ISQua®

International Journal for Quality in Health Care, 2015, 27(3), 189–195
doi: 10.1093/intqhc/mzv018
Advance Access Publication Date: 8 April 2015
Article

OXFORD

Article

The business case for pediatric asthma quality improvement in low-income populations: examining a provider-based pay-for-reporting intervention

KRISTIN L. REITER[1], KRISTIN ANDREWS LEMOS[2], CHARLOTTE E. WILLIAMS[3], DOMINICK ESPOSITO[4], and SANDRA B. GREENE[1,3]

[1]Department of Health Policy and Management, Gillings School of Global Public Health, The University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-7411, USA, [2]Mathematica Policy Research, Inc., Washington, DC 20002-4221, USA, [3]Cecil G. Sheps Center for Health Services Research, The University of North Carolina at Chapel Hill, Chapel Hill, NC 27599, USA, and [4]Deputy Director of the Center on Health Care Effectiveness, Mathematica Policy Research, Inc., Princeton, NJ 08543, USA

Address reprint requests to: Kristin L. Reiter, Department of Health Policy and Management, Gillings School of Global Public Health, The University of North Carolina at Chapel Hill, 1104H McGavran-Greenberg Hall, Campus Box 7411, Chapel Hill, NC 27599-7411, USA. Tel: +1-919-843-8619; Fax: +1-919-843-6308; E-mail: reiter@email.unc.edu

Accepted 7 March 2015

Abstract

Objective: To measure the return on investment (ROI) for a pediatric asthma pay-for-reporting intervention initiated by a Medicaid managed care plan in New York State.
Design: Practice-level, randomized prospective evaluation.
Setting: Twenty-five primary care practices providing care to children enrolled in the Monroe Plan for Medical Care (the Monroe Plan).
Participants: Practices were randomized to either treatment (13 practices, 11 participated) or control (12 practices).
Intervention: For each of its eligible members assigned to a treatment group practice, the Monroe plan paid a low monthly incentive fee to the practice. To receive the incentive, treatment group practices were required to conduct, and report to the Monroe Plan, the results of chart audits on eligible members. Chart audits were conducted by practices every 6 months. After each chart audit, the Monroe Plan provided performance feedback to each practice comparing its adherence to asthma care guidelines with averages from all other treatment group practices. Control practices continued with usual care.
Main Outcome Measures: Intervention implementation and operating costs and per member, per month claims costs. ROI was measured by net present value (discounted cash flow analysis).
Results: The ROI to the Monroe Plan was negative, primarily due to high intervention costs and lack of reductions in spending on emergency department and hospital utilization for children in treatment relative to control practices.
Conclusions: A pay-for-reporting, chart audit intervention is unlikely to achieve the meaningful reductions in utilization of high-cost services that would be necessary to produce a financial ROI in 2.5 years.

Key words: Medicaid, asthma, pay-for-reporting, audit and feedback, business case, return on investment

Introduction

Financial incentives have been suggested as one method for improving primary care in low-income populations [1, 2]. Among common conditions affecting low-income primary care populations, pediatric asthma has been noted as a promising area for quality improvement because of the high cost associated with potentially avoidable asthma hospitalizations and emergency department (ED) visits [3, 4]. For example, a report by the Institute of Medicine in the USA identified significant gaps in care relative to existing evidence-based practice guidelines and thus designated asthma care as a quality improvement priority area [5].

Research evidence suggests that aligning provision of asthma care in accordance with guidelines can improve outcomes [6]. For example, the use of asthma action plans has been shown to improve patient adherence to medications, patient self-management, caregiver management of asthma exacerbations and asthma control [7–9] and thus result in a lower likelihood of ED visits or hospitalizations for asthma [10–12]. However, despite being recommended for all patients [13], asthma action plans are not provided to many in community-based primary care settings [14].

