiarity with the child’s condition, (3) close involvement during hospitalizations, and (4) proactive outpatient care.”²⁶ Across the programs the authors examined, Gordon and colleagues identified several key aspects of each program that led to their success in improving the child’s care, while at the same time reducing costs in certain areas.

Seven of the programs reviewed established a primary medical home where the child’s primary care physician (PCP) served as the focal point of care. While having a PCP with an extensive knowledge of the child’s clinical history to consistently care and coordinate care for that patient is ideal, it is often not feasible due to logistical and economic constraints. PCPs can face difficulties in providing medical homes without assistance due to incomplete knowledge of community resources, distance from tertiary care centers,

²⁶ Gordon, J.B., Colby, H.H., Bartelt, T., Jablonski, D., Krauthoefer, M.L., Havens, P. (2007). A tertiary care primary care partnership model for medically complex and fragile children and youth with special health care needs. *Archives of Pediatric Adolescent Medicine* 161(10), 937–944.

Cost of Care Coordination

limited familiarity with unusual disorders and therapies, poor reimbursement for care coordination, and limited time.²⁷

While tertiary care programs provide a larger array of services, these programs also face difficulties in providing medical homes for MCC as their target population often live far away, increasing the burden on families through additional travel time for visits that could be substituted with community based care.²⁸ Therefore, a number of programs have incorporated a co-management team where the PCP works closely with a tertiary care center to coordinate the child's care and reduce the burden on the family.²⁹ Co-management teams also incorporated community support, through collaborations with social workers and other psychosocial professionals to better inform parents of community resources available to support them in caring for their child.³⁰

Another important aspect noted by several authors was the involvement of parents in clinical decisions, also known as “shared decision making.” Eight studies noted an increased involvement of families in clinical decisions, and benefits from better informing families of their child's care. According to one study, “shared decision-making allows families and clinicians to participate in decisions, exchange information, express preferences and negotiate a treatment plan. This limits the overuse of treatments that the patients do not value.”³¹ Shared-decision making has been shown to decrease utilization in children with special health care needs and increase patient and family satisfaction. It also leads to a reduced burden on families as parents are able to better plan their schedules ahead to account for their child's appointments. Ultimately, shared-decision making has led to an improved quality of life among parents of these patients.³²

Other studies indicated that having a nurse care coordinator serve as the primary point of contact was beneficial to the child's care, as the coordinator had an extensive knowledge of the patient's history and clinical needs given a reported problem. Having a nurse care coordinator also was reported to help reduce duplication of care, as he/she could inform specialists of the patients history, and was beneficial to parents as they knew exactly who

²⁷ Gordon, J.B., Colby, H.H., Bartelt, T., Jablonski, D., Krauthoefer, M.L., Havens, P. (2007). A tertiary care primary care partnership model for medically complex and fragile children and youth with special health care needs. *Archives of Pediatric Adolescent Medicine* 161(10), 937-944.

²⁸ Cohen, E., Friedman, J.N., Mahant, S., Adams, S., Jovcevska, V., Rosenbaum, P. (2010). The impact of a complex care clinic in a children's hospital. *Child Care Health and Development* 36(4), 574-582.

²⁹ Gordon, J.B., Colby, H.H., Bartelt, T., Jablonski, D., Krauthoefer, M.L., Havens, P. (2007). A tertiary care primary care partnership model for medically complex and fragile children and youth with special health care needs. *Archives of Pediatric Adolescent Medicine* 161(10), 937-944.

³⁰ Klitzner, T.S., Rabbitt, L.A., Chang, R.K. (2010). Benefits of care coordination for children with complex disease: a pilot medical home project in a resident teaching clinic. *Journal of Pediatrics* 156(6), 1006-1010.

³¹ Fiks, A.G., Mayne, S., Localio, A.R., Alessandrini, E.A., Guevara, J.P. (2012). Shared decision-making and health care expenditures among children with special health care needs. *Pediatrics* 129(1), 99-107.

