



**Impact of Primary Care on  
Healthcare Cost and Population Health  
A Literature Review**

February 23, 2012

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### **Executive Summary**

Many healthcare professionals and public health advocates believe improving access to primary care, expanding utilization of existing primary care supply in underserved populations, and improving primary care infrastructure has the potential to reduce healthcare costs, improve health outcomes, and reduce health disparities among populations with social inequalities.

#### **Methods**

PubMed's database was searched for research on primary care's impact on population health, costs and disparities. The literature analyzed three primary care domains: supply, utilization, and architecture. Additional information was derived from gray literature.

#### **Findings**

Consistent positive associations between primary care supply and health outcomes have been demonstrated in the Medicare population. The supply of primary care physicians is also positively associated with better health outcomes in U.S. population-based studies regardless of the level of analysis: state, county, metropolitan statistical area (MSA), or non-MSA. Moreover, reasonable evidence suggests that an increased supply of primary care physicians is associated with a decrease in socioeconomic health disparities. There is reasonable evidence to suggest primary care supply is negatively associated with annual Medicare cost per beneficiary. Although no rigorous studies were identified that examined the impact of primary care utilization on the Medicaid population, two case reports indicated that higher primary care utilization rates are associated with improved health outcomes and decreased per person cost trends. Analyses of the impact of primary care architecture on various patient populations focused on the impact of changes to specific components of primary care practice. For example, recent pilot projects involving Patient Centered Medical Home suggest that increasing coordination and making primary care delivery more comprehensive will improve health outcomes and reduce healthcare costs. A study of the U.S. Department of Veterans Affairs (V.A.)'s investment in the use of electronic health records (EHRs) has shown improved health outcomes in the veteran population and cost savings.

#### **Conclusion**

The magnitude of cost and outcome improvements from improved primary care supply, improved primary care utilization, and improved primary care practice architecture are not predictable. Data trends, taken together, suggest that sizable outcomes may be achieved from a robust statewide primary care policy that brings together improvements in primary care supply, utilization, and practice architecture, and makes these improved primary care practices available to all Rhode Islanders.

### **Introduction**

No healthcare system in the United States has achieved the “triple aim”—improving population-based health outcomes, containing cost, and improving the personal experience of healthcare interactions (Berwick, et al, 2008). Rhode Island’s healthcare system has the potential to address the triple aim by providing access to a more robust primary care system to all Rhode Islanders. Convenient and timely access to primary care is at the heart of every effective healthcare delivery system. In addition to providing patients with much needed access to community-based care, primary care providers and their care teams have the unique opportunity to provide preventive services, educate people and communities about chronic diseases, conduct population-based analysis of disease control and healthcare quality, and help reduce health disparities on the basis of race, class, income and geography. These disparities have bedeviled the U.S. and Rhode Island for as long as population-based health outcomes have been measured.

The impact of primary care may be understood as the sum of a number of components and attributes. Six interacting primary domains of primary care policy may influence health outcomes and reduce costs: (1) primary care supply (number of primary care physicians per ten thousand population), (2) per patient actual utilization rate of the available primary care supply, (3) architecture of primary care practice (whether solo practice or multidisciplinary and robust), (4) extended access (to include extended service hours, same day or open access care, and improved access to shared resources for small and solo practices); (5) population-based quality management, and (6) electronic health records. This paper will explore the existing literature that evaluates the impact of primary care supply, utilization, architecture, service delivery standards, shared resources, and electronic medical records on cost, population-based health outcomes, and health disparities on the basis of race, class, or income.

### **Primary Care Supply**

Many healthcare professionals and public health advocates believe that increasing primary care supply reduces healthcare cost and improves health outcomes. The Medicare population, which uses more services and incurs more cost than any other coverage group, should benefit most from better access to comprehensive primary care than those earlier in life. The cost and quality of medical care received by Medicare beneficiaries varies dramatically throughout the United States (Jencks, 2000; Fischer, et. al, 2003), a variation that can be studied for associations with factors, like primary care supply. A number of studies have examined the association between primary care supply, healthcare costs, healthcare quality, population based health outcomes, and population health disparities based on race or income.

