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Health Care Utilization and Cost Impacts of Delivery System Innovations: An Updated Review of the Evidence

INTRODUCTION

This issue brief provides an updated review of the evidence about the impacts of delivery system interventions with a focus on outcomes related to health care utilization and costs. The original issue brief was provided to SIM awardees in the fall of 2013. Since that time, the volume of research on the topic areas summarized below has increased significantly. The 2013 version of this issue brief included 38 sources; it now includes findings from 131 sources.

HOW TO USE THIS BRIEF

The payment model and delivery system changes designed and implemented by awardees under the SIM initiative have and will continue to vary along a continuum of reform. Regardless of the new initiative forged, awardees will need to ensure that:

- Robust forecasts of health care utilization and cost impacts for various program design scenarios are available;
- Reimbursement models account for the risks of populations served;
- Overall financial resources and budgets are adequate to support the changes desired; and
- Awardees have evidence to develop sustainability plans as SIM funding phases out.

Health care modeling and financial analysis will be core to informing and supporting these key objectives. However, modeling and financial analysis can only be as good as the research evidence that informs the assumptions and structure of the model. Thus, it is important to ensure that the projections rely on objective and rigorous research evidence wherever possible. In addition, it will be important for projections to be transparent with regard to the modeling of impacts, including assumptions about the effectiveness of interventions for various segments of the population – especially where multiple stakeholders are involved in developing interventions, each with an interest in understanding potential impacts on their own organization.

BACKGROUND

This issue brief reviews existing evidence about the impacts of delivery system interventions, primarily based in ambulatory care. The review is intended to be used by SIM awardees to inform stakeholder discussions about potential strategies and interventions, as well as to inform modeling of the impacts of interventions.

The primary types of impacts examined include utilization of care and cost impacts. Six main categories of interventions are included in this review:

- **Care management** interventions, which include features such as care coordination, managing transitions across care settings and between providers, and patient self-management interventions;
- **Medical home** models, which include the care management and care continuity features described above but also includes functions such as the collection and use of data for population management, using evidence-based guidelines for care management, tracking and coordinating of tests, referrals, and care transitions, and use of performance measures for quality improvement. Standards for defining and certifying medical homes vary across states, with different levels of recognition. The medical home studies included in this review also use varying definitions of the term;
- **Integration of behavioral health and primary care**, which can take place inside or outside of a medical home model and includes emerging Medicaid Health Homes models;
- Traditional **disease management** interventions, which are more often payer-based or sponsored (e.g., nurse-care line) and may have limited involvement by a patient's own health care providers. In contrast to care management, disease management interventions treat specific conditions, rather than the multiplicity of conditions that an individual may have. Based on research findings that showed little impact of these models, few payers are currently pursuing these models, but we include them here because they help to tell the story of how interventions to reduce unnecessary health care utilization and contain cost have evolved over the past decade;
- Similarly, **care continuity** interventions have largely been replaced by more complex interventions with many advanced features, but we include the research findings on these earlier models for comparison;
- **Accountable care organization** models, which often include several or all of the care management, medical home, integration, disease management, and care continuity features described above and involve one or multiple payers.

Care delivery transformation initiatives, and initiatives with PCMH features in particular, have proliferated and, as a result, the evidence base on the impacts of medical home initiatives has also expanded considerably. Furthermore, there are many other potential sources of information in addition to the peer-reviewed research literature, and it can be difficult to sort out which information is rigorous and reliable enough to inform projections of impact. This review focuses on peer-reviewed research studies, although other sources of information are included when deemed to be sufficiently well-documented and reliable. More information about how studies were selected for inclusion in this review is provided in the appendix. In the box below, we provide several questions to keep in mind when considering any type of evidence.

KEY QUESTIONS TO ASK ABOUT NEW EVIDENCE AND ADDITIONAL INFORMATION SOURCES

- Does this study come from a neutral, reputable source?
- How applicable are the study results to the proposed initiatives? For example, is the study population similar to the proposed population? Is the intervention similar?
- Does the study clearly describe the intervention, the study population, and the analysis methods? Is enough information included to back up the study conclusions about impacts of care interventions?
- What efforts do the study authors make to disentangle their observed results for the study population from other possible factors? For example, do they use a control group?
- How clearly do the study authors describe the impacts of the intervention? For example, do they include cost and utilization impacts? Over what period of time do they observe the impacts? From whose perspective are the impacts provided (e.g., payer, provider, society)?
- What are the study limitations? How likely is it that the study findings are applicable to the type of intervention that the state is considering? For example, awardees might want to be cautious about applying results from a study of a commercially-insured population to an intervention that they are planning in their Medicaid program.

In addition to the quality of research evidence available, there are two important issues to consider when evaluating the evidence to inform assumptions about the impact of proposed SIM initiatives:

- **Scope:** The literature on the impact of delivery system reforms is largely based on standalone pilot programs or narrowly implemented demonstration projects. Although there has been a significant increase in the amount of research published, to date, there are still relatively few studies of larger scale, multi-payer implementation efforts that affect larger and more diverse patient and health care provider populations, such as those undertaken in the SIM initiative.
- **Duration:** Another difficulty in forecasting the impact of system change is accounting for long-term versus short-term outcomes. Reducing potentially avoidable admissions and emergency department visits for certain conditions are examples of outcomes that can often be directly associated with specific interventions, frequently after a relatively short observation period. Other interventions, such as hypertension control over many years, are more difficult to directly associate with health care impacts and the performance of the system. Although the majority of studies to date tend to focus on outcomes that are quantifiable in the short-term in order to quickly document return on investment, several recent studies have longer observation periods. This is an important shift and both are important components to understanding the full impact of an intervention. Longer-term findings may provide more evidence to indicate whether the findings can be sustained and longer observation periods may provide evidence that the true impact of interventions is observed over time. They may also be useful in identifying which interventions yield the greatest overall impact to costs, utilization, and health-related outcomes.

In light of these challenges and the fact that many of these interventions are relatively novel, policymakers should continue to consider state-specific contextual factors (e.g., political environment, stakeholder buy-in and experience, etc.) that may be similar to or different from that which is documented in the literature. Additionally, it is prudent to develop conservative estimates of the impact of a particular initiative given the individual time and place circumstances often associated with these initiatives found in the literature.

EVIDENCE ABOUT UTILIZATION AND COST IMPACTS

In this brief, Table 1 below, and the accompanying detailed Excel table that is sortable by type of intervention, care setting, disease/condition, payer, age, and study duration, we provide a scan of the evidence from the 131 sources that are included in our review (more detail on how the studies were selected is included in the appendix).

The tables include descriptive information about the study populations, duration of the study, and reported findings about return on investment, total cost impact of the intervention, and cost and utilization impacts for emergency department visits, hospital admissions, hospital readmissions, primary care services, and specialty care services separately where available. Although quality was not a primary focus of our review, the detailed Excel table also includes information about quality outcomes when the study authors provided it.

Review Studies

Systematic and critical review articles and reports are helpful to consider because they look across varying results from multiple studies, identify commonalities and differences in study results, and help to identify factors that contribute to differences in results. We included eleven review studies/reports that systematically summarize evidence across multiple studies that were particularly relevant to states' activities around care delivery interventions. Summaries of each are provided below:

- **Care Management Interventions for Patients with Complex Health Care Needs.** Bodenheimer and Berry-Millett (2009) reviewed care management interventions for people with multiple chronic conditions. For primary care-based interventions, five of eight studies showed no effect on hospitalizations or emergency department use, while three studies demonstrated reduced hospitalizations and total costs for patients with high or moderate risk of incurring major health care costs. Several of the studies evaluating hospital-to-home transition programs showed reduced hospital use and costs for patients with congestive heart failure plus comorbidities and hospitalized patients with other multiple diagnoses. Additionally, only one out of three studies found reduced costs for care management interventions in integrated multispecialty groups. Vendor-supported interventions yielded inconclusive evidence, and home-based interventions had no evidence of reduced costs.
- **Case Management for High-Risk Patients in Primary Care.** Stokes et al.'s (2015) review of 36 articles did not provide strong evidence that case management in primary care results in significant reductions in total cost of care or specialty care services utilization. Case management, however, was shown to improve patient satisfaction. Most of the articles included in Stokes' meta-analysis were aimed at the elderly population, with an average age of 76 years.
- **Chronic Care Management for Patients with Chronic Obstructive Pulmonary Disease (COPD).** Lemmens et al. (2013) reviewed 37 articles published between 1995 and 2009. Some articles found a significant decrease in hospitalizations, but results were mixed. Additionally, results were mixed for the impact of the interventions on emergency department utilization.
- **Community-Based Case Management with Adults that Abuse Substances.** Joo and Huber's (2015) review of seven randomized controlled trials found mixed results. Of three studies reporting health care resource use, two found no decrease in the hospital, emergency department, or physician visits and one found a lower rate of hospital admissions. The two studies that did not observe decreases in health care service utilization attributed the findings to the limited duration of the case management interventions (they were one year and six months in duration). The study finding reductions in hospitalizations followed patients for three years.
- **Integration of Mental Health/Substance Abuse and Primary Care.** Butler et al.'s (2008) review included a summary of the evidence on the cost impact of integrating mental health and primary care – showing mixed results overall (with higher costs in some cases for the study intervention groups than for the control groups).