³² Fiks, A.G., Mayne, S., Localio, A.R., Alessandrini, E.A., Guevara, J.P. (2012). Shared decision-making and health care expenditures among children with special health care needs. *Pediatrics* 129(1), 99-107.

Cost of Care Coordination

to contact if their child needed medical assistance.³³ Care coordinators also reported being able to reduce unnecessary ER visits by arranging home care for the patients.³⁴ As such, six studies also stated that having after-hours availability for patients to contact clinicians was an important aspect of any care coordination program and having a detailed patient history and personalized care plan helped to reduce unnecessary care.

Five studies reported using electronic medical records (EMRs), while three studies used personal health records that the patient carried with them to each appointment. The use of EMRs or personal health records helped to reduce time in taking a patient's history each time they saw a new clinician, and helped to reduce duplication of care as clinicians could see an extensive detailed history of their patient. This also helped to improve patient safety and quality of care because clinicians were better informed of their patient's medical condition. EMRs also facilitate in data analysis, which was also a common aspect across several of the programs we evaluated. Data analysis allows practices and hospitals to share data to examine program efficiencies, and facilitates the adoption of best practices to improve efficiencies and quality of care.³⁵

Evidence of Program Costs

Several of the published studies we reviewed provided information on the costs to the program for patient care coordination. These costs represent the direct salary and benefits of the nurse care coordinators, administrative staff, and clinicians hired or assigned part-time to work in the care coordination program. Although less well-understood, the costs of care coordination in general also include indirect overhead costs, such as information technology, data analytic capabilities, and other forms of infrastructure necessary to improve the quality of care and provide services for these patients.

Based on a limited number of sources in the literature and unpublished findings, as well as key informant interviews and informal discussions with CHA staff and members, we estimated a PMPM cost of 9 percent of total baseline Medicaid spending by CRG to coordinate care for MCC enrolled in a nationally designated pediatric network. In addition, we assume that care coordination efforts will also not be operating at full efficiency in 2014, and that implementation of the program will likely require spending above the 9 percent PMPM amount.

³³ Casey, P.H., Lyle, R.E., Bird, T.M., Robbins, J.M., Kuo, D.Z., Brown, C., et al. (2011). Effect of hospital-based comprehensive care clinic on health costs for Medicaid-insured medically complex children. *Archives of Pediatric Adolescent Medicine* 165(5), 392-398.

³⁴ Gordon, J.B., Colby, H.H., Bartelt, T., Jablonski, D., Krauthoefer, M.L., Havens, P. (2007). A tertiary care primary care partnership model for medically complex and fragile children and youth with special health care needs. *Archives of Pediatric Adolescent Medicine* 161(10), 937-944.

³⁵ Klein, C., LaCoste, J. (2011, July). Children's Healthcare Access Program 2010 Annual Report. SRA International, Inc.

Cost of Care Coordination

Consistent with the legislative proposal’s transition from fee-for-service to risk-based payments in the third year, we presume that care coordination will be operating at full efficiency (9 percent PMPM) by the third year (2016). We therefore phase in the costs of care coordination provided through the nationally designated pediatric network over three years according to the schedule presented in Exhibit 6.

Exhibit 6: Phase-in Schedule of Care Coordination Costs

Year	Percent of Base Year Care Coordination Costs	Effective PMPM Cost of Care Coordination
Year 1 (2014)	150%	13.5%
Year 2 (2015)	125%	11.3%
Year 3 (2016)	100%	9.0%

For example, the PMPM cost to coordinate care for CRG 5b is \$147 in 2014 (at 150 percent) and \$106 in 2016 (at 100 percent), while for CRG 8 the cost is \$678 in 2014 (150 percent) and \$488 in 2016 (100 percent). As with baseline Medicaid payments, we inflated these care coordination costs (by the medical CPI-U) from 2014 through 2023.