## **Impact of Primary Care on Healthcare Cost and Population Health**

### **Medicare Studies**

2004 - Baicker and Chandra

In 2004, Baicker and Chandra studied the relationships between cost per beneficiary, physician supply, and quality of care in the Medicare population. They evaluated the relationships between state cost per Medicare beneficiary and health outcomes, state physician supply (primary care and specialty) and Medicare cost per beneficiary, and state physician supply (primary care and specialty) and health outcomes (total quality measure). The study utilized the 24 quality measures developed by the Medicare Quality Improvement Organization that were computed at the state level for 2000–2001 (Jencks, et al., 2000). The study computed the overall quality rank measure from samples of patient discharge records for the treatment of six common medical conditions (acute myocardial infarction, breast cancer, diabetes mellitus, heart failure, pneumonia, and stroke), number and type of interventions, and evaluations for 24 commonly accepted measures related to improved outcomes, such as prescribing warfarin for atrial fibrillation, or providing a biennial diabetic eye examination.

#### **Outcomes / Quality**

The Baicker and Chandra (2004) analysis suggests that primary care physician supply is associated with improved patient outcomes/quality. The study showed that states with more primary care supply have better overall quality ranking as measured by overall quality rank in 2000 (Jencks, et al., 2000). Increasing the number of general and family practitioners in a state by 1 per 10,000 population (while decreasing the number of specialists to hold constant the total number of physicians) was associated with a rise in that state's quality rank of more than 10 places ( $p < .0005$ ). Conversely, increasing the fraction of specialists by 1 per 10,000 was associated with a drop in overall quality rank of almost 9 places ( $p < .005$ ).

#### **Cost**

The study found that states with more primary care supply have lower costs per Medicare beneficiary. The authors estimated that increasing primary care supply by 1 per 10,000 population (while decreasing the number of specialists to hold constant the total number of physicians) would produce a reduction in overall annual cost of \$684 per beneficiary ( $p < .0005$ ). Conversely, increasing specialty physician supply by 1 per 10,000 was associated with an increase in cost of \$526 per beneficiary ( $p < .004$ ).

#### **Disparities**

This study did not evaluate primary care supply and disparities.

2011 - Chang, Stukel, Flood, and Goodman

Chang, Stukel, Flood, and Goodman performed a cross-sectional analysis of the outcomes of a 20% sample of 2007 fee-for-service Medicare beneficiaries aged 65 years or older ( $N=5,132,936$ ) to measure the association between the *adult* primary care supply and individual patient outcomes. Study beneficiaries were assigned to Primary Care Service Areas (PCSAs) based on their resident zip code. The study used two measures of adult

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primary care physician supply across PCSAs (N=6542): (1) American Medical Association's master file of nonfederal, office-based physicians per total population, and (2) Medicare claims data of office-based primary care clinical full-time equivalents per beneficiary. The study examined the association between the adult primary care supply, individual-level health outcomes (mortality, hospitalizations for 12 specific ambulatory care sensitive conditions<sup>1</sup>), and Medicare program, cost-adjusted for patient characteristics and geographic variables.

### **Outcomes**

Chang, Stukel, Flood, and Goodman found only small differences in mortality rates across quintiles of primary care physicians per population after adjusting for patient and area covariates (5.19 vs. 5.49 per 100 beneficiaries; RR, 0.95; 95% CI, 0.93-0.96). They did, however, find that higher levels of primary care supply were associated with other favorable patient outcomes. Compared with areas with the lowest quintile of primary care physicians, beneficiaries in the highest quintile had fewer Ambulatory Care Sensitive Condition (ACSC) hospitalizations (74.90 vs. 79.61 per 1000 beneficiaries; relative rate [RR], 0.94; 95% confidence interval [CI], 0.93-0.95).

### **Cost**

Chang, Stukel, Flood, & Goodman (2011) found that small, inconsistent, associations were found between primary care supply and Medicare cost, after adjusting for patient and area covariates. When using the supply measure of primary care physicians per total population, a statistically insignificant negative association was found (\$8722 vs. \$8765 per beneficiary; RR, 1.00; 95% CI, 0.99-1.00) and when using the number of physicians per Medicare beneficiaries a slight positive association was found \$8857 vs. \$8769 per beneficiary; RR, 1.01; 95% CI, 1.004-1.02).