- **Patient Outcomes Associated with a PCMH.** Alexander and Bae (2012) synthesized 61 empirical studies. The outcomes assessed were broad and included access to a PCMH, service utilization, patient satisfaction and quality. Most of the studies reviewed focused on pediatric populations. Alexander and Bae found decreases in emergency department utilization and increases in preventive services, a positive association between patient satisfaction and PCMH, and mixed outcomes results. Despite finding generally positive associations between PCMH and patient outcomes, the authors suggest that audiences should be cautious given certain methodological and measurement limitations. For example, several of the studies were conducted relatively quickly after implementation. They also noted that more research is needed related to context and the intervention structures to better understand PCMH research findings.
- **PCMH Early Evaluations.** Peikes et al. (2012) conducted a systematic review of 14 quantitative studies of 12 interventions. They found that most early evaluations tested PCMH precursors, not fully implemented PCMH models. Findings on their impact on total costs were mixed. For example, one intervention demonstrated cost reductions for high-risk Medicare patients but increased costs across the full patient sample. Three interventions yielded generally positive results, though their impacts were mixed, with two reducing hospitalizations for all patients and one only reducing admissions for a high-risk subgroup. Peikes et al. concluded that more rigorous quantitative evaluations and analyses of comprehensive implementation are needed to better assess the effectiveness of PCMHs.
- **PCMHs for Older Adults.** DePuccio and Hoff (2014) reviewed 13 articles covering 2000 to January 2012. Overall, the evidence they reviewed showed no significant decreases in emergency department visits or hospitalizations. The majority of the articles (8) exclusively studied populations 65 years or older, and five articles had a study population with a mean age of 65 years or older.
- **PCMH's Impact on Cost and Quality.** Nielsen et al.'s (2016) review of 30 publications—including 17 peer-reviewed studies, 4 state government evaluations, 6 industry reports, and 3 independent evaluations of federal initiatives—shows a consistent trend that PCMHs can lead to reductions in health care costs and unnecessary utilization. The most impressive outcomes were found in PCMHs participating in multi-payer collaboratives with specific incentives for performance measures linked to quality, utilization, patient engagement, or cost savings.
- **PCMH Model.** Hoff et al. (2012) reviewed 36 articles covering the period 2007 to 2010. Overall, these evaluations showed reasonably strong associations between the provision of medical home care and improved quality. In addition, medical home care was associated with decreased utilization of high-cost services such as emergency department use. Most of the studies included in Hoff's review were of programs for older adults with multiple chronic illnesses, while only a few were conducted in pediatric or general adult primary care populations. Hoff also reported a relationship between the lengths of exposure to medical homes, with longer exposure resulting in lower health care costs.

- **PCMH Model.** Jackson et al. (2013) reviewed 19 studies. Only a few of these studies addressed the care utilization and cost impacts that are the focus of this issue brief, and the authors concluded that the studies provide no evidence for overall cost savings but noted substantial variation in how PCMH is defined. They noted that research in the coming years will shed more light on the impacts of PCMH over a longer period of time.

Individual Studies

In addition to the eleven review studies, our review also included 120 individual studies. Many of these studies are included in the review articles described above, but we include them individually to provide information for awardees in a consistent format that is as comparable as possible across studies. Each individual study is summarized in both Table 1 below and the accompanying detailed Excel table.

General Conclusions

In general, these studies evaluated the impact of interventions at the provider level. Studies published prior to the fall of 2013 focused primarily on older adults, typically with chronic or complex conditions – in other words, populations at relatively high risk for significant use of health care resources. More recent research includes a wider variety of study populations, with several focusing on all ages and a few studies focusing on children with special health care needs. Additionally, many more recent studies include patient populations with commercial insurance, whereas the studies included in our original review focused primarily on Medicare or Medicaid populations.

Overall, the literature on utilization impacts and cost savings due to delivery system reform continues to be of varying quality and report somewhat inconsistent findings. In addition, individual studies can be difficult to compare because of variations in the care interventions and the target populations. Even when the interventions and target populations seem to align, different types of outcomes may be reported. Because of the increasing number of delivery system reform innovations occurring in recent years, sample sizes are increasing. This enhances the ability to detect statistically significant changes in utilization and cost that are needed to conclude that the intervention had an impact. However, many studies remain relatively small in size and randomized control trials are still less common than other, less rigorous approaches (e.g., comparisons from baseline for the population being studied).

Other general observations include the following:

- **Several studies showed decreases in hospital admissions and readmissions, emergency department visits, and costs for patients with more than one chronic condition (“high-risk”),** even when findings for the patient population more generally did not show positive results. These findings suggest that targeting interventions at high-need patients may be more efficient than reforms that intervene with a broader patient population.
- **Emerging research on the integration of mental health and primary care indicate positive associations with health care cost reductions and health care service utilization overall.** For example, mental health and primary care integration was generally associated with reductions

in total cost, emergency department visits, and hospital admissions for adults with serious mental illnesses and children with serious emotional disorders. Additionally, for adults being treated for chemical dependency and older adults with depression, total costs declined with the intervention. Adults with depression were found to be 50% less likely to have an emergency department visit, which indicates the possibility of cost savings. One notable exception was found, however, in that the integration of mental health and primary care did not show a statistically significant cost savings for patients with poorly controlled diabetes and/or coronary heart disease who also had coexisting depression. These patients were found to have increased primary care visits, however, which indicates improved access, and likely a shift from emergent and inpatient care to outpatient care.

- **The intensity of the intervention also seems to make a difference.** Telephonic standalone disease management programs have produced mixed results but in general seem to not have produced significant savings; on the other hand, nurse-based programs with contact and engagement with patients and physicians have produced the greatest savings through reducing both emergency department visits and inpatient use. Similarly, ACO attribution length was associated with reductions in readmission rates, hospital lengths of stay, and increases in office visits.
- **Cost savings, regardless of the specific intervention, is most often found through reductions in emergency department and reductions in inpatient admissions and readmissions.** These outcomes were not always sustained in the few studies with longer observational periods, supporting the need for more research of longer durations to fully understand the impact of an intervention.
- **There are often corresponding increases in primary and specialty care.** In addition to reduced emergency department and inpatient use as drivers of cost savings, modest increases in use of primary and specialty care are often reported – as one would expect. These increased costs and the additional costs of the program itself must be offset by the reductions in emergency department and inpatient use to achieve a positive net savings for the intervention.

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Additional resources of potential interest:

NORC slide deck for SIM Awardees, “Integration of Behavioral Health and Primary care,” August 2015.

Mercer issue brief for SIM Awardees, “Actuarial Measurement of New Payment and Delivery Models,” March 2015.

CHCS memo to SIM Awardees, “The Return on Investment for Integrating Behavioral Health and Physical Health Care Delivery,” July 23, 2013, M. Crawford and T. McGinnis.