The weighted average of care coordination costs across CRGs is \$150.55 for the period 2014 to 2023 (including the phase-in during 2014 and 2015), which is comparable to the average care coordination fee negotiated between CMS and participants in the Medicare Coordinated Care Demonstration.³⁶

³⁶ Brown, R.S., Peikes, D., Peterson, G., Schore, J., & Razafindrakoto, C.M. (2012). Six features of Medicare Coordinated Care Demonstration programs that cut hospital admissions of high-risk patients. *Health Affairs* 31(6), 1156-1166.

Analytic Results

We estimated the potential impact on the Medicaid program for two policy alternatives:

- 1) National All-in Policy
- 2) State Opt-in Policy

Below we present the results for our analysis of these two policies.

National All-in Policy

As shown in Exhibit 7, if the CHA legislative proposal was adopted at a national level, under which all Medicaid children meeting the definition of MCC (CRGs 5b-9) were enrolled in a nationally designated pediatric network, the Medicaid program could save between \$6 billion (Model B) and \$26 billion (Model A), representing between roughly 1 and 4 percent net savings, respectively, from baseline Medicaid spending (including both federal and state dollars). Under Model C, the proposed pediatric network could save approximately \$17 billion, roughly 2.4 percent.

Exhibit 7: Summary of Medicaid Program Impact for National All-in Policy Models, 2014-2023 (Billions)

CRG	Cost (+) or Savings (-) by CRG		
	A) Targeted Efficiencies	B) Moderate	C) Moderate with Targeted Efficiencies
Baseline	\$698.7	\$698.7	\$698.7
5b	-2.4%	-0.6%	-2.4%
6	-3.2%	-1.2%	-3.2%
7	-5.5%	-3.3%	-5.5%
8	-11.3%	0.0%	0.0%
9	-5.2%	0.0%	0.0%
Gross Savings	-\$94.0	-\$73.8	-\$84.4
% Gross	-13.4%	-10.6%	-12.1%
Net Savings	-\$26.3	-\$6.2	-\$16.7
% Net	-3.8%	-0.9%	-2.4%

Source: Dobson | DaVanzo analysis of FY2008 MSIS and Truven Health Analytics analysis of MarketScan® Multi-State Medicaid Database of Medicaid patients under 18 enrolled 2009-2011 with standardized 2011 payment data.

Analytic Results

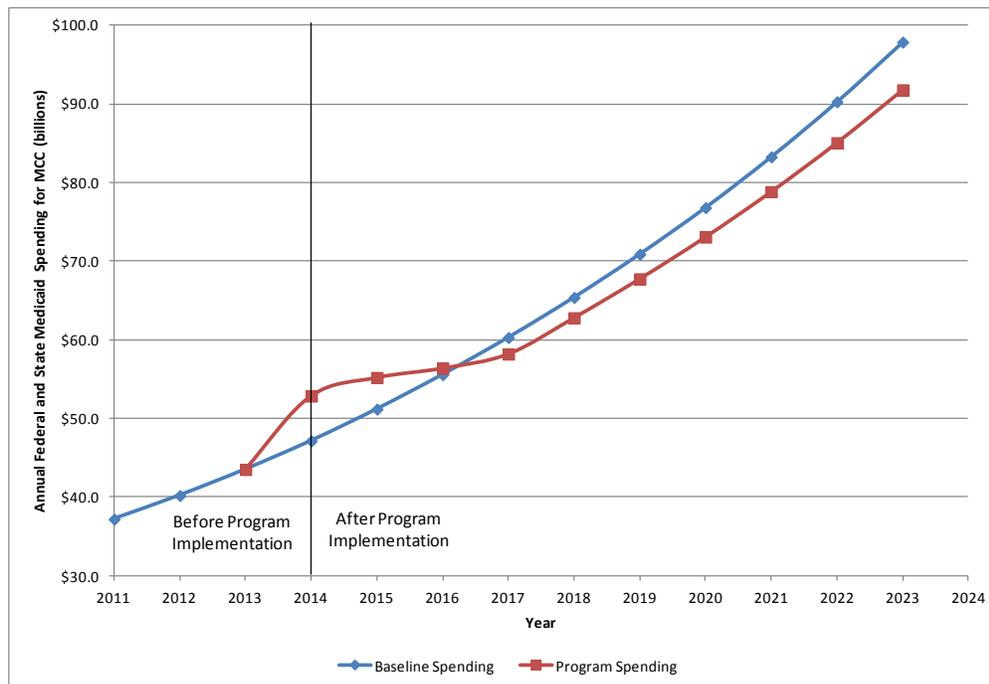
In Exhibit 8 we present the results of Model C (Moderate with Targeted Efficiencies) in greater detail. Under this model, we estimate the program will achieve approximately \$85 billion in gross savings, offset by \$68 billion in care coordination costs, for a net savings of \$17 billion (or 2.4 percent of baseline Medicaid spending) over the 10-year period 2014 to 2023. Exhibit 9 shows the impact of the program by year over the scoring window.