### **Disparities**

This study did not evaluate primary care supply and disparities.

#### **2009 - Chernow, Sabik, Chandra, and Newhouse**

In 2009, Chernow, Sabik, Chandra, and Newhouse examined the relationship between primary care supply and healthcare spending *growth*. They analyzed cost per person of Medicare Part A and Part B costs for each of 306 Hospital Referral Regions (HRR) in the United States between 1995 and 2005. These costs were adjusted for age, sex, and race.

### **Outcomes**

This study did not evaluate primary care supply and health outcomes.

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<sup>1</sup> Convulsions, chronic obstructive pulmonary disease, pneumonia, asthma, congestive heart failure, hypertension, angina, cellulitis, diabetes, gastroenteritis, kidney or urinary infection, and dehydration.

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### Cost

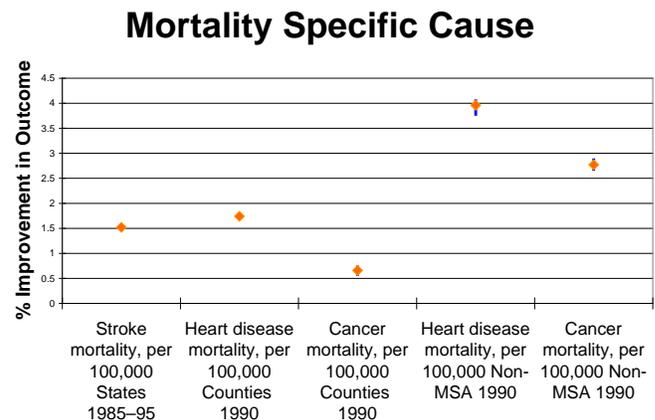
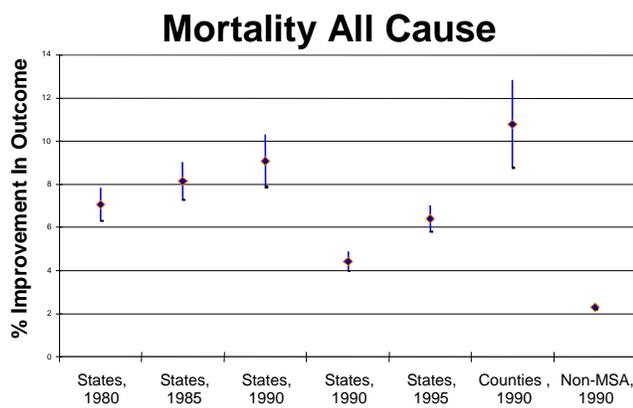
The study found that regions with higher primary care supplies had lower Medicare costs increases per beneficiary. Areas with ten percent (10%) more primary care physicians in the physician workforce were associated with a 1.8% higher rate of spending growth than the baseline areas over the study period.

#### 2007- Meta- Analysis Macinko, Starfield, and Shi

In 2007, Macinko, Starfield, and Shi published a meta-analysis of 10 original research studies examining the association between primary care supply and health outcomes in the United States. These studies were published between 1985 and 2005. These studies were selected from among 106 potential articles identified by a PubMed search that met criteria regarding the rigorosity of the analysis and the availability of the data for reexamination.

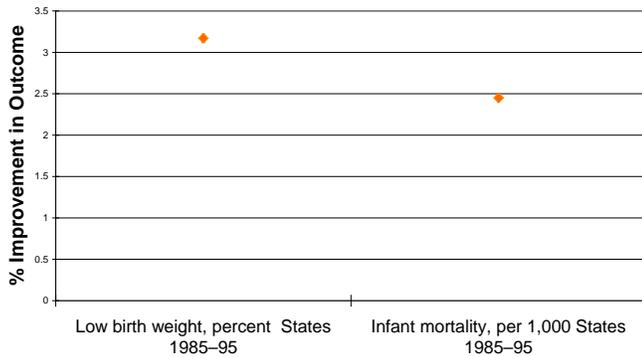
### Outcomes

Consistent positive associations were found between primary care supply and improved health outcomes at all geographic levels at which data was grouped (state, county, city, and rural area). Two measures of primary care supply were used: the number of primary care physicians per 10,000 population and quartiles of primary care physician density based on that rate. The reanalysis of the original data estimated changes in health outcomes associated with adding one more primary care physician per 10,000 population. Several health outcomes were examined. Eleven studies looked at all cause mortality. Two studies found lower infant mortality and fewer low birth weight babies when primary supply was increased. Two studies examined the impact on the infant health outcomes of low birth weight and infant mortality. Five studies found rates of the specific, common adult mortality causes of cancer and heart disease associated with increased supply. Finally, two studies found increases in self-rated health impacts associated with increased supply.