TABLE 1: SUMMARY OF RESEARCH EVIDENCE ON UTILIZATION AND COST IMPACTS OF CARE DELIVERY INTERVENTIONS

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Accountable care organization studies			
Centers for Medicare & Medicaid Services 2015	Medicare Shared Savings Program (MSSP) ACOs.	333 Medicare Shared Savings Program ACOs.	Total net savings to Medicare was \$465 million for 2014 and \$383 million for 2013.
Christensen and Payne 2016 (JAMA)	ACO for a pediatric Medicaid population.	A retrospective study of Medicaid claims data for 28,794 unique pediatric patients covering 346,277 patient-attributed months within a single children’s hospital.	Continuous attribution to the ACO for more than 2 years was associated with a decrease (40.6%) in inpatient days but an increase in office visits (23.3%), ED visits (5.8%), and in the use of pharmaceuticals (15.3%). Changes in the use of health care resources combined resulted in a cost reduction of 15.7%.
Christensen and Payne 2016 (The Journal of Pediatrics)	ACO for a pediatric Medicaid population.	A retrospective study of Medicaid claims data for 28,794 unique pediatric patients covering 346,277 patient-attributed months within a single children’s hospital.	Attribution length was associated with a significant reduction of 2.7% (and 31% relative reduction) in the population-level 30-day readmission rate. Costs per index admission fell 44% or \$617 from \$1387 in the reference period to \$770 in the intervention period.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Geyer et al. 2015	Pioneer ACO.	A retrospective review study of 7,696 adult trauma patients transferred from acute care hospitals within the pioneer ACO were compared to those transferred from outside the system.	Patients transferred from within the ACO had a 7.2% lower overall cost of hospitalization. Patients transferred from within the ACO had fewer imaging studies during the hospitalization than those transferred from outside the system, without significant differences in disease burden, hospital length of stay, or mortality.
Kelleher et al. 2015	ACO for a pediatric Medicaid population.	An observational study that compared cost growth of a pediatric ACO for a pediatric Medicaid population to the cost growth of FFS and Medicaid MCOs within the same state.	The ACO achieved a lower rate of cost growth than Medicaid FFS. The ACO also achieved a lower rate of cost growth than Medicaid managed care organizations in the same state, though the finding was not statistically significant.
L&M Policy Research 2013	CMMI ACO Initiatives - Effect of Pioneer ACOs on Medicare Spending in the First Year.	32 Pioneer ACOs.	On average, spending was approximately \$20 less per beneficiary per month than it would have been had those beneficiaries not been aligned with a Pioneer ACO. The evaluation estimates an overall \$146.9 million savings to the Medicare program.
L&M Policy Research 2015	Evaluation of CMMI ACO Initiatives - Pioneer ACO Evaluation Findings from Performance Years One and Two.	32 Pioneer ACOs.	Pioneer ACOs saved a total of \$384 million over the first two performance years, and collectively had reductions in utilization in acute inpatient settings.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Nyweide et al. 2015	Pioneer ACO.	Participants were FFS Medicare beneficiaries aligned with 32 ACOs and a comparison group of alignment-eligible beneficiaries in the same markets.	Total spending for beneficiaries aligned with Pioneer ACOs in 2012 or 2013 increased from baseline less relative to comparison populations (approximately -\$280 million in 2012 and -\$105 million in 2013). Inpatient spending showed the largest differential change of any spending category and changes in utilization of physician services, ED, and postacute care followed a similar pattern.
Sandberg et al. 2014	Safety-net ACO.	Medicaid beneficiaries enrolled in Hennepin Health.	There was a decrease in ED visits of 9.1% and a 3.3% increase in outpatient visits from 2012 to 2013.
Schwartz et al. 2015	Impact of Pioneer ACO on the use low-value services.	The use of 31 low-value services was compared between Medicare FFS beneficiaries attributed to health care provider groups that entered the Pioneer program and beneficiaries attributed to other health care providers (control group) before (2009-2011) vs after (2012) Pioneer ACO contracts began.	In year 1 of Pioneer contracts, there was a differential reduction of 1.9% relative to the expected 2012 mean for the ACO group of services per 100 beneficiaries. The differential reduction in use of low-value services corresponded to a 4.5% differential reduction in spending on low-value services.
Care management studies			
Amin et al. 2014	Use of a service-based care management program in an academic medical center.	Adults who had a readmission within 30-days of discharge from the index admission.	Mean disease-related 30-day readmissions significantly decreased from the implementation period to the post-intervention period. Mean all-cause 30-day readmissions decreased from the implementation period to the post-intervention period, though it was not statistically significant.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Angstman et al. 2014	Use of collaborative care management (CCM) to determine if depression remission was correlated with outpatient utilization.	Adults clinically diagnosed with major depressive disorder or dysthymia and had a PHQ-9 score of ≥ 10 who were enrolled in CCM in a primary care clinic and had a complete set of intake data as well as 6 and 12 month follow up data.	Patients in remission were statistically less likely to be an outlier (> 8 visits at 6 months and > 12 visits at 12 months) for outpatient utilization than those not in remission. Patients who were in remission at 6 and 12 months had a lower number of outpatient visits than patients who were not in remission.
Au et al. 2015	Use of a telehealth program.	Medicare enrollees with a COPD diagnosis who participated in the Health Buddy pilot program between 2006 and 2010.	The Health Buddy program was associated with lower quarterly all-cause hospital admissions and lower respiratory-related hospital admissions. A reduction in quarterly ED use was not found.
Baker et al. 2013	Use of a telehealth program.	High-cost Medicare FFS beneficiaries enrolled in two demonstration clinics who were diagnosed with congestive heart failure, COPD, or diabetes.	Participants in the Health Buddy program had greater reductions in hospital admissions than their matched controls. No relationship was found between participation in the program and ED visits or hospital days.
Bell et al. 2015	Care management intervention led by registered nurse.	Disabled Medicaid beneficiaries with high health care costs. Eligibility criteria included: (a) enrollment in the Medicaid Categorically Needy program; (b) resident of King County, WA; (c) evidence of at least 1 chronic physical condition and a mental health problem, substance abuse disorder, or both recorded in state administrative databases; and (d) predicted future health care costs at least 50% higher than those of the average Medicaid	Overall, there were no health care cost savings for participants. Participants had fewer inpatient admissions preceded by an ED visit resulting in lower associated monthly costs. Participants also had higher odds of outpatient mental health service use and higher costs for monthly prescriptions and drug/alcohol treatment. Participants also had greater odds of having higher long term care costs.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
		Supplemental Security Income recipient.	
Bisiani and Jurgens 2015	Collaborative case management program.	Patients 65 years or older with a hospital inpatient, no psychiatric admission.	Researchers found no statistically significant differences in 30 readmission rates between the pre-model and post-model groups.
Bodenheimer and Berry-Millett 2009	Review of multiple studies.	Patients with multiple chronic conditions who were at high or moderate risk of incurring major health care costs.	In primary care settings, 5 of 8 studies showed no significant reductions in health care costs, ED use, or hospital use. However, three studies showed reductions in hospital use for subpopulations of patients (higher-risk patients). Studies of hospital-to-home management of CHF and other health conditions showed reduced hospital readmissions and lower costs.
Boult et al. 2011	Use of guided care teams with a high-risk population.	Elderly Medicare enrollees, medium to high-risk. Multiple payers/delivery systems.	The only statistically significant reduction in service use overall was in home health care. One payer also saw reduced skilled nursing facility admissions and days.
Counsell et al. 2009	Patients received 2 years of home-based care management by a nurse practitioner and social worker who collaborated with the primary care physician and a geriatrics interdisciplinary team and were guided by 12 care protocols for common geriatric conditions.	Low-income seniors; most had multiple comorbid conditions and high rates of utilization for acute care services.	No difference in mean 2-year total costs. Analysis indicates shift from acute care expenses to preventive cost expenses, and overall neutral effect on costs for patients at high-risk of hospitalization. Intervention high-risk patients had lower inpatient costs compared to high-risk usual care patients (\$7,343 vs. \$11,731). Total chronic and preventive care costs were significantly higher in intervention patients. Intervention patients had higher costs for specialty care, procedures, rehabilitation services, and mental health.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Counsell et al. 2007	Patients received 2 years of home-based care management by a nurse practitioner and social worker who collaborated with the primary care physician and a geriatrics interdisciplinary team and were guided by 12 care protocols for common geriatric conditions.	Low-income seniors; most had multiple comorbid conditions and high rates of utilization for acute care services.	Cumulative 2-year ED visit rates (per 1,000) were lower in the intervention group; visits were significantly lower in year 2 for intervention group. There was no effect on readmissions.
Daaleman et al. 2014	Use of a care manager intervention implemented using an organizational innovation approach.	All patients at the family medical center PCMH were eligible for care manager services.	The intervention was associated with an absolute decrease of 8 ER visits per month for recipients of care management during the 2 year implementation period and an absolute decrease of 7.5 inpatient admissions per month during the 2-year implementation phase.
Davis et al. 2015	90-day transitional care program integrating telemonitoring and home visits.	Patients with COPD and heart failure that spoke either English or Spanish, had U.S. residency, were independent in their own care or with a reliable care giver, were deemed underserved base on insurance payer type.	Program patients had a significant reduction of 30-day and 180-day hospital readmissions, but did not have a significant difference in ED utilization.
Fillmore et al. 2014	Integration of a systematic care management intervention program with a PCMH.	Non-elderly Medicaid recipients with disabilities.	There was significant cost avoidance associated with program enrollment after the first years. The savings was found to increase over the course of a patient's enrollment in the program. Additionally, the intervention's impact was greater for patients with multiple chronic diseases.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
French et al. 2014	A collaborative care intervention including a trained care coordinator, individualized self-care management protocols and education, information and counseling for caregivers, and standardized assessment tools.	Patients of a safety-net health care system memory care clinic with two or more visits.	The intervention was estimated to generate annual net cost savings of up to \$2,856 per patient.