Exhibit 8: Medicaid Program Impact for National All-in Policy Model C, 2014-2023 (Billions)

	(1)	(2)	(3)	(4) = (2) + (3)	(5) = (4) / (1)
CRG	Baseline Spending	Gross Impact to Medicaid Program	Care Coordination	Net Cost (+) or Savings (-)	Percent Savings
5b	\$155.1	-\$18.8	\$15.0	-\$3.8	-2.4%
6	\$369.6	-\$47.4	\$35.7	-\$11.7	-3.2%
7	\$23.2	-\$3.5	\$2.2	-\$1.3	-5.5%
8	\$29.3	-\$2.8	\$2.8	\$0.0	0.0%
9	\$121.6	-\$11.8	\$11.8	\$0.0	0.0%
Total	\$698.7	-\$84.4	\$67.6	-\$16.7	-2.4%

Source: Dobson | DaVanzo analysis of FY2008 MSIS and Truven Health Analytics analysis of MarketScan® Multi-State Medicaid Database of Medicaid patients under 18 enrolled 2009-2011 with standardized 2011 payment data.

Exhibit 9: Medicaid Program Impact by Year for National All-in Policy Model C, 2014-2023 (Billions)



Source: Dobson | DaVanzo analysis of FY2008 MSIS and Truven Health Analytics analysis of MarketScan® Multi-State Medicaid Database of Medicaid patients under 18 enrolled 2009-2011 with standardized 2011 payment data.

During the first three years, the program is estimated to cost more than baseline Medicaid spending due to higher care coordination costs and lower estimated savings. However, as care coordination costs decrease and savings increase through gains in efficiency during years three and beyond, the program achieves savings for Medicaid over 10 years.

State Opt-in Policy

Under an alternative policy scenario, states could voluntarily opt into the nationally designated pediatric network program. To determine which states were most likely to opt-in, we developed two independent criteria in conjunction with staff at CHA for state inclusion in the model:

- 1) States that submitted a letter of support for the National Initiative for Children’s Healthcare Quality (NICHQ)/CHA medical home proposal to the Center for Medicare and Medicaid Innovation within CMS, or
- 2) States in which the governor has publicly supported Medicaid expansion under the Affordable Care Act (as of May 22, 2013).

Based on these criteria, we identified 33 states plus the District of Columbia as likely to voluntarily opt-in to a nationally designated pediatric network program. Exhibit 10 presents these states.

Exhibit 10: States Most Likely to Participate in the State Opt-in Policy

Opt-in States			
Arizona	Illinois	Nevada	Rhode Island
Arkansas	Indiana*	New Hampshire	Tennessee*
California	Kentucky	New Jersey	Texas
Colorado	Maryland	New Mexico	Utah
Connecticut	Massachusetts	New York	Vermont
Delaware	Michigan	North Dakota	Washington
District of Columbia	Minnesota	Ohio	West Virginia
Florida	Missouri	Oregon	
Hawaii	Montana	Pennsylvania	

* Indicates states with governors who support an alternative approach to the Medicaid expansion that did not submit a letter of support for the NICHQ/CHA medical home proposal.

