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Patient-Centered Medical Homes:
A Review of the Evidence

The Washington State Legislature directed the Washington State Institute for Public Policy (WSIPP) to "calculate the return on investment to taxpayers from evidence-based prevention and intervention programs and policies."[1] Additionally, WSIPP's Board of Directors authorized WSIPP to work on a joint project with the MacArthur Foundation and the Pew Charitable Trusts to extend WSIPP's benefit-cost analysis to health care topics.

As part of the Pew-MacArthur Results First Initiative, the "patient-centered medical home" (PCMH) was identified as an important health care topic for states. About half the states, including Washington, have implemented PCMH pilot projects for Medicaid enrollees.

This study reviews evidence on the effectiveness of patient-centered medical homes in reducing emergency department utilization, hospitalizations, and total medical costs.[2] In a subsequent report, WSIPP will present benefit-cost results for medical homes.

Summary

WSIPP's Board of Directors authorized WSIPP to work on a joint project with the MacArthur Foundation and the Pew Charitable Trusts to extend WSIPP's benefit-cost analysis to health care topics. The Pew-MacArthur Results First Initiative identified patient-centered medical homes (PCMHs) as an important health care topic for states. One important goal is to determine whether PCMHs help states control Medicaid and other health care costs.

The PCMH model attempts to make health care more efficient by restructuring primary care. The aims are to: (a) facilitate care coordination across providers; (b) ensure that all the patient's care needs (preventive, acute, chronic, and mental health) are met; (c) promote care quality and patient safety; (d) increase responsiveness to patient preferences and needs; and (e) enhance access to care.

We identified and reviewed 11 credible research studies on the effectiveness of PCMHs in reducing emergency department utilization, hospitalizations, and total medical costs. We found some evidence that PCMHs in integrated health care settings can reduce emergency department visits. However, we did not find evidence that PCMHs significantly reduce hospitalizations or the total cost of health care.

Much of the evidence we examined is for PCMHs for general patient populations. PCMHs may potentially be more effective when targeted at higher risk populations, but more research is needed on this topic.

In a subsequent report, WSIPP will present benefit-cost results for PCMHs.

[1] Engrossed Substitute House Bill 1244, Section 610(4), Chapter 564, Laws of 2009.

[2] These results have been summarized in a December 2014 WSIPP report: Bauer, J., Kay, N., Lemon, M., & Morris, M. (2014). *Interventions to promote health and increase health care efficiency: A review of the evidence*, (Doc. No. 14-12-3402). Olympia: Washington State Institute for Public Policy.

I. Background

The Patient-Centered Medical Home (PCMH) model attempts to increase health care efficiency by restructuring primary care. Definitions of PCMH vary, but medical homes typically include the following features.[3]

- Team-based: care is provided by a cohesive clinical team; a primary point of contact coordinates care where team members have defined roles and shared accountability.
- Comprehensive: most health care needs (preventive, acute, chronic, and mental health) are addressed by medical home providers.
- Coordinated: a care manager coordinates services with primary care providers, specialists, hospitals, and community service providers.
- Quality and safety: practices adopt system-based approaches to quality: evidence-based medicine, clinical decision-support tools, electronic health records, methods to track care, and identification of high-risk patients.
- Patient-centered: care is responsive to patient preferences and needs; decision-making is shared; patients are given self-management support.
- Enhanced access: expanded office hours, shorter waiting times for urgent needs, and enhanced communication (online or telephone) are emphasized.

[3] See Peikes et al., 2011; Jackson et al., 2013; and Bao et al., 2013. PCMH definitions have been proposed by the Patient Centered Primary Care Collaborative, the Agency for Healthcare Research and Quality (AHRQ) and the National Committee for Quality Assurance (NCQA). The NCQA has set standards for medical homes and offers PCMH certification to providers. Some evaluations rely on NCQA certification to identify medical homes; others define medical homes based on practices having implemented many of the components listed above.

Medical homes span two dimensions—provider structure and patient population. Both physician-led primary care practices and integrated health delivery systems have established medical homes. Some implementations include general patient populations, while others recruit high-risk elderly or chronically ill patients.

The *Medicaid Health Home*, a more recent variant of the PCMH model, focuses on comprehensive care for patients with serious mental illness and substance abuse disorders.[4] Because WSIPP has previously reviewed the literature on health homes, in this report, we review PCMH studies with general patient populations, chronically ill patients, and elderly patients.