Gilbert et al. 2013	Case managers identified patients at risk for readmission during hospital admission and provided care management from the day of admission to post 90-days of discharge.	Patients with acute myocardial infraction, heart failure, or pneumonia admitted to a community hospital and at high-risk of readmission.	A significant association was found between pneumonia readmission and time period, where readmissions decreased over time. The intervention was not associated with decreased readmissions for patients with acute myocardial infraction or heart failure.
Graham et al. 2014	Care management intervention.	Patients ≥60 years old surgically treated for hip fracture at a hospital.	There were no statistically significant differences between patients enrolled in care management and patients receiving standard care for all-cause ED visits or all-cause hospitalizations at 6- or 12-months post-operation.
Granata et al. 2015	Relationship-based care management model with key performance indicators and a 3 level incentive-based compensation plan for case managers.	Traditional and managed Medicare patients.	Readmission rates and average length of stay were reduced for both traditional Medicare patients and managed Medicare patients.
Hawkins et al. 2015	In-person and telephonic case management to improve care coordination for high-risk Medicare beneficiaries.	Medicare patients in 5 states with Hierarchical Condition category score >3.74.	The program demonstrated \$7.7 million in savings and a ROI of \$1.40 for every dollar spent on the program. Savings increased with longer time in intervention.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Joo and Huber 2015	Review of multiple studies.	Adults that abuse substances.	In a review of 7 randomized controlled trials of community-based case management for adults that abuse substances, there were mixed results related to reductions in health care service utilization.
Lemmens et al. 2013	Review of multiple studies.	Adults with COPD.	The reviewed studies generally found reductions in hospitalizations, but results were mixed. Additionally, the results related to ED utilization was inconclusive.
McAdam-Marx et al. 2015	A pharmacist-led diabetes collaborative drug therapy management program.	Adult patients with uncontrolled type two diabetes who were treated at a patient-centered primary care community clinic.	The intervention was associated with a less substantial increase in all-cause health care costs relative to usual care.
Patel 2014	Use of a care management checklist.	Children with epilepsy with the highest number of ED visits and/or unplanned hospitalizations.	The program was cost-saving and reduced patient ED visits and hospitalizations for the patient population.
Romanelli et al. 2015	PCMH with medication management program (MMP) for patients with one or more chronic conditions.	Patients taking medication for one or more chronic condition. Intervention population (patients receiving PCMH +MMP) were matched using propensity scores to comparison populations receiving only PCMH and patients receiving usual care (no PCMH or MMP).	Patients in the MMP + PCMH group had overall higher ambulatory visit rates but lower hospitalization rates than both the PCMH and usual care populations. The MMP +PCMH group also had lower rates of ED utilization than the usual care group, but there were no statistically significant differences for this outcome when compared to the PCMH only group.
Sharieff et al. 2014	ED case management program with registered nurse intervention.	ED patients targeted for hospital admission were assigned RN case managers to explore safe alternatives to hospitalization	Pilot study revealed the ED case management program was able to find alternative resources for a ED patients to prevent hospital admissions, though statistical analysis for cost and utilization was not available due to lack of baseline control analyses.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Stokes et al. 2015	Review of multiple studies.	Patients in primary care settings with multiple conditions at risk of hospitalization	36 studies showed no significant reductions in total health care costs, primary care use, or specialty care use from case management in primary care settings. Case management did result in a small increase in patient satisfaction.
Taylor et al. 2014	Brief care management interview prior to discharge for psychiatric patients at high-risk for readmission.	Patients who had a 30-day readmission from prior psychiatric hospitalization.	Control group was over twice as likely to experience a repeat readmission as group receiving brief interview intervention. Results suggest that utilization of a recovery-focused brief interview by care managers before discharge may be an effective bridging strategy to reduce early readmission in individuals at higher-risk for psychiatric readmission.
Wang et al. 2015 (American Journal of Hospice & Palliative Medicine)	Nurse based palliative case management.	Cancer patients age 18-65 in last 30 days of life, enrolled in Medicaid MCO.	Intervention group had significantly lower inpatient admissions (57% vs. 74%) and ICU admissions (13% vs. 24%) than control group. There was no significant impact on ED utilization or length of ICU stays once admitted.
Wu et al. 2014	Cancer support program (CSP) with telephonic case management led by oncology nurses.	Members of large employer funded plans with cancer diagnoses.	Self-selected participation in the cancer support program was associated with lower cancer-related medical costs and greater hospice use. Monthly cancer-related costs for survivors were 9.8% lower. 58% lower inpatient costs were the main driver. Although savings were also shown for decedents in initial analysis, sensitivity analysis did not confirm the validity of these results.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Care coordination studies			
Bronstein et al. 2015	Care coordination intervention consisting of 1 home visit and 1-2 phone calls from a social work (MSW) student intern.	Patients ≥50 years old at moderate-to high-risk of readmission post-discharge as determined by a score of 7 or higher on the LACE (Length of stay, Acute admission through ED, Comorbidities, and ED visits in the past 6 months) index.	Patients in the intervention group were 22% less likely to be readmitted than patients in the control group.
Carter et al. 2015	Use of a discharge nurse to coordinate post-discharge services and transitional care pharmacist to reconcile medication pre-discharge and call patients post-discharge.	Patients <60 years old at high-risk for readmission including those with pneumonia, atrial fibrillation, altered mental status, dehydration, acute renal failure, urinary tract infection, cancer pain, >10 medications.	Statistically significant decrease in all-cause readmission rates by 30% over the four-year period.
Colla et al. 2014	Medicare Pioneer ACOs at risk for cost and quality outcomes for attributed members (shared savings and shared risk). Difference-in-difference analysis used to determine the impact of attribution to a Medicare Pioneer ACO on utilization of discretionary cardiovascular imaging.		No significant impacts of Medicare Pioneer ACO attribution on the utilization of discretionary cardiovascular imaging were found.
Duru et al. 2009	Care management intervention involving home assessments, follow-up, access to community services, and provider education.	Medicare beneficiaries age 65+ with dementia who had an informal caregiver.	No significant cost savings.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Harman et al. 2014	Provider service networks (PSNs), ACO "like" model with multiple components including PCMH, HIT to support care coordination, and QI efforts.	Medicaid TANF and SSI populations.	PSN enrollees had slightly larger reductions in adjusted PMPM costs over the 4-year intervention compared to HMOs.
Hewner et al. 2014	Risk-stratified care coordination programs implemented in a regional health plan population.	Medicare, Medicaid, and privately insured patients.	Risk-stratified care management was associated with reductions in hospitalization rates in all three populations.
Jackson et al. 2013 (Health Affairs)	Community-based programs to provide care management resources during transition from hospital discharge to home.	High-risk Medicaid patients multiple or catastrophic chronic conditions discharged from the hospital and enrolled in PCMH at time of discharge.	After 1 year, study patients had 17.4 per 1,000 fewer readmissions compared to usual care population.
McCarty et al. 2015	A case management program aimed at aligning high ED utilizers more closely with primary care providers to improve care and reduce unnecessary ED visits.	22 adults (ages 23 to 57) who had >25 ED visits per year.	Overall ED visits were reduced by 75.7% during the 6 months post-intervention. No statistical difference in post-intervention ED visits when comparing younger vs. older or male vs. female. Other outcomes include: decrease in overall cost of operating the ED, reduction in patient census and waiting times, increase in access to ED for community members allowing better quality care, and overall the payers saved an average of \$9,000 dollars per individual in the 6 months post-intervention.
Murphy and Nevan 2013	ED care coordination program through the use of a regional information system capable of sharing patients' individualized care plans.	Adults who have been high-users of EDs.	The program was cost saving to the hospital, and was associated with statistically significant reductions in ED visits and direct-treatment costs.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Peikes et al. 2012 (Health Affairs)	Changing a telephone-based intervention model to a locally-based, in-person model. Program redesign included other enhanced features such as stronger transitional care, more comprehensive medication management, and more thorough assessment of unmet needs.	Medicare beneficiaries deemed to be at high-risk of requiring hospitalization within the next 12 months.	After redesign, hospitalizations among all program enrollees declined by 11.7% compared to control group and a higher-risk subgroup of enrollees declined by 17% compared to a control group. Claims costs declined by 9.6% and 14.8% respectively, for all program enrollees and the higher-risk group; when intervention costs are included, only the reduction for the higher-risk group was statistically significant (9.7% savings).
Peikes et al. 2009	15 care coordination demonstration projects using varied interventions, such as patient education, ongoing monitoring, and improving communication between patients and physicians.	FFS Medicare patients (primarily with congestive heart failure, coronary artery disease, and diabetes).	Only 2 of the 15 programs had significant differences in hospitalization: 1 program had fewer hospitalizations and the other had more hospitalizations. None of the 15 programs generated net savings. Intervention patients had lower Medicare expenditures in three of the programs; however, savings offset program costs in only 2 of those programs and savings were too small to be sustainable for 1 of those 2 programs.
Stranges et al. 2015	Multidisciplinary community based PCMH transitional care program (TCP) targeted at reducing 30-day readmissions.	Age 60+ with inpatient hospitalization.	30-day readmission rates significantly lower (11.7% vs. 17.3%) among patients receiving the TCP intervention compared to matched control group. Estimated potential "avoided" costs of \$737,000 for 217 patients receiving the TCP services (extrapolated from average costs and readmission rates among the population not receiving intervention).
Wegner 2008	Reimbursement for telephone consultations between primary care physicians and pediatric subspecialists.	Pediatric Medicaid patients.	Overall, an estimated \$39 was saved per dollar spent. Providing reimbursement for telephone consults led to avoidance of