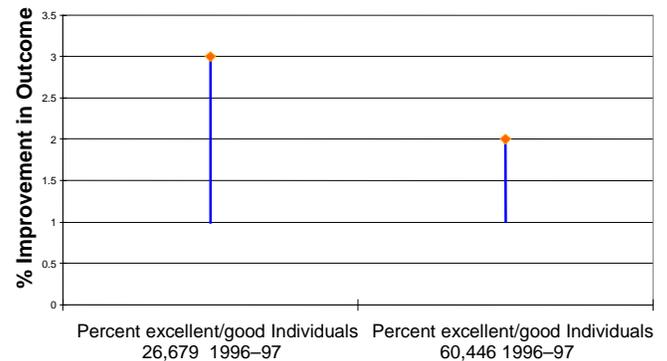


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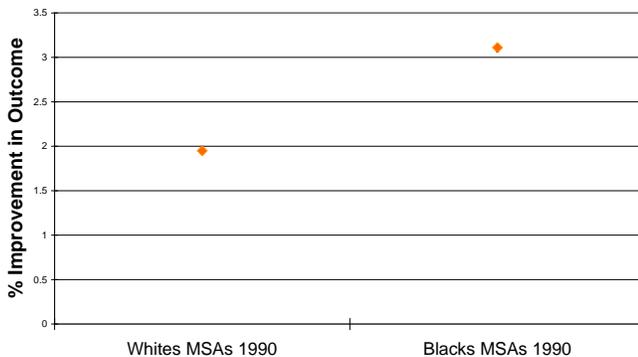
### Infant Health Outcomes



### Self-Rated Health



### Black / White Mortality



### Studies Related to Health Disparities

There is reasonable evidence to suggest primary care supply could aid in reducing socioeconomic disparities in health and overall population health.

#### 2001- Shi & Starfield

Shi and Starfield reviewed 273 metropolitan areas, as defined for the 1990 census, to compare the associations between income inequality and primary

care physician supply, and mortality in black populations and white populations. The researchers found “both income inequality and primary care physician supply were significantly [inversely] associated with White mortality ( $P < .01$ ). After the inclusion of the socioeconomic status covariates, the effect of income inequality on Black mortality remained significant ( $P < .01$ ), but the effect of primary care physician supply was no longer significant ( $P > .10$ ), particularly in areas with high income inequality. Improvement in population health requires addressing socioeconomic determinants of health, including income inequality and primary care availability and access.

#### 2005 – Shi, Macinko, Starfield, Politzer, & Zu

Shi, Macinko, Starfield, Politzer, and Zu examined the relationship of primary care resources and income inequality with all-cause mortality within the entire U.S. population, and in black and white populations in a 50 state comparison over an 11-year period. Their findings suggest primary care supply is significantly and inversely associated with both white and black mortality, after controlling for socio-demographics and income

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inequality. The study found that an increase of one primary care physician per 10,000 population was associated with a reduction of 14.4 deaths per 100,000. The impact of primary care coefficients was higher for black mortality than for white mortality. Income inequality was not associated with mortality after controlling for state-level socio-demographic covariates.

### **Primary Care Supply Summary**

The evidence shows that improved primary care supply is associated with better health outcomes and lower healthcare costs among the country's elderly and permanently disabled populations who are Medicare recipients. More detailed examinations of the data, which sought to account for confounding geographic and patient variables, show less of an impact on cost. Unfortunately, less is known about these potential relationships in other populations because populations other than Medicare recipients have been less well-studied.