One approach to encouraging guideline concordant care is through audit and feedback. A review of evidence on the effectiveness of audit and feedback interventions aimed at changing clinical practice found that improvements in clinical practice were likely under a variety of circumstances, though the improvements were relatively small [15, 16]. To test the effectiveness of financial incentives tied to audit and feedback, in 2008, a fully capitated Medicaid managed care plan in Rochester, New York—the Monroe Plan for Medical Care ('the Monroe Plan')—developed a pay-for-reporting program. The program was called the Pediatric Asthma Care Enhancement Project or PACE. Under PACE, physician practices received financial incentives to conduct chart audits for pediatric patients being treated for asthma. The results of the chart audits were subsequently fed back to the practices to make physicians more aware of their practice patterns.

This study reports the results of an evaluation of the business case for the Monroe Plan's pay-for-reporting intervention. Here, the business case is defined as a relatively short-term financial return on investment for the organization investing in the intervention. The idea of a business case was first introduced in health care by Leatherman and colleagues in 2003 [17]. Since then, it has garnered substantial attention as healthcare resources have become increasingly constrained [18–21]. The concept of a business case is grounded in modern finance theory, suggesting that organizations will be more likely to undertake and/or sustain projects that can be shown to generate a positive (or at least break-even) financial return on investment as determined through discounted cash flow analysis. Thus, establishing a business case may be one key to widespread adoption and sustainability of proven quality interventions [17].

The PACE intervention aimed to increase providers' awareness of the concordance of their own care practices with accepted asthma care guidelines. Underlying the intervention was an assumption that providers would act on what they learned and increase their adherence to guidelines, for example, by providing asthma action plans, better monitoring asthma symptoms and prescribing appropriate asthma medications [16]. This, in turn, would result in lower utilization of expensive services [10–12]. Thus, the PACE intervention was hypothesized by the Monroe Plan to be effective in reducing ED use and hospitalizations, thereby resulting in cost savings. The Monroe Plan is fully capitated by Medicaid, but pays nearly all of its contracted providers' fee for service. Therefore, reductions in utilization and costs in excess of the costs of investing in and operating PACE would result in a positive return on investment for the Monroe Plan.

Methods

Study design

The evaluation was designed as an intent-to-treat, randomized, controlled trial with randomization at the practice level. The Monroe Plan identified 25 eligible primary care practices in Rochester, New York and the surrounding area, defined as those that served at least 20 Monroe Plan-enrolled children with asthma. Practices were first stratified by three characteristics: size, measured by the number of eligible Monroe Plan members; Federally Qualified Health Center status; and single versus multiple physicians for small practices. Practice size (small, medium and large) was determined by the number of Monroe Plan-enrolled children with asthma (fewer than 100, between 100 and 200 and > 200). The number of eligible members was used to measure practice size, because the incentive payment was tied to eligible members and not to the overall size of the practice based on total visits. Practices were randomized to either treatment (13 practices) or control arms (12 practices), and treatment group practices were invited to participate in the PACE intervention. Participation was voluntary and two treatment group practices declined to participate in the intervention; however, Monroe Plan expenditures on services provided by the practices were included in the evaluation (intent-to-treat approach) nonetheless.

The intervention

With the dual goals of reducing unnecessary, high-cost utilization for children with asthma and improving outcomes, in November 2008, the Monroe Plan implemented the PACE project. The Monroe Plan offered the PACE intervention to all practices randomized to the treatment group. The intervention period lasted slightly >3 years, although the evaluation period was limited to two and a half years due to data availability. The centerpiece of the intervention was a $5 per month incentive fee paid to each treatment practice for each eligible Monroe Plan member assigned to the practice. All children with asthma that met inclusion criteria were considered eligible; not only those for which a chart audit was performed. In exchange for the incentive, practices conducted chart audits every 6 months on a sample of their eligible Monroe Plan-enrolled children with asthma. The sample sizes were determined by the Monroe Plan, but the individual patient charts were selected by the practices at random. Treatment practices with fewer than 60 eligible Monroe Plan members were required to complete chart audits for 20 eligible children; those with 60–400 eligible members were required to conduct chart audits for 28% of eligible children; and those with >400 eligible members were required to complete chart audits for 100 eligible children. These requirements were established by the Monroe Plan based on findings from a previous chart audit intervention with physician practices [16].