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
			specialist visits, hospital transfers, hospital admissions, and ED visits.
Patient-centered medical home studies			
Alexander and Bae 2012	Review of multiple studies.	This varied across the empirical studies reviewed.	Generally positive associations between PCMH and health-related outcomes were found, including decreases in ED utilization and increases in preventive services in some of the studies reviewed.
Alexander et al. 2015	Study examining the effects of PCMH implementation level on patient-related outcomes and costs in adult primary care practices.	2,218 Michigan adult primary care practices, defined as having at least one primary care physician.	Full PCMH implementation at the beginning of the study year was associated with higher adult quality composite scores (4.6%, $p < .001$) and higher adult preventive composite scores (4.0%, $p < .001$).
Bergert et al. 2014	Children's Asthma Care (CAC) measure implementation.	Pediatric patients ages 2-18 who were discharged with a primary diagnosis of asthma.	Readmission rates were lower in the post-CAC implementation period, but only significantly lower for the 91-180 day period post-implementation (71% lower than the pre-CAC period). No difference was found in ED utilization rates.
Christensen et al. 2015	Assessing the relationship between health care utilization by children and "medical homeness," using the Medical Home Index or NCQA medical home self-assessment.	Medicaid claims from child-serving practices participating in CHIPRA in 3 states (32 practices from Illinois, 32 practices from North Carolina, and 32 practices from South Carolina).	Higher medical homeness scores may be associated with lower nonurgent, preventable, or avoidable ED visits.
Cole et al. 2015	PCMH certification (through NCQA) intervention.	Medicaid patients within primary care clinics (≥ 50 patients in a clinic).	There were no statistically significant results for inpatient use in primary care, ED, ambulatory sensitive care, or cost. Additionally, there were no statistically

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Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
			significant results for primary care use, except for PCMHs that treated a higher proportions of chronically ill patients.
Cooley et al. 2009	Study examined impact of practice's "medical homeness", based on the Medical Home Index, on utilization outcomes for children with special health care needs.	Children with special health care needs in Medicaid or commercial plans.	Chronic condition management was associated with decrease in rate of ED visits. Decrease in hospitalizations significantly associated with practices being a medical home, its organizational capacity, chronic care management and care coordination.
David et al. 2014	Assess whether adoption of the PCMH reduces ED utilization among patients with and without chronic illness over 3-year period.	Commercially insured patients, 65% with one or more chronic conditions seen at subset of clinics participating in the PA Chronic Care Initiative program.	PCMH clinics associated with 5% – 8% reduction in ED utilization; the largest decline in ED usage was seen for patients with diabetes and hypertension. Reductions in ED usage appeared to be a result of better management of chronic illnesses, not expanding access to primary care clinics.
DePuccio and Hoff 2014	Review of multiple studies.	PCMH for older adults.	No significant reductions in ED visits or hospitalizations were found.
DeVries et al. 2012	Observational cohort study utilizing claims data for patients treated at PCMH and non-PCMH practices.	Commercially insured, non-elderly patients.	Total risk-adjusted costs for patients at PCMH practices were 14.5% lower for adults and 8.6% lower for children than for non-PCMH patients. This was driven by lower rates of ED visits, hospitalizations, and high-cost diagnostic imaging.
Domino 2009	Analysis comparing utilization and cost among FFS, primary care case management, and medical homes.	Children with asthma enrolled in Medicaid.	Both MH and PCCM had about 8% lower rates of ED use compared to the FFS rate. The rates of hospital use were 18% and 13% lower in the MH and PCCM programs, respectively. Both MH and PCCM programs were associated with an increase in total Medicaid expenditures compared to FFS, in part due to increase use of asthma maintenance

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Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
			medications. Considering only claims with an asthma diagnosis, both MH and PCCM were cost neutral.
Dorr et al. 2008	Medical home model involving nurse care managers supported by specialized information technology in primary care.	Elderly Medicare patients with chronic conditions.	No significant impacts on inpatient hospitalizations, ambulatory care sensitive hospitalizations, or ED visits.
Driscoll et al. 2013	PCMH model at Southcentral Foundation (SCF), a tribally owned and managed primary care system.	Patients receiving care through Indian Health Services at SCF.	ED use declined during and after PCMH implementation for overall use, patients with asthma, and unintentional injuries.
Fifield et al. 2013	Randomized control trial of outcomes associated with 2-year transition to PCMH status. Intervention practices received 18 months of tailored practice redesign support; 2 years of revised payment, including up to \$2.50 per member per month (PMPM) for achieving quality targets and up to \$2.50 PMPM for PPC-PCMH recognition.	Patients served at study practices.	No cost savings were found compared with control practices overall. Fewer ED visits were associated with \$1,900 lower costs per physician per year.
Flottemesch et al. 2012	Impact of PCMH adoption.	Medicare and Medicaid adult patients seen at study clinics.	Increase in PCMH scores was associated with significantly decreased total costs (savings of \$446/person in 2005 and \$184/person in 2009). The increase in PCMH scores was associated with fewer ED visits, with more visits avoided for patients with multiple conditions.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Fontaine et al. 2011	Impact of PCMH.	Adults seen at study clinics.	PCMH patients had significantly fewer primary and specialty care visits and lower primary and specialty care costs.
Friedberg et al. 2015	27 small primary care sites became NCQA PCMH certified.	Patients were attributed to 27 pilot PCMH and 29 comparison practices.	Becoming a NCQA PCMH significantly reduced the all-cause ED visit rates (per 1,000 patients per month) by 4.7, all-cause hospitalization rates by 1.7, increased ambulatory primary care rates by 77.5 over the three-year intervention period.
Friedberg et al. 2014	Impact of Southeastern Pennsylvania Chronic Care Initiative. Pilot practices received disease registries and technical assistance and could earn bonus payments for achieving NCQA PCMH recognition.	Over 64,000 commercial and Medicaid patients attributed to intervention practices.	No statistically significant impacts on utilization (ED visits, hospitalizations, primary, specialty) or associated costs.
Gilfillan et al. 2010	Medical home model using patient-centered primary care team practice, integrated population management, micro-delivery systems, quality outcomes program, and a value reimbursement system.	Medicare Advantage patients.	18% reduction in inpatient admissions and 36% reduction in readmissions. The impact on cost was not statistically significant.
Goyal et al. 2014	PCMH intervention.	Adults <65 years old with early-stage breast cancer who had been enrolled in Medicaid for at least 1 month. During the intervention, patients had to have been on Medicaid for 12 out of the 15 months.	There were no statistically significant differences between patients enrolled in the PCMH versus patients not enrolled in PCMH on ED visits, inpatient admissions, or outpatient visits associated with chemotherapy-related adverse events.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Higgins et al. 2014	Commercial HMO members in nonpediatric practices that adopted PCMH.	High-risk adult patients with commercial insurance.	No impact for total population. However, total savings of 7.9% from baseline for total adjusted costs (3 year study) for high-risk population. Statistically significant reductions in inpatient utilization and costs, significant but relatively small (\$16 PMPM) increase in cost of specialty care services for high-risk population.
Hoff et al. 2012	Review of multiple studies.	Varied.	7 of 10 studies that reported impact on ED visits found significant reduction; 4 of 7 studies that reported an impact on hospital admissions found a reduction; and 1 of 5 studies with cost impacts found a reduction in total overall cost, 1 reported increased costs, 1 reported no difference, and 2 reported mixed impacts.
Jackson et al. 2013 (Annals of Internal Medicine)	Review of multiple studies.	Varied.	Overall, studies showed some evidence for reduction in ED visits in adults. No evidence of impact on inpatient admissions or cost.
Jones et al. 2015	Vermont Blueprint for Health enrolled patients in PCMHs that were also supported by community care teams. Enrolled patients were compared to a control group.	Commercial (age 1-64), Medicaid (age 1-64), and Medicare (age >1).	Annual risk-adjusted total expenditures, inpatient utilization and costs, and outpatient utilization and costs were significantly lower among participants compared to a control group.
Kaushal et al. 2015	Level 3 PCMH implementation (based on 2008 NCQA certification standards). Study targeted separating impact of PCMH from adoption of EHRs without PCMH on several types	275 primary care physicians and 230,593 patients (all ages) in the Hudson Valley in New York. Multi-payer.	PCMH was associated with a significant decrease in the rate of specialist visits compared to both non-PCMH practices with paper records and those with EHRs. No significant impacts on inpatient, primary care,