PCMH providers typically receive a per-member per-month (PMPM) care management payment, in addition to traditional fee-for-service payments, for establishing medical homes. Payers (private health insurers, Medicaid, Medicare) may also provide pay-for-performance bonuses, usually for meeting certain quality measures.

About half the states, including Washington, have implemented PCMH pilot projects for Medicaid enrollees.[5] Most pilot projects pay providers a PMPM fee aligned with a set of qualification standards, usually the National Committee for Quality Assurance (NCQA) medical home recognition.

[4] See Bao et al., 2013. WSIPP has reviewed the evidence on health homes; those findings are reported on our website: http://www.wsipp.wa.gov/BenefitCost

[5] Takach, 2012 & 2011.

II. Research Methods

When WSIPP carries out study assignments from the legislature to identify what works in public policy, we implement a set of standardized procedures. We analyze all available high-quality studies to identify program effects. We look for research studies with strong evaluation designs and exclude studies with weak research methods.

Given the weight of the evidence, we calculate an average expected effect ("effect size") of a policy on a particular outcome of interest, and estimate the margin of error for that effect.

An effect size measures the degree to which a program has been shown to change an outcome (such as hospital admissions) for program participants relative to a comparison group. For this review, we estimate effects using data for the longest reported follow-up in an evaluation, typically two to three years for these studies. Our methodology is described in detail in WSIPP's Technical Documentation.[6]

For this review, we searched PubMed, Google Scholar, and the Cochrane Library for studies published through September 2014. After examining abstracts, we conducted full reviews of 67 studies and 11 of these were included in the meta-analysis. The included studies met our methodological requirements and reported the outcomes of interest discussed earlier. Only two evaluations utilized a randomized controlled study design. The majority of included studies used an observational, quasi-experimental design, which typically examined outcomes before and after PCMH implementation relative to a comparable group of physician practices.

[6] Mean effects are derived using inverse variance weights, and adjustments are made for clustering when studies do not do so. For a discussion of WSPP's study selection criteria and meta-analysis methodology, please refer to the following report. Washington State Institute for Public Policy, (2014). *Benefit-cost technical documentation,* Olympia, WA: Author.
http://www.wsipp.wa.gov/TechnicalDocumentation/WsippBenefitCostTechnicalDocumentation.pdf

III. Meta-Analysis Findings

While the evidence base is growing, researchers face methodological challenges in evaluating and comparing outcomes for PCMH implementations. Few studies are randomized controlled trials, and results are often subject to potential statistical biases because practices volunteer to become medical homes. In addition, many studies include too few physician practices; thus they may lack the statistical power to identify variation in medical home providers and detect effects on utilization or costs.[7]

We reviewed evidence on the effectiveness of PCMHs in reducing emergency department visits, hospitalizations, and total medical costs. We report average effect sizes for all PCMHs, those in integrated health systems, those in physician-led practices, and implementations that recruit high-risk patients.[8]

Emergency Department Visits

We find emerging evidence that PCMHs can reduce emergency department visits (Exhibit 1).[9] Across the eight studies in our analysis, medical home implementations reduce visits by about 3%. The most significant result is for a PCMH in a large integrated health delivery system.[10] Among those in smaller, physician-led practices, the results are less robust.[11]

In addition to our own meta-analysis of the effect of PCMHs on emergency department visits, we located two other systematic reviews. These other reviews also report mixed results for PCMH effects on emergency department utilization.[12]

[7] See Appendix A2 for a more extensive discussion of methodological issues.
[8] See Appendix Exhibit A1 for individual study descriptions and findings.

[9] We use an intraclass correlation coefficient (ICC) of 0.038 to adjust estimates for studies that do not take participant clustering into account. This ICC is based on estimates reported by Dale & Lundquist, 2011; Huang et al., 2005; Leff et al., 2009; Littenberg & MacLean, 2006; and Rosenthal et al., 2013. Sensitivity analysis, allowing the ICC to vary between 0.01 and 0.10, suggests that inferences are not sensitive to choice of ICC.
[10] Reid et al., 2013 examined a PCMH pilot project at Group Health Cooperative in Washington State.
[11] Three studies also report effects on ambulatory care sensitive (ACS) emergency department visits—Friedberg et al., 2014; Rosenthal et al., 2013; and Werner et al., 2013. The average effect size for ACS visits is also not significant.
[12] Jackson et al., 2013 and Williams et al., 2012.