Source: Dobson | DaVanzo and CHA.

To estimate the potential impact of the State Opt-in Policy on the Medicaid program, we first determined the proportion of total Medicaid children ages 0-18 represented by the 33 states and the District of Columbia shown in Exhibit 12. These states represent approximately 78 percent of Medicaid children. As 78 percent of the eligible population

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would therefore enroll in the nationally designated pediatric network program under a state opt-in policy, the program impact and savings estimates for the State Opt-in Policy therefore represent 78 percent of the comparable figures for the National All-in Policy presented in Exhibits 9 through 11 above. In addition, we assume that the case mix of the MCC population (or distribution of patients across the CRG categories 5b-9) in this sample of states is consistent with the case mix at the national level.

As shown in Exhibit 11, if the CHA legislative proposal was adopted at a state level, under which Medicaid children living in a state that voluntarily opts into the program and meeting the definition of MCC (CRGs 5b-9) were enrolled in a nationally designated pediatric network, the Medicaid program could save between \$5 billion (Model B) and \$21 billion (Model A), representing between roughly 1 and 3 percent net savings, respectively, from baseline Medicaid spending (including both federal and state dollars).

Exhibit 11: Summary of Medicaid Program Impact for State Opt-in Policy Models, 2014-2023 (Billions)

CRG	Cost (+) or Savings (-) by CRG		
	A) Targeted Efficiencies	B) Moderate	C) Moderate with Targeted Efficiencies
Baseline	\$698.7	\$698.7	\$698.7
5b	-1.9%	-0.4%	-1.9%
6	-2.5%	-1.0%	-2.5%
7	-4.3%	-2.6%	-4.3%
8	-8.8%	0.0%	0.0%
9	-4.0%	0.0%	0.0%
Gross Savings	-\$73.3	-\$57.6	-\$65.8
% Gross	-10.5%	-8.2%	-9.4%
Net Savings	-\$20.6	-\$4.8	-\$13.1
% Net	-2.9%	-0.7%	-1.9%

Source: Dobson | DaVanzo analysis of FY2008 MSIS and Truven Health Analytics analysis of MarketScan® Multi-State Medicaid Database of Medicaid patients under 18 enrolled 2009-2011 with standardized 2011 payment data.

In Exhibit 12 we present the results of Model C (Moderate with Targeted Efficiencies) in greater detail. Under this model, we estimate the program will achieve approximately \$66 billion in gross savings, offset by \$53 billion in care coordination costs, for a net savings of \$13 billion (or 2 percent of baseline Medicaid spending) over the 10-year period 2014 to 2023. Exhibit 13 shows the impact of the program by year over the scoring window.

As with the National All-in Policy, under the State Opt-in Policy baseline Medicaid spending is lower in the first three years but the program achieves savings for Medicaid over 10 years as care coordination costs decrease and savings increase through gains in efficiency during years three and beyond.