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
	of healthcare utilization. 3 years of data were studied, including 1-year post-PCMH implementation.		radiology, laboratory, ED, and hospital readmissions.
Klitzner et al. 2010	Pediatric medical home intervention including longer intake and follow-up visits, access to a "family liaison" to serve as primary contact and coordinator, and a regularly updated medical records binder.	Children with complex medical needs (requiring treatment by at least 2 pediatric subspecialists on an ongoing basis) enrolled in Medicaid.	There was a significant reduction in average number of ED visits per patient. There was no significant impact on outpatient visits, urgent care visits, hospital admissions, hospital length of stay, or hospital days.
Kohler et al. 2015	PCMH enrollment for women with breast cancer enrolled in Medicaid.	381 female breast cancer patients in North Carolina.	PCMH enrollment was associated with \$429 higher monthly costs at 15 months after diagnosis. Costs were no longer significantly higher at 24 and 36 months after diagnosis. No significant impacts on ED visits or hospitalizations were found.
Kuntz et al. 2014	Oncology medical home demonstration, monthly care management fees and reimbursement for advance care and chemotherapy planning. Upside shared savings for reduced ED use and hospitalizations.	85 patients receiving chemotherapy for cancer diagnosis.	Average estimated cost savings of \$550 per patient. Reductions in ED visits and hospitalizations.
Lemak et al. 2015	An examination of the impact that the Blue Cross Blue Shield of Michigan's Physician Group Incentive Program had on primary care spending and the quality of services.	Over 3 million Blue Cross Blue Shield beneficiaries in over 11,000 physician practices in Michigan.	Participation in the fee-for-value incentive program was associated with a 1.1% decrease in total spending for adults and the same or better performance on 11 of 14 quality measures over the study period.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Liss et al. 2014	PCMH with focus on virtual medicine. Outcomes for patients with select chronic conditions at the intervention site were compared to patients with same conditions at 19 control sites.	1,181 adults with diabetes, hypertension, and/or coronary heart disease.	PCMH was associated with lower inpatient utilization (7%) and costs (17%), 21% fewer ambulatory care sensitive admissions, and lower total health care costs (7%).
Maeng et al. 2015	Longitudinal analysis of claims data from Medicare patients attending PCMH clinics over a 90-month period.	Elderly Medicare patients.	Total costs associated with PCMH exposure declined by \$53 per member per month (approximately 7.9%). The largest source of savings was acute inpatient care (\$34, or 19% savings per member per month), which accounted for about 64% of the total estimated savings.
Martin et al. 2007	Pediatric medical home project involving a full-time care coordinator in a rural family practice, focusing on organizational capacity, chronic care management, care coordination, community outreach, data management, and quality improvement.	Children with special health care needs, over age 2 with at least 6-months of continuous Medicaid eligibility.	ED visits fell for study and control groups. In second year after the intervention was implemented, the decline in ED visits was larger for the study population than the control group.
Mosquera et al. 2014	Comprehensive care at medical home high-risk clinic.	Children with high health care use and high estimated risk of hospitalization.	Statistically significant reductions in total clinic and hospital costs with comprehensive care versus usual care. In addition, there were significant reductions in serious illnesses, ED visits, hospitalizations, ICU admissions, and number of days in the hospital. In addition, there were increases in access and patient experience.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Nelson et al. 2014	PCMH model using a Patient Aligned Care Team (PACT).	Veterans accessing care through VHA primary care clinics implementing the PACT initiative	Top implementation sites demonstrated significantly lower hospitalization rates for ambulatory care-sensitive conditions, and lower ED use compared to less effective implementation sites.
Nielsen et al. 2016	Review of multiple studies.	This varied across the 30 publications reviewed.	The PCMH approaches with the most impressive cost and utilization outcomes were those who participated in multi-payer collaboratives with specific incentives or performance measures linked to quality, utilization, patient engagement or cost savings. 21 of 23 studies that reported on cost measures found reductions in one or more measures. 23 of the 25 studies that reported on utilization measures found reductions in one or more measures.
Paustian et al. 2014	Practices at varying stages of PCMH model implementation.	Approximately 1.5 million BCBS members attributed to a final study group of 2,432 practices providing primary care in Michigan. Each practice had to have at least one physician affiliated with a physician organization participating in the Blue Cross Blue Shield of Michigan (BCBSM) Physician Group Incentive Program (PGIP) in 2010.	Full PCMH implementation was anticipated to result in \$26.37 lower PMPM medical costs for adults but no reduction in costs for pediatric populations.
Peikes et al. 2012 (American Journal of Managed Care)	Review of multiple studies.	Varied across the 14 evaluations of 12 interventions studied.	The findings varied by intervention. The costs impacts were inconclusive (2 interventions), cost-neutral (1 intervention), or increased costs (1 intervention). Three interventions reduced the number of hospital visits, one

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
			reduced ED visits, and others had inconclusive impacts on utilization.
Philpot et al. 2015	Evaluation of a usual source of care with one or more PCMH features on health care expenditures.	Medicare beneficiaries with at least one of five co-occurring chronic condition dyads.	Increased access to PCMH features at a usual source of care may differentially impact health care expenditures in various categories based on the co-occurring chronic conditions a patient has. Overall, average total health care expenditures were not affected.
Pines et al. 2015	Assessment of average annual practice-level payments per beneficiary for ED use and hospital utilization before and after PCMH recognition, using fiscal year 2008-2010 Medicare FFS data.	Medicare beneficiaries in primary care practices and FQHCs (308 with PCMH recognition and 1,906 without PCMH recognition).	Compared to non-PCMH practices, the rate of growth in ED payments per beneficiary was \$54 less for 2009 PCMHs and \$48 less for 2010 PCMHs. Also, 2009 and 2010 PCMHs had lower rates of growth in all-cause ED visits (13 and 12 visits fewer, respectively) and ambulatory-care-sensitive condition ED visits (8 and 7 visits fewer, respectively).
Pourat et al. 2015	Evaluation of the Health Care Coverage Initiative in California assessing the impact of the initiative on ED and hospital utilization.	Adults ages 21-64: 4,191 enrollees in the pre initiative period and 5,837 in the post period.	Patients in PCMHs had a 42% higher probability of adhering to primary care providers. Patients who were adherent to their primary care providers had a higher probability of having no ED visits and no hospitalizations.
Randall et al. 2014	Evaluation of a VHA PCMH program called PACT.	Veterans with posttraumatic stress disorder (PTSD).	PACT were associated with a decrease in hospitalizations and specialty care utilization and an increase in primary care visits.
Raphael et al. 2015	Parents of children in Medicaid and practices providing care to them were surveyed for key aspects of PCMH (e.g., data management and organization capacity). Claims data were used to determine associations	240 children in Medicaid with chronic conditions.	Key PCMH components for reducing health care utilization include having a usual source of care, organizational capacity, and data management. Parent report of usual source of care and practice report of organizational capacity (e.g. communication, data use, and