**Primary Care Utilization** Primary care supply is not a measure of how extensively primary care physicians are utilized. Moreover, policies and changes in the medical coverage system can influence the number of visits (the rate of primary care utilization) within a population. Case studies of states which have made changes in Medicaid to encourage increased primary care utilization and national studies which examine utilization of primary care by the Medicare population show a positive association between utilization improved health outcomes and a negative one with the rate of cost increases.

### **Medicaid Reports**

No studies have been identified that quantify the impact of primary care utilization on an entire population. Two case reports on state Medicaid populations indicate, however, that increases in primary care utilization are associated with improved health outcomes and cost savings.

#### *2008 - North Carolina Medicaid Experience: Steiner et.al.*

Community Care of North Carolina was found to have improved health outcomes and achieved cost savings for the state's Medicaid population during its first ten years of operation. Community Care of North Carolina manages care for about 750,000 Medicaid patients, roughly 80% of the state Medicaid population. (Most of those not enrolled in the North Carolina managed care program are dual Medicaid/Medicare eligible or are pregnant women.)

Community Care of North Carolina is collaboratively organized and operated by community physicians, hospitals, and health and social service departments. It comprises approximately 1,200 primary care practices, more than half of the practices in the state.

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### Outcomes

Asthma and diabetes measures were used to highlight the program's effectiveness on health outcomes. During the first year of the program,

- **Asthma** - both emergency department visits and hospitalization rates for Community Care of North Carolina-enrolled children with asthma decreased by 8% and 34% respectively. According to the 2008 article, the reductions were sustained through 2007.
- **Diabetes** - Community Care of North Carolina patients exceeded National Committee for Quality Assurance benchmarks in five of six diabetes control performance measures.

### Cost

According to an independent analysis by The Mercer Group, Community Care of North Carolina is conservatively estimated at saving approximately \$160 million annually, as cited by Steiner.

### Disparities

This study did not evaluate primary care utilization and disparities.

#### 1999 2006 - Rhode Island Medicaid Experience: Tricia Leddy

A federal Medicaid Research and Demonstration waiver issued to Rhode Island in 1993 allowed the state to extend, and change the healthcare delivery of Medicaid Program beneficiaries enrolled in Aid to Families with Dependent Children (AFDC), as well as an expansion group of low income pregnant women and uninsured children under age seven. Between August 1994 and August 1995, all AFDC families, as well as the pregnant women and children expansion group, were enrolled in RIte Care, the state's new Medicaid managed care program, and chose one of five health plans. The enrollees also chose (or were assigned by their health plan if they did not choose) a primary care physician, who was responsible for coordinating all their care and meeting certain access and quality standards.

### Outcomes

For enrollees in RIte Care, there was a strong positive association between primary care utilization and improved access, quality, and health outcomes. While physician visit rates more than doubled, from an average of 2 per year to almost 5 per year, emergency department visits and hospital days dropped to half their previous levels. In a specific study on the impact of the program on infant mortality from 1990 to 1999:

- **Infant mortality declines** - Overall rates declined from 10.7 to 6.8 deaths per thousand births (36%). Moreover, the gap between Medicaid and privately insured infant mortality rates was reduced significantly, narrowing the gap from 4.3 to 1.5 deaths per thousand births.
- **Post-neonatal mortality declines** - Post-neonatal death rates (death between 30 days of birth and the first birthday) for Rhode Island infants with Medicaid coverage decreased from 4.5 deaths to 1.9 deaths per thousand (57%). This sharp decline in post-neonatal infant mortality is not reflected in the rest of the nation, and can be assumed to be due to improvements in access to pediatric care. ( Tricia Leddy, Rhode Island Medicine and Health, 2006)

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### **Cost**

RIte Care limited the annual growth in expenditures to no more than 6 % for each enrollee for the first 8 years of the program, as required under the federal waiver. This 6% growth was less than half the double-digit rate of growth experienced during this time by commercial health insurers. In the early 1990s (pre-RIte Care) the situation was the opposite – the cost of covering Medicaid families was increasing at 8%, twice the average rate of growth in expenditures in the commercial market, which was then 4%.

### **Disparities**

This study did not evaluate primary care utilization and disparities.