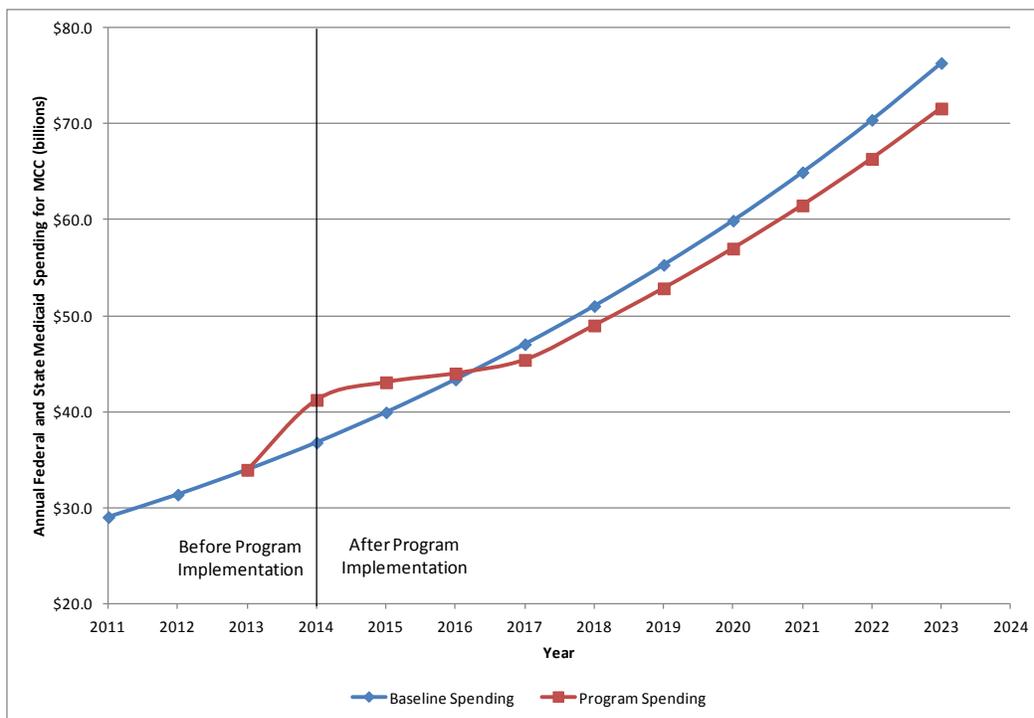
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Exhibit 12: Medicaid Program Impact for National All-in Policy Model C, 2014-2023 (Billions)

CRG	(1) Baseline Spending	(2) Gross Impact to Medicaid Program	(3) Care Coordination	(4) = (2) + (3) Net Cost (+) or Savings (-)	(5) = (4) / (1) Percent Savings
5b	\$155.1	-\$14.7	\$11.7	-\$3.0	-1.9%
6	\$369.6	-\$37.0	\$27.9	-\$9.1	-2.5%
7	\$23.2	-\$2.7	\$1.8	-\$1.0	-4.3%
8	\$29.3	-\$2.2	\$2.2	\$0.0	0.0%
9	\$121.6	-\$9.2	\$9.2	\$0.0	0.0%
Total	\$698.7	-\$65.8	\$52.7	-\$13.1	-1.9%

Source: Dobson | DaVanzo analysis of FY2008 MSIS and Truven Health Analytics analysis of MarketScan® Multi-State Medicaid Database of Medicaid patients under 18 enrolled 2009-2011 with standardized 2011 payment data.

Exhibit 13: Medicaid Program Impact by Year for State Opt-in Policy Model C, 2014-2023 (Billions)



Source: Dobson | DaVanzo analysis of FY2008 MSIS and Truven Health Analytics analysis of MarketScan® Multi-State Medicaid Database of Medicaid patients under 18 enrolled 2009-2011 with standardized 2011 payment data.

Sensitivity Analyses

To better understand the potential impact of the CHA legislative proposal on the Medicaid program, we conducted a series of sensitivity analyses by modifying the basic assumptions in our cost estimation model as described above. Through these sensitivity

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analyses, we developed a range of potential program impacts. The range of modified assumptions is summarized in Exhibit 14 below.

Exhibit 14: Summary of Modified Assumptions for Sensitivity Analysis, Models A-C

Model	Reductions for Inpatient Facility	Increases for Primary Care Provider	Savings Potential across CRGs
A) Targeted Efficiencies	CRGs 5b-7: 40% - 2014-2017, increasing to 50% by 2023; CRGs 8-9: 40% - 2014-2023	CRGs 5b-7: 30% - 2014-2017, decreasing to 20% by 2023; CRGs 8-9: 30% - 2014-2023	100% all CRGs following phase-in
B) Moderate	CRGs 5b-9: 40% - 2014-2023	CRGs 5b-9: 30% - 2014-2023	5b-7 – 100% 8 – 46% (budget neutral) 9 – 65% (budget neutral)
C) Moderate with Targeted Efficiencies	CRGs 5b-7: 40% - 2014-2017, increasing to 50% by 2023; CRGs 8-9: 40% - 2014-2023	CRGs 5b-7: 30% - 2014-2017, decreasing to 20% by 2023; CRGs 8-9: 30% - 2014-2023	5b-7 – 100% 8 – 46% (budget neutral) 9 – 65% (budget neutral)