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
	between these characteristics and ED and inpatient hospital utilization.		staff education) were associated with lower rates of ED and inpatient hospital utilization.
Raskas et al. 2012	Three WellPoint PCMH pilot programs (CO, NY, and NH). The CO and NH pilots layer incentive payments for care coordination and quality improvement over FFS. The NY pilot pays doctors an enhanced fee tied to achievement of quality levels.	The three pilots included patients in commercial, Medicare, Medicaid, and employer self-insured plans.	NH pilot had 5% increase in costs, compared to 12% increase in traditional practices. NY pilot program had costs 14.5% lower for adults, 8.6% lower for children, compared to control population.
Reeves and Kapp 2013	Self-insured employer PCMH insurance program.	Enrolled employees and dependents.	Total medical costs in the initial intervention year were less than actuarially projected (13% after 1 year and 36% after 2 years) and less than actual total medical costs in the baseline year (4% after 1 year and 23% after 2 years). ED visit rates were reduced by 16% and hospital days were reduced by 48%, while physician office visits increased by 19%.
Reid et al. 2013	PCMH intervention in clinics owned and operated by a large nonprofit, consumer-governed, integrated health insurance and care delivery system.	412,943 patients.	Decline in ED use seen during years 1 and 2 (13.7% and 18.5%) compared to expected usage. Decline in office visits of 5.1% and 6.7% during the early and stabilization years, but an increase seen in use of email and phone encounters. No statistically significant changes were found for hospital admissions.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Reid et al. 2010	Medical home model involving advanced care teams, and enhanced staffing to promote stronger relationships with patients, address care needs more comprehensively, and provide time to coordinate care.	Adults served by a prototype medical home clinic.	Compared to control group, patients in the study group had 29% fewer ER/urgent care visits, 6% fewer hospitalizations, and 13% fewer ambulatory care sensitive hospitalizations. Total savings were not statistically significant but "approaching significance"; cost reductions for ED and inpatient utilization were partially offset by higher costs for primary and specialty care. Authors estimated \$1.50 in savings for every \$1 invested in the pilot.
Reid et al. 2009	Redesign of a PCMH with the goal of improving patient experience, lessening staff burnout, improving quality, and reducing downstream costs.	Adults served by a prototype medical home clinic.	After 12 months, compared to the control group study patients had a 29% lower rate of ED use and 11% lower rate of hospitalization for ambulatory care sensitive conditions (though no significant difference in hospitalizations overall). Reductions in ED and hospital use were somewhat offset by an increase in specialty care visits. No statistically significant difference in total costs at 12 months.
Roby et al. 2010	PCMH intervention in a safety net-based system of care.	Adult uninsured, low-income patients assigned to a PCMH.	Odds of ER visit declined with longer enrollment in medical home; patients with three or more medical home changes had 28% higher odds of ER visit. Males and younger patients were more likely to visit ED.
Rosenberg et al. 2012	PCMH pilot at 10 primary care sites in part of a large,	23,900 adults who received primary care at one of the 10 clinic sites.	There was a 160% ROI, 5.1% decrease in ED visits during year 2, and 12.5% decrease

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
	integrated delivery and financing system.		during year 1 and 18.3% decrease during year 2 when compared to non-pilot network sites.
Rosenthal et al. 2016	A multi-payer PCMH pilot.	98,000 patients were attributed to pilot PCMHs and there were 66 comparison non-pilot practices.	At the end of the 3-year pilot intervention, there was a 9.3% significant reduction in ED use from baseline and ED costs decreased significantly by 11.8%. Among patients with two comorbidities, costs were significantly reduced by 14.5% after 3 years and there was a 1.4% significant decrease in primary care visits.
Rosenthal et al. 2015	PCMH intervention.	Adults 18 and older accessing primary care.	Overall, there were no significant changes found in total spending. The intervention was associated with a significant decrease in ED visits and an increase in primary care visits. Prescription drug utilization increased but drug spending decreased, potentially indicating the use of more generic medications.
Rosenthal et al. 2013	A multi-payer PCMH pilot in 5 independent primary care practices in the Rhode Island Chronic Care Sustainability Initiative.	Patients in 5 pilot and 34 comparison practices.	ED use and inpatient admissions at pilot practices were lower but it was not statistically significant. The only significant difference was a lower rate of ambulatory care sensitive ED visits.
RTI International 2015	Evaluation of the MAPCP Demonstration First Annual Report.	8 states participating in CMS's MAPCP Demonstration.	There was evidence of reduced rates of growth in total Medicare expenditures in VT and MI as well as evidence of decreased growth rates in ER expenditures in MN.
Smith et al. 2015	PCMH implementation at tribal health organization in Alaska, study focuses on impacts for patients with type II diabetes.	Patients with type II diabetes.	Significant decrease in ED visits, but specific amount not specified. No significant impacts on inpatient utilization. No control group, so cannot definitively determine impact of PCMH intervention vs. secular trends.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
	Outcomes evaluated 5- and 10-years after intervention.		
Steele et al. 2010	Medical home model using patient-centered primary care team practice, integrated population management, value care system, quality outcomes program, and reimbursement model.	Medicare FFS, Medicare Advantage, and commercial populations.	With each program expansion, risk-adjusted acute hospital admission rates fell significantly.
van Hasselt et al. 2015	PCMH intervention for primary care practices and multispecialty practices.	Patients with Medicare coverage.	Rates of visits declined for all patients by risk groups, associated primarily with decreased payments to acute care hospitals. PCMH certification was associated with a 4.9% decline in total payments.
Vats et al. 2013	Multi-payer PCMH intervention.	Adult patients	ED utilization decreased by 11% in the first year; evaluation and management visits decreased by 3.4% in year 1 and 6.5% in year 2; lab tests decreased by 16.5% in year 2. Overall savings were not statistically significant but health care spending growth reduction was estimated at 6% - 8%.
Wang et al. 2014 (Journal Public Health Management Practice)	PCMH for patients with diabetes. Team based care with case managers and health educators. EHR and registries to target patients in need of case management. Patients followed for 3 years.	Commercial managed care population with diabetes.	Intervention reduced total medical costs by 21% in the first year. Inpatient costs reduced by 44%, but no parallel reduction in inpatient utilization. More lagged impacts for specialty utilization (18% reduction by third year) and ED utilization and costs (34% and 45% respectively by the second year.)