### **2011 – National Medicare Study**

2011 – Ferrante *et.al.*

A recent study on colorectal cancer outcomes among Medicare beneficiaries has shown a positive association between primary care utilization and colorectal cancer (CRC) outcomes. The study examined patients in the Surveillance, Epidemiology and End Results (SEER) Medicare linked database who were diagnosed with colorectal cancer between 1994 and 2005. Ferrante et al. examined the number of primary care visits within this population, both before and after diagnosis. They found that people who visited a primary care physician more often were more likely to receive cancer screenings and had lower mortalities for both colorectal and all cause mortality. “Persons with 5 to 10 visits had 16% lower CRC mortality (adjusted hazard ratio [AHR], 0.84; 95% CI, 0.80-0.88 and 6% lower all-cause mortality (0.92;0.91-0.97) compared to with persons with 0 or 1 visit.”

### **Primary Care Utilization Summary**

The literature on the impact of primary care utilization on the Medicaid population does not come from well-designed clinical trials or precise statistical analyses. It does, however, provide evidence that health outcomes may be improved by increasing primary care visits without increases in cost, or with reductions in cost trends. The literature on the impact of primary care utilization in the Medicare population is from a single study, and showed increased primary care utilization was associated with lower colon and rectal cancer mortality and lower all cause mortality.

## **Primary Care Architecture**

### **Patient Centered Medical Home Reports**

The Patient-Centered Medical Home model seeks to improve clinical care outcomes and lower costs through the use of comprehensive primary care, multidisciplinary teams, and better care coordination. Pilot demonstration projects sponsored by Medicare, Medicaid, and major health plans are currently operating in many states, including Rhode Island. Although there are many Patient-Centered Medical Home studies involving implementation and outcomes, no studies exist which evaluate population-based Patient Centered Medical Home

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outcomes in the United States. Three reports of population experiences, however, have been identified that provide evidence for cost savings and improved outcomes achieved when the patient centered medical home model is employed.

### **2010 - Seattle-based Group Health Cooperative: Reid R, Coleman K, Larson E, *et al.***

This report examined the impact of a Seattle-based Group Health Cooperative's medical home prototype clinic 21 to 24 months after implementation. The report compared use and costs of 7,018 adults enrolled at the prototype clinic with 200,970 adults enrolled at other Group Health Cooperative clinics. The authors also examined patients' experiences and clinician burnout and found the prototype clinic compared favorably to the traditional clinics.

#### **Outcomes**

To measure clinical quality, the researchers used 22 indicators from the Healthcare Effectiveness Data and Information Set (HEDIS) aggregated into four composites, with the patient as the unit of analysis. Composites were compared among traditional clinics and the prototype clinics to determine differences. The prototype clinic performed better at baseline and showed greater improvements over the course of the study for each composite chosen.

#### **Cost**

Patients in the Patient Centered Medical Home clinics saved an estimated \$10.30 per patient per month 21 months into the pilot project compared to the other clinics.

#### **Disparities**

This report did not evaluate primary care architecture and disparities.

### **2010 - ProvenHealth Navigator: Gilfillan, R. J., Tomcavage, *et al.***

This report evaluated the ability of a medical home model to improve the efficiency of care for Medicare beneficiaries. The researchers evaluated the ProvenHealth Navigator Patient Centered Medical Home model by evaluating medical claims data and demographic information for 15,310 members of Group Health Plan's Medicare Advantage who were cared for by matched physician practices during the study period at 11 intervention sites with 75 control groups. Four years of claims data (2005 to 2008) were analyzed to compute hospital admission and readmission rates, and the total cost of care. Regression modeling was used to establish predicted rates and costs in the absence of the intervention. Actual results were compared with predicted results to compute differences attributable to the ProvenHealth Navigator practice.

#### **Outcome**

The ProvenHealth Navigator patient-centered medical home model was associated with a significant reduction in hospital admissions and readmissions in the study population. ProvenHealth Navigator was associated with an

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18% ( $P < .01$ ) cumulative reduction in inpatient admissions and a 36% ( $P = .02$ ) cumulative reduction in readmissions across the total population over the study period.

### **Cost**

Total care costs for the entire ProvenHealth Navigator population decreased 7%, but were not found to be statistically significant.

### **Disparities**

This report did not evaluate the association between the patient-centered medical homes and disparities.