Exhibit 1

Emergency Department Utilization Effects

Implementation type	Average effect size	Standard error	p-value	Number of studies	Number in treatment groups
All types[(1)]	-0.019	0.010	0.049	8	459,478
Integrated health system[(2)]	-0.032	0.004	0.000	1	305,578
Physician-led practices (by target populations)					
All populations[(3)]	-0.015	0.010	0.148	7	153,900
General patient populations[(4)]	-0.013	0.012	0.251	5	122,753
High-risk patients[(5)]	-0.034	0.030	0.252	3	31,147

Studies included:
(1) Reid et al., 2013; Boult et al., 2011; Werner et al., 2013; David et al., 2014; Wang et al., 2014; Friedberg et al., 2014; Rosenthal et al., 2013; Fifield et al., and 2013.
(2) Reid et al., 2013.
(3) Boult et al., 2011; Werner et al., 2013; David et al., 2014; Wang et al., 2014; Friedberg et al., 2014; Rosenthal et al., 2013; and Fifield et al., 2013.
(4) Werner et al., 2013; David et al., 2014; Friedberg et al., 2014; Rosenthal et al., 2013; and Fifield et al., 2013.
(5) Boult et al., 2011; David et al., 2014; and Wang et al., 2014.

Hospital Admissions

We located eight studies that measure hospital admissions as an outcome.[13] We find no observable effect of PCMHs on hospital admissions, on average (Exhibit 2).[14]

Total Cost of Care

We located six studies that measure total cost of care. We find no significant effect on total cost of care (Exhibit 3).[15] Again, our meta-analytic result is consistent with published systematic reviews conducted by others.[16]

[13] Reid and colleagues (2010) evaluated a medical home implementation at Group Health Cooperative, a large integrated health care system in Washington. They found the PCMH reduced admissions. In a later study for Group Health Cooperative, included in our analysis, Reid and colleagues (2013) found no significant effect on hospital admissions after accounting for patient clustering.

[14] Estimates use an intraclass correlation coefficient (ICC) of 0.022 to correct of participant clustering when the study does not; this ICC is based on averaging across estimates reported by Dale & Lundquist, 2011; Huang et al., 2005; Leff et al., 2009; and Rosenthal et al., 2013. Sensitivity analysis, allowing the ICC to vary between 0.01 and 0.10, indicates that estimates do not change substantially.

[15] We use an intraclass correlation coefficient (ICC) of 0.026 to adjust estimates when a study does not take participant clustering into account. This ICC is based on averaging across estimates reported by Dale & Lundquist, 2011 and Campbell et al., 2001. Sensitivity analysis, allowing the ICC to vary between 0.01 and 0.10, indicates that inferences are not sensitive to the choice of ICC.

[16] A comprehensive review by Peikes et al., (2012) identified four rigorous evaluations reporting effects on total patient costs. Only one evaluation found evidence of savings for a high-risk subgroup of Medicare enrollees. Two other systematic reviews found no evidence of cost savings—Williams et al., 2012 and Jackson et al., 2013.

Exhibit 2

Hospital Admission Effects

Implementation type	Average effect size	Standard error	p-value	Number of studies	Number in treatment groups
All types[(1)]	0.001	0.003	0.847	8	385,985
Integrated health system[(2)]	0.001	0.004	0.766	2	314,212
Physician-led practices[(3)]	-0.0004	0.005	0.934	6	71,778

Studies included:
(1) Reid et al., 2013; Boult et al., 2011; Werner et al., 2013; Wang et al., 2014; Friedberg et al., 2014; Rosenthal et al., 2013; Fifield et al., 2013; and Gilfillan et al., 2010.
(2) Reid et al., 2013 and Gilfillan et al., 2010.
(3) Boult et al., 2011; Werner et al., 2013; Wang et al., 2014; Friedberg et al., 2014; Rosenthal et al., 2013; and Fifield et al., 2013.

Exhibit 3

Total Cost of Care Effects

Implementation type	Average effect size	Standard error	p-value	Number of studies	Number in treatment groups
All types [(1)]	0.004	0.006	0.431	6	75,632
Integrated health system[(2)]	-0.021	0.071	0.771	2	15,652
Physician-led practices[(3)]	0.005	0.006	0.416	4	59,980
High-risk patients [(4)]	-0.040	0.029	0.178	3	12,472

Studies included:
(1) Reid et al., 2010; Werner et al., 2013; Wang et al., 2014; Friedberg et al., 2014; Fifield et al., 2013; and Gilfillan et al., 2010.
(2) Reid et al., 2010 and Gilfillan et al., 2010.
(3) Werner et al., 2013; Wang et al., 2014; Friedberg et al., 2014; and Fifield et al., 2013.
(4) Wang et al., 2014; Gilfillan et al., 2010; and Fishman et al., 2012. These include two integrated health system and one physician-led practice implementation.