In Model A—which we refer to as the “Targeted Efficiencies” model—we assume that after the program has achieved its full savings potential in 2017, reductions in inpatient care will grow from 40 percent to 50 percent of baseline Medicaid spending and increases in primary care will be lowered from 30 percent to 20 percent by 2023. We model this assumption on the basis that savings potential will increase as the program matures and best practices are widely adopted. However, we limited these efficiency gains to CRGs 5b-7. Additional savings may be difficult to achieve in CRG 8 (dominant or metastatic cancers), in which care already frequently follows standard clinical protocols, and CRG 9 (catastrophic conditions), which is the most severe and unpredictable CRG.

In Model B—which we refer to as the “Moderate” model—we assume that reductions in inpatient spending (40 percent) and increases in primary care spending (30 percent) remain constant from 2017, when full savings potential has been achieved, to 2023. In addition, we assume that cost of care coordination for patients in CRGs 8 and 9, given the clinical considerations for these patients, offsets all potential program savings for these patients (i.e., these CRGs are “budget neutral”).

In Model C—which we refer to as the “Moderate with Targeted Efficiencies” model—we assume that the program remains budget neutral for CRGs 8 and 9 but that efficiencies in inpatient care and primary care can be achieved for the patients in CRGs 5b-7.

Actuarial Review of Model Assumptions

As described earlier, in August 2013, CHA submitted a grant application to the CMMI HCIA Round 2 process. Through this grant application, CHA proposed to implement a care delivery and payment system reform at nine children’s hospitals across the country targeted to the Medicaid MCC population. Although smaller in magnitude, the care delivery intervention proposed under the CMMI grant application shares many of the same aspects as the program outlined above in the legislative proposal. These aspects of care include the importance of care coordination, the role of primary care physicians, increased communication among members of a pediatric patient’s care team, and shared decision making between the physician and the patient/patient’s family. In addition, the intervention would focus on reducing hospital inpatient and emergency room care through increases in outpatient hospital and primary care, as well as better management of and adherence to prescription drugs.

As a requirement of the grant application, CHA obtained actuarial review and certification from Milliman, Inc. (Milliman) of its financial model, which estimated the total amount of health care spending that could be reduced for a target population given the proposed intervention and funding request for the grant. Dobson | DaVanzo was commissioned by CHA to develop the CHA HCIA grant application financial model. The CHA financial model was based on many of the assumptions underlying the model constructed by us to estimate savings from the CHA legislative proposal as described above.

After a thorough review of the assumptions and source data, the Milliman actuaries assigned to review CHA’s financial model certified the reasonableness of the assumptions and projections. Milliman concluded that, “[CHA’s] attention to model detail, sophistication of the analysis, and the quality of the supporting evidence are appropriate.”

Actuarial Review of Model Assumptions

Below we highlight and discuss several of the key assumptions on which the financial model, and hence the legislative proposal savings estimation model, is based.

Target Population and Baseline Spending

To estimate the total number of Medicaid MCC potentially eligible to participate in the program, we used the total number of Medicaid enrollees age 0 to 18 by state from the 2008 Medicaid Statistical Information System (MSIS) data file. We then applied percentages calculated by Truven (using three years of Medicaid claims data from a 12-state sample) to estimate the total number of Medicaid MCC by CRG, and inflated this population annually by a growth rate of 5 percent. Milliman concluded that, “[t]his data source and approach is reasonable and appropriate.”