## **Open Access Reports**

Open access systems are scheduling methods which are designed to improved primary care architecture by reducing wait times, increasing efficiency, and better matching the patient's appointment needs with provider availability. An advanced search of PubMed revealed 18 potential articles using the key words "open access" and "primary care". Of these, one provided some insight to the potential impact of an open access system.

2005 - Bundy, D., *et al.*

This report evaluated pilot-study data for four North Carolina primary care practices (two family medicine and two pediatric practices) participating in a quality-improvement collaborative from May 2001 to May 2002 to assess the potential impact of an open access model on appointment delays, appointment no-shows, patient satisfaction, continuity of care, and staff satisfaction during the 12-month study period. Providers in all four practices implemented the open access model.

### **Outcome**

As a result, from the first to fourth quarter of implementation:

- **Timely Scheduling** - the average delay to the third available appointment was reduced from 36 days to 4 days.
- **No-show rates** – these rates declined from 16% to: 11%
- **Overall patient satisfaction** - patients rating the overall visit quality as excellent went from 45% to 61%
- **Staff satisfaction** – staff satisfaction neither improved nor declined.

### **Cost**

This study did not evaluate the association between open access and cost.

### **Disparities**

This report did not evaluate the association between open access and disparities.

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### **Shared Resources**

#### **2009 - The Commonwealth Fund**

In 2009, The Commonwealth Fund surveyed 1,442 physicians regarding practice capacity, characteristics, and experiences to determine how sharing staff and clinical services affected patient care. At the time of the survey, 37% of small practices shared resources. Survey results indicated that although small practices typically have fewer capacities in information technology and managing and tracking clinical patient information, sharing resources among small (two to four physicians) and medium (five to nine) practices improves these capacities. Sharing resources allows small practices to double their capacity for Electronic Health Records and Health Information Technology. Additionally, offices received more reminders for tracking laboratory results, send more notices to patients of needed follow up treatment, ordering lab tests (22% small, 39% shared resource models, 52% large practices) and providing patients with results (16% small, 30% shared resource models, 43% large practices). Collaboration also increased the ability to provide after-hours care and support patient self-management, both of which are more cost effective than using emergency rooms. Finally, practices that share resources were more likely to engage patients in their care, and monitor patients' improvement, satisfaction, and clinical outcomes. Sharing resources improves patient care and allows physicians to employ practices that would otherwise be unaffordable. More evaluation is necessary to identify shared-resource models that are sustainable and successful.

#### **Outcomes**

This article did not evaluate the effect of shared resources on outcomes.

#### **Cost**

This article did not evaluate the effect of shared resources on cost.

#### **Disparities**

This article did not evaluate the effect of shared resources on disparities.

### **Comprehensive Electronic Health Records**

The use of EHRs and health information exchange (HIE) technology may result in a safer and more efficient healthcare system. In 2010, Rhode Island's Physician Health Information Technology (HIT) Survey reported approximately 42.8% of all licensed physicians use EHRs. However, only 10.7% use qualified EHRs. The U.S. Department of Health and Human Services released the final criteria defining "meaningful use" of EHRs on July 13, 2010 to improve quality and efficiency of care and encouraged more clinicians and acute care hospitals to use EHRs by providing financial incentives.

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2010 - Veteran's Administration Study Byrne C, *et al.*

Across the United States, the Veteran's Administration (V.A.) almost exclusively uses Electronic Health Records. This compares to lower rates of adoption (10–30%) by private sector ambulatory care physicians (Jha, *et al.*, 2008). Two methods were used to analyze the impact of the adoption of EHRs. A benchmarking analysis compared the adoption, cost, and quality-related impacts of health information technology across the V.A. relative to private healthcare sector benchmarks. A cost benefit model was also used to estimate the financial value of key components of the V.A.'s Electronic Health Record system. Results demonstrate both improved health outcomes and cost savings within the V.A. healthcare system.

### Outcomes

- **Preventive Care** - The V.A. population had higher performance on preventive care measures such as cancer screenings during 2004–2007 than the private healthcare sector.
- **Diabetes** - Twenty-nine patients with diabetes had better glucose testing compliance and control, more controlled cholesterol, and more timely retinal exams when compared to the Medicare health maintenance organization (HMO) private-sector benchmark. The V.A. averaged about 15 percentage points higher than the private sector on preventive care for patients with diabetes and 17 percentage points higher for patients with diabetes who have well-controlled cholesterol.