Other Outcomes

Our meta-analysis focuses on outcomes where costs and benefits can be determined through economic analysis—emergency department visits, hospital admissions, and total cost of care.

Evaluations completed to date have found mixed results for other outcomes associated with PCMHs. Studies find small to moderate positive effects on both patient and provider experiences and on some measures of care quality.[17] However, the evidence on health outcomes is inconclusive; a few studies find improvements in patient outcomes while other studies show no effect.[18] It is difficult to estimate monetary benefits for many outcomes included in these studies.

[17] Jackson et al., 2013; Williams et al., 2012; Friedberg et al., 2014; and Arend et al., 2012.
[18] Jackson et al., 2013; Peikes et al., 2012; Williams et al., 2012; and Jaen et al., 2010.

IV. Conclusions

Our review of PCMHs produced mixed results. While we found some evidence that PCMHs can reduce emergency department visits, we did not find evidence that PCMHs significantly reduce hospitalizations or the total cost of care.

Much of the evidence we examined is for PCMHs in physician-led practices with general patient populations. PCMHs may potentially be more effective when targeted at higher risk populations, but more research will be needed on this topic.[19]

In a subsequent report, WSIPP will present benefit-cost results for PCMHs.

[19] Ackroyd & Wexler, (2014) found that several demonstration projects have shown better diabetes health outcomes and prevention of inpatient and emergency room visits. However, they conclude that it is not clear whether the PCMH model can lower the cost of care in diabetes populations. Some programs cite cost savings, other do not.

Appendix

Patient-Centered Medical Homes: A Review of the Evidence

A1. Program Descriptions and Study-Level Results

Exhibit A1

Studies Included in the Meta-Analysis

Citation	Study description	Population	Number of practices/clinics	Controls for clustering	WSIPP-computed effect sizes			Reported outcomes*		
					Emergency department visits	Hospital admissons	Total costs	Emergency department visits	Hospital admissons	Total costs
Boult et al., 2011	Cluster randomized control study of Guided Care model in practices in Baltimore and Washington, DC	Elderly (age 65+), high risk	7 PCMH, 7 comparison		0.020	0.007	na	no significant effect	no significant effect	na
David et al., 2014	Observational study (difference-in-difference with practice fixed effects; exploits differences in implementation timing); evaluates practices receiving NCQA medical home recognition in Philadelphia area; separate analyses for chronic and non-chronic populations	Chronically ill	280 PCMH		-0.043	na	na	5.2% reduction; significant	na	na
		Not chronic	280 PCMH		-0.005	na	na	no significant effect	na	na
Fifield et al., 2013	Cluster randomized control study of a single-payer PCMH implementation of independent primary care practices in New York; PCMH status determined by NCQA recognition	All Adults	18 PCMH, 14 comparison	Yes	-0.065	-0.023	0.001	3.8 fewer ED visits per physician per year; significant (P=0.002)	no significant effect	no significant effect
Fishman et al., 2012	Observational study (pre-post evaluation comparing single pilot clinic to 19 comparison clinics; controlling for age, gender, baseline risk score, baseline costs); evaluates Group Health Cooperative PCMH pilot	Elderly (age 65+)	1 PCMH,19 comparison		-0.120	-0.020	-0.006	21% reduction; significant (P<0.001)	no significant effect	no significant effect
Friedberg et al., 2014	Observational study (difference-in-difference with comparison group; extensive controls for baseline utilization and cost, practice-level and patient characteristics; propensity score weighting); evaluates practices participating in the SE Pennsylvania Chronic Care Initiiative; NCQA PCMH recognition	All patients	32 PCMH, 39 comparison	Yes	0.005	0.004	0.009	no significant effect	no significant effect	no significant effect
Gilfillan et al., 2010	Observational study (pre-post analysis with propensity-selected control practices; patient-level controls for risk score); evaluates the ProvenHealth Navigator PCMH model at Geisinger Health System in Pennsylvania	Elderly (age 65+)	11 PCMH, 75 comparison		na	-0.046	-0.020	na	18% reduction; significant (P<0.01)	no significant effect
Reid et al., 2010	Observational study (pre-post evaluation comparing single pilot clinic to 19 comparison clinics; controlling for age, gender, baseline risk score, baseline costs); evaluates Group Health Cooperative PCMH pilot.	All patients	1 PCMH,19 comparison		-0.040	-0.033	-0.022	30% reduction; significant (P<0.001)	5.6% reduction; significant (P=0.007)	2% reduction; marginally signficant (P=0.076)
Reid et al., 2013	Observational study (interrupted time series with comparison group; controls for member demographics, education, income, health plan and benefits, case mix); evaluates extension of PCMH pilot to all Group Health Cooperative clinics	All patients	26 PCMH	Yes	-0.032	0.001	na	18% reduction; significant (P<0.001)	no significant effect	na
Rosenthal, 2013	Observational study (interrupted time series with propensity-scored matched comparison practices; controls for age, sex, comorbidity index); evaluates multiple-payer PCMH pilot including 5 independent practices in Rhode Island; NCQA PCMH recognition	All members under 65	5 PCMH, 34 comparison	Yes	-0.011	-0.004	na	no significant effect	no significant effect	na
Wang et al., 2014	Observational study (difference-in-difference with comparision practices; propensity score matching; controls for age, gender, risk score comorbidities, diabetes type); evaluates 26 Pennsylvania practices with NCQA PCMH recognition	Diabetics	26 PCMH, 97 comparison	Yes	-0.037	0.021	-0.044	no significant effect	no significant effect	no significant effect
Werner et al., 2013	Observational study (difference-in-difference with mached comparison practices; propensity score matching at practice-level; patient-level controls for age, sex, risk score); evaluates single-payer medical home demonstration with 8 independent practices in New Jersey	All patients	8 PCMH, 24 comparison	Yes	0.002	0.000	0.002	no significant effect	no significant effect	no significant effect