To estimate baseline health care spending on Medicaid MCC, we used per-member per-month (PMPM) estimates from 2011 calculated by Truven (using three years of Medicaid claims data from a 12-state sample) for each site of service, and then adjusted prices each year for inflation using the Medicare market basket (when available) or the medical urban consumer price index (CPI-U). Milliman concluded that, “[t]his data source and calculation approach is reasonable and appropriate given the difficulty in obtaining state-specific Medicaid data.”

Effect of Program on Medicaid Health Care Spending

To estimate the potential impact on spending of the proposed care coordination program for MCC, we: 1) reviewed the literature on medical homes and other existing children’s hospital-based programs targeted to MCC; 2) conducted key informant interviews with clinicians, as well as hospital and health plan administrators, at children’s hospitals; and 3) reviewed final assumptions with two advisory bodies organized by CHA—the Finance Work Group and the Medical Home Network Team—that included both clinicians with expertise in MCC and children’s hospital administrators.

In both the CMMI financial model and the legislative proposal savings estimate, we project that a broad-based care coordination program for MCC could achieve the following savings (-) or costs (+) by care setting:

Care Setting	Program Impact
Inpatient Facility	-40.0%
Outpatient Facility	10.0%
Emergency Room	-20.0%
Primary Care Provider	30.0%
Prescription Drugs	10.0%

Milliman raised concerns with the estimate of 40 percent savings in the inpatient setting,

Actuarial Review of Model Assumptions

citing other studies of patient-centered medical homes (PCMHs) in the Medicare program that found little to no savings. Given the primarily pre-/post- study designs of the studies included in the literature review, Milliman also raised concerns about regression to the mean.

In addition to our literature review, Milliman identified other sources evaluating the effect of care coordination on health care spending, including the results of a randomized controlled trial presented at the 2013 Pediatric Academic Societies Annual meeting.³⁷

³⁸This study found a 45.6 percent reduction in inpatient hospital use and a 42.9 percent reduction in emergency room use for MCC enrolled in a care coordination program, which Milliman considered to be an upper bound on the potential reduction in hospital and emergency room care for this population. After adjusting the savings estimates above for reversion to the mean, Milliman stated that, “[t]he savings assumptions in the financial template are within the range of reasonable assumptions, although near the top of the range.”

Based on its independent review of the literature, interviews with clinicians, and analysis of claims data for trends in reversion to the mean, Milliman summarizes its conclusion as follows: “our conclusions (after reviewing the studies available to us) is that PCMHs can produce significant savings for a small subset of the population (the subset with high costs), and the best performers produce savings consistent with the CHA assumptions.”

Conclusion

The purpose of this report was to synthesize the findings of each of the four studies sponsored by CHA and to show how they relate to each other. The four studies together build a picture of a distinct and unique population of MCC that has multiple complex conditions and need for a specialized and coordinated regimen of care. The review of the literature by Berry and colleagues establishes the clinical rationale for considering MCC as a distinct population group. The Truven study then presents claim-based information on the size of the MCC population and their Medicaid utilization and spending. Using these two studies as inputs, Dobson | DaVanzo develops a methodology to estimate the impact on the Medicaid program if care for this complex population was structured in a series of risk-bearing pediatric networks. Finally the Milliman actuarial review of the CHA HCIA grant application certifies the reasonableness of the Dobson | DaVanzo model assumptions. Each of the four bodies of research are interdependent and together present a compelling case for the proposed legislation.

³⁷ Mosquera RA, Tyson JE, Avritscher EB, Pedroza C, Harris TS, Samuels CL. An Enhanced Medical Home Providing Comprehensive Care (CC) to High-Risk Chronically Ill (CI) Children: A Randomized Trial (RCT). *Publication 3618.6*

³⁸ Peikes D, Zutshi A, Genevro, et al. (2012) Early evaluations of the medical home: Building on a promising start. *Am Jour Managed Care*; 18(2):105-116.