### Cost

The researchers modeled annual and cumulative costs and potential benefits. The total cost to develop, implement, and maintain the V.A. health information technology system VistA applications, including the Computerized Patient Record System, was estimated to be \$4.07 billion. The gross value of the V.A.'s investments in VistA applications was projected to be \$7.16 billion, resulting in the total net value of the V.A.'s investments in the VistA components model in excess of \$3.09 billion.

### Disparities

This article did not evaluate the effect of shared resources on disparities.

## Primary Care Practice Architecture Summary

The architecture of primary care practices is quite variable. While these differences make it difficult to study the impact on a broad scale, they do point to techniques which can be used to improve public health outcomes, contain costs and reduce disparities. A number of features – adopting the Patient Center Medical Home model; open access, which allows patients who report themselves ill to be seen the same day; sharing resources; and adopting electronic medical record systems, have, individually, been shown to lower costs or improve process or disease specific population health outcomes. Outcomes related to a number of other primary care practice architecture features—use of a multidisciplinary team, extended and weekend hours, integrating mental and behavioral health professionals into the primary care practice, availability of translation services, special training of staff (in areas such as the healthcare of gay, lesbian, and transgendered individuals), and use of community health workers—have all *not* been studied or reported. Because no studies or reports have examined the cost and

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population health outcomes obtained from combining some or all these approaches, the cost and health outcome implications of redesigned, robust, and accessible primary care practice is unproven.

### Summary Discussion

The studies and data reviewed, taken together, show that cost, population health outcome, and disparity improvements are likely to result from a number of primary care policy changes: improved primary care supply, improved primary care utilization, and improved primary care practice architecture.

One study (Chang *et al.*), which uses a different, but likely precise methodology, suggests that costs may increase as primary care supply increases. The methodology employed by Chang *et al.* used a method which evaluated 6,000 small population groups. The finding that Medicare costs in small population groups increases as the primary care supply increases is not unexpected, as the access to care provided by primary care physicians is likely to yield some increased health services utilization as the population is more effectively screened, as more preventable disease is identified and treated, and better outcomes are achieved. If by contrast, the specialist supply is increased while the primary care supply is held steady, we see a much greater increase in costs, while health outcomes may not improve. While increasing the primary care supply may marginally increase cost, improved outcomes may also result (Pettersen, personal communication).

Of note, the measured impact of primary care supply, utilization, and practice architecture is likely to be population dependent. Impacts on costs and outcomes are likely to be more significant in the Medicare population, where utilization of healthcare services, and the incidence and prevalence of disease, is greater. Conversely, the true impact of primary care supply, utilization, and practice architecture on the Medicaid population may be difficult to demonstrate, because that population may have different social risks. These could include poverty, lack of high school education, and community environment, all of which may impact healthcare utilization, costs, and outcomes. However, the studies of the impact of primary care supply on health disparities are promising, as they suggest that primary care supply does have the ability to mitigate some of the adverse impacts of social determinants on population health.

Finally, many years of research have shown the power of local medical culture to affect both cost and population health outcomes, with considerable variation from place to place. The impact of a robust policy investment in primary care supply, utilization, and practice architecture on local medical culture is impossible to predict, but may be reflected in the many state-by-state analyses, which show improvements in cost and population health outcomes associated with improved primary care supply in the Medicare population.

## **Impact of Primary Care on Healthcare Cost and Population Health**

Finally, the ability of improvements in primary care supply, utilization, and practice architecture to impact a whole population is unknown. Most reports have described interventions with segments of the population, and may reflect selection bias.

### **Conclusions**

The studies and data reviewed, taken together, show that cost and population health outcome improvements are likely to result from a number of primary care policy changes: improved primary care supply, increased primary care utilization, and improved primary care practice architecture.

The magnitude of cost and outcome improvements is not predictable. Data trends, taken together, suggest sizable outcomes are achievable from a robust statewide primary care policy, which brings together improvements in primary care supply, utilization, and practice architecture, and makes improved primary care practices available to all Rhode Islanders.

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