* Reported outcomes and effect sizes are for the longest reported follow-up in a study. This is typically two to three years.

A2. Methodological Issues in PCMH Evaluations

Small sample sizes and patient clustering—Most studies of PCMHs include relatively small numbers of clinics or physician practices. Medical homes are established at the practice or clinic level, and the number of practices included in a study is critical to the validity of an evaluation. For example, a study might include thousands of patients. However, if these patients are based in only a few large clinics, the study may lack the statistical power to identify variation in medical home providers and detect effects on utilization or costs.

The number of practices required for an evaluation depends on the extent to which patient outcomes are correlated (or clustered) within a practice. If providers strongly influence patient outcomes, this clustering issue would be important, and evaluation results might vary substantially depending on which providers were included in intervention and comparison groups. Studies that fail to explicitly account for clustering in medical practices can overstate the statistical significance of their findings.[20]

Substantial variation in utilization and costs—A related problem occurs when there is wide variation in costs of care and utilization rates for some services (e.g., hospital admissions) across providers. The high variance makes it difficult to isolate the effects of medical homes from disparities that may normally occur (random variation). Patient outcomes in the general population typically display wide variation—a portion of the population has little or no utilization and another segment may have heavy utilization. By including this range of outcomes, it is typically more difficult to observe program impacts. On the other hand, studies may find significant effects for chronically ill patients since utilization and costs vary less among this subset of high risk patients.[21]

Study design and selection bias—Only a few randomized controlled trials of PCMHs have been conducted. Most completed studies are observational; examining outcomes before and after implementation in practices that choose to become medical homes. The better evaluations identify comparison practices that are similar to pilot practices in terms of numbers of providers, physician specialties, use of healthcare information technology, patient demographics, and baseline utilization and costs. Without random assignment of provider practices, even the best observational studies are subject to potential selection biases. This selection bias can occur because practices volunteer to become medical homes.[22] Selection bias can also arise when patients can opt into medical homes.[23]

[20] Peikes et al.,2011. In our meta-analyses we used intra-class correlation coefficients to account for patient clustering when studies did not do so.
[21] Ibid.
[22] See Peikes et al., 2012; Alexander & Bae, 2012; and Devries et al., 2012.
[23] For example, Medicare members in Geisinger Health Plan had the opportunity to opt into practices implementing the Personal Health Navigator medical home model. Ackroyd & Wexler (2014) note that outcomes are compared between those who opted in versus those who did not, potentially confounding results.

A3. Studies Included in the Meta-Analysis

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Washington State Institute for Public Policy

The Washington State Legislature created the Washington State Institute for Public Policy in 1983. A Board of Directors—representing the legislature, the governor, and public universities—governs WSIPP and guides the development of all activities. WSIPP's mission is to carry out practical research, at legislative direction, on issues of importance to Washington State.