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Wholey et al. 2016	Evaluation of Minnesota's Health Care Homes (HCH) Initiative from 2010 through 2014, using Medicare and Medicaid claims data to assess differences between HCHs and non-HCHs.	HCH and non-HCH clinics throughout Minnesota.	The HCH Initiative reduced cost and utilization while increasing quality of care. Health care disparities either decreased or remained stable through the initiative. The evaluation reported program-wide savings of over \$1 billion over the 2010-2014 study period.
Mental health / primary care integration studies			
Butler et al. 2008	Review of multiple studies.	Varied.	Evidence of potential savings, but significant barriers remain.
Herbert et al. 2014	The Veterans Health Administration (VHA) nationwide initiative called Patient Aligned Care Teams (PACT) that reorganized care at all VHA primary care clinics in accordance with the PCMH model. PACT builds on an initiative to integrate primary care and mental health that started in 2007.	Patients receiving care at 908 primary care in community clinics through the VA. Represents nearly all veterans receiving primary care through the VA. Data from 2003-2012 was evaluated.	Total utilization cost savings of \$639.3 million, but overall net loss of \$178 million when accounting for program costs. Researchers found reductions in inpatient utilization and costs but no impact on ED visits. There was also a decrease in mental health specialty care and an increase in total primary care visits.
Katon et al. 2012	Guideline-based, collaborative care management provided by nurses to control risk factors associated with multiple diseases.	Patients with poorly controlled diabetes, coronary heart disease, or both and coexisting depression.	Study population had better health outcomes and quality of life but there was no statistically significant net cost savings.
Kirk et al. 2013	Targeted case management for patients with substance use disorders. Outcomes compared based on data for a 6- or 12-month period pre- and	32,800 patients with ≥4 acute detox inpatient stays in a 6-month period.	Total costs were reduced by 46%; 53% reduction in use of inpatient psychiatric stays.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
	post-intervention for each patient.		
Meunier et al. 2014	Primary care patients with diagnosed depression assigned to usual care or collaborative care management (CCM) program.	Adults with diagnosed depression.	In primary care patients treated for depression, successful treatment to remission at 6-months decreased the likelihood of the patient having more than 8 outpatient visits during the 6-months after diagnosis. Enrollment in CCM (vs. usual care) did not have a significant impact on outpatient utilization.
Park et al. 2015	Chronic care management for substance dependence in primary care.	Adults with co-occurring substance dependence and major depressive disorder or posttraumatic stress disorder.	Though patients received significantly more addiction medication, mental health treatment, and psychiatric medication through care management, the only marginally significant reduction was in ED visits among patients with depression.
Parks 2015	Integrated "virtual" health homes for individuals receiving care at community mental health centers (CMHCs). CMHCs have primary care nurse liaisons on site to educate the behavioral health staff about general medical issues and train case managers in recognizing and managing chronic medical conditions; use a common, shared electronic health record, disease registry, and next-day notification of emergency and hospital use systems; and regular reports on	21,000 Medicaid enrollees receiving care at community mental health centers. Adults with serious mental illness and children with severe emotional disorders.	\$98 per member per month (PMPM) reduction in health care costs, which led to \$31 million in Medicaid savings. Saving due primarily to reductions in ED utilization (8.2%) and hospitalizations (12.7%) from baseline.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
	psychotropic drugs, medication adherence, and chronic disease management.		
Reiss-Brennan et al. 2010	Mental health integration (MHI) team-based approach involving primary care providers and staff, mental health professionals, community resources, care management and the patient.	Patients ages 19-62 diagnosed with depression.	Study patients were 54% less likely to have ED visits than control group. After initial diagnosis of depression, costs for both study and control group patients increased, but grew by less for study group patients.
Unützer et al. 2008	Collaborative care program provided by nurse or a psychologist in primary care clinic.	Patients ages ≥60 with depression.	Likely cost savings (87% probability that the intervention was associated with lower costs than usual care).
Disease management studies			
Ahn et al. 2013	The Chronic Disease Self-Management Program (CDSMP) provides education to patients with one or more chronic diseases to help improve health behaviors, health outcomes, and health care utilization.	1,170 community-dwelling CDSMP participants.	Participants in the program had significantly reduced numbers of ED visits at both 6- and 12-months from baseline. Participants also had significantly reduced hospitalizations at 6-months from baseline. Net cost savings estimated to be \$363.80 per participant (total estimated costs saved was \$731.80 and total estimated cost of program was \$350 per participant). If program reached 5% of adults with one or more chronic disease. National savings would be estimated around \$3.3 billion.
Avery et al. 2015	Participation in a self-management program.	16,224 program participants with a chronic disease were compared to 13,509 control patients. All patients	Participation in the program resulted in an average risk-adjusted savings of \$1,157.91 per enrollee. Though not statistically significant, results also seemed to indicate higher savings

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
		were members of self-insured employer health plans.	among patients who were enrolled in the program longer.
Esposito et al. 2008	Telephone-based intervention providing patient education and monitoring	Medicare-Medicaid dual eligibles who had congestive heart failure, diabetes, or coronary artery disease.	No significant differences in hospital admissions, ED use, or total cost. For enrollees with congestive heart failure, expenditures were reduced by 9.6%.
Holmes et al. 2008	Intensive nurse care management program offered to high-risk members, and a less intensive telephonic program offered to lower-risk members.	Aged/blind/disabled Medicaid members in Indiana with congestive heart failure, diabetes, or both.	Claims paid by Medicaid decreased by \$283.01 per participant per month for congestive heart failure patients overall. Larger program impacts were found in the low-risk rather than in the high-risk congestive heart failure subgroup. There was no significant effect for patients with diabetes.
Lin et al. 2012	Telephone health coaching.	High-risk nonelderly adult Massachusetts Medicaid and safety net patients with one or more chronic conditions.	No statistically significant effects on acute hospitalizations, ambulatory care visits, or medical expenditures. During the second year of the intervention, ED visits decreased significantly more for the comparison members than the study group.
Ory et al. 2013 (Journal of Aging and Health)	A self-management chronic disease program through participation in a workshop format intervention.	Middle-aged and older adults with at least one chronic disease.	6-month outcome findings showed a significant decrease in ED visits (5%) and hospitalizations (3%) when compared to baseline.
Ory et al. 2013 (Medical Care)	A self-management chronic disease program through participation in a workshop format intervention.	Middle-aged and older adults with at least one chronic disease.	12-month outcome findings showed average number of ER visits was significantly reduced when compared to baseline (21%). Mean number of hospitalizations was significantly reduced at 6 months, but this change was not sustained at 12 months.

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
Phillips et al. 2014	State-level implementation of a primary care case management program and a complementary disease management program.	Medicaid beneficiaries.	Total Medicaid savings were estimated to be \$1.46 billion, with significant reductions in ED visit and hospitalization rates.
Rice et al. 2010	Disease management program for COPD patients that included an education session, action plan for self-treatment, and monthly case manager follow-up calls.	VA patients with COPD who experienced hospital admission or ED visit for COPD, use home oxygen, or had a corticosteroid COPD treatment in the past year.	Disease management group had significantly fewer cumulative COPD-related hospitalizations and ED visits compared to control group, a 41% composite reduction in hospitalizations and ED utilization for COPD, and a significant decrease in hospitalizations for other cardiac and pulmonary conditions.
Continuity of care studies			
Chaiyachati et al. 2014	Care continuity study where care continuity was defined as a patient visiting their assigned PCP.	Patients with established care at a Veterans Affairs primary care clinic.	Patients with continuity of care (≥ 1 PCP visit) had a 46% reduced ED utilization.
Hussey et al. 2014	Retrospective cohort study of the association between continuity of care as measured by the Bice-Boxerman continuity of care index (which reflects the relative share of all of a patient's visits during the year that are billed by distinct providers and/or practices; and the costs for Medicare beneficiaries with chronic disease.	Medicare beneficiaries with a diagnosis of CHF, COPD, and/or diabetes.	Higher levels of continuity were associated with lower odds of inpatient hospitalization and lower odds of ED visits. As continuity increased, costs for CHF, diabetes, and COPD episodes decreased.
Sharma et al. 2009	Analysis of the impact of outpatient-to-inpatient	Medicare beneficiaries diagnosed with advanced lung cancer ≥ 66 years	Patients with outpatient-to-inpatient continuity of care had a 25.1% reduced odds

* See bibliography for complete citation.

Reference*	Intervention Description	Study Population	Summary of Utilization and Cost Impacts
	continuity of care on use of ICU during terminal hospitalization.	old, and who died within one year of diagnosis.	of entering the ICU during their terminal hospitalization.
Teixeira et al. 2015	Use of a transitional care plan with social service.	Recently released incarcerated individuals with HIV.	After 6 months, those involved in the intervention reduced ER visits compared to baseline by 66%. Study also showed significant improvements in housing stability, food security, compliance with medication protocols, and health status. However, there was no control population so effect cannot be reliably attributed to the intervention alone. Data based on self-report.

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APPENDIX - METHODS

We used the terms “Medical home(s)”, “patient-centered medical care”, “patient-centered health care”, “case management”, “care coordination”, “care management”, “chronic disease”, “accountable care organization(s)”, and “health home(s)” to identify relevant literature from PubMed, Medline, and EconLit. Only articles in English pertaining to U.S.-based interventions were included. Articles were selected for review only if the abstracts/articles described a clinical trial, secondary data analysis from claims records or if they described projects implementing the core concepts of advanced ambulatory care. The intervention and outcomes, if possible in terms of impacts on cost, utilization, and quality, as well as return on investment, cost-benefit or cost savings were identified and mapped. Since the focus of this issue brief is on cost and utilization impacts, articles that reported only on quality outcomes were excluded.

The identified interventions included care management strategies to support better continuity of care through care coordination/transition management and comprehensive medical home models, and other miscellaneous interventions (such as availability of dedicated care staff, primary care provider access and triage and end of life care). We also identified interventions related to traditional disease management programs often sponsored by payers but are being replaced or augmented by provider-delivered and patient-centered interventions that are often based on advanced primary care structures and processes. Outcomes were charted in terms of impact on utilization (effect on emergency department utilization, prevention of hospital admissions or readmissions), use of specialists, overuse of services, impact on utilization of hospitals/lengths of hospital stays and overall cost.