Practices were required to electronically report chart audit results to the Monroe Plan using an on-line tool. Practices in the treatment

arm received training on the use of the online chart audit reporting tool and direct feedback on chart audit results compared with peer practices. Feedback was provided after each round of chart audits (seven rounds in total) through in-person meetings between the practice physician leading the chart audit activity and the medical director of the Monroe Plan. In addition, treatment practices participated in twice yearly asthma learning collaborative meetings. These meetings were structured as hour-long lunchtime meetings during which invited speakers presented on asthma care topics such as the definition and appropriate use of asthma action plans and monitoring of asthma symptoms. Practices were also given time to interact with each other so that they could discuss the intervention, best practices and challenges. The goal of the meetings was to improve providers' understanding of asthma care guidelines and to give providers strategies for improving the frequency with which they provided guideline-concordant asthma care. Control practices did not receive the incentive fee, were not asked to conduct chart audits and were not offered performance feedback or participation in the learning collaborative meetings.

Study sample

The study population consisted of all children in treatment and control practices that met eligibility criteria. To be included, children needed to meet the following requirements: (i) be a Monroe Plan enrollee, though not necessarily continuously enrolled, during the study period (1 January 2008 to 30 June 2011 which included one baseline year and 2.5 intervention years), (ii) have an asthma diagnosis (defined by an ICD-9 code of 493.xx in any position on a medical claim in the year before or during the intervention period), (iii) be older than 2 but younger than 19 at study entry and (iv) be affiliated with a treatment or control practice as determined by the Monroe Plan primary care provider designation. Children aged 2 and younger were excluded because of the challenges associated with firmly diagnosing asthma in very young children. A total of 7731 children met eligibility criteria.

Data

Data for the study were obtained from two sources. Costs of investing in and operating PACE were collected directly from the Monroe Plan and included costs for personnel; contracted services; office, travel and training; equipment; incentive payments to practices; and indirect (overhead) costs. Costs were recorded in the period in which they were incurred. Evaluation-related costs were also collected but were separately identified since these costs would not have been incurred in the absence of the PACE evaluation (evaluation-related costs not shown).

Fee-for-service payments made by the Monroe Plan to primary care providers were collected from Monroe Plan claims data for a baseline period (1 January 2008–31 December 2008) and the two and half year intervention period (1 January 2009–30 June 2011). Fee-for-service payments were aggregated to the practice level and converted to annual per member per month expenditures on the following sources of care: inpatient; outpatient; office; ED; pharmacy; ambulance, home health, capitation and other; and expenditures on all sources of care.

Analysis

We conducted weighted difference-in-differences regression analyses to assess whether there were statistically significant differences in per member per month payments in treatment practices relative to control practices following the intervention. Analytic weights were defined as the number of member months contributed by each practice. The unit of analysis was the practice. We analyzed total expenditures to assess whether the intervention was successful, in aggregate, at reducing spending by the Monroe plan. We also ran separate analyses for expenditures on each of the six sources of care (inpatient; outpatient; office; ED; pharmacy; ambulance, home health, capitation and other) to provide greater insight and potential explanations of results for aggregate expenditures. Analyses were estimated using weighted ordinary least squares (OLS), and robust standard errors were calculated to account for clustering at the practice level. Analyses using practice-level fixed effects revealed similar results; thus, only OLS results are presented. All analyses were conducted in Stata 13.1.

We calculated cost savings (or losses) to the Monroe Plan arising from changes in health care utilization using actual PMPM payments for each category of service in the baseline year and each intervention year for treatment and control practices. Cost savings or increases for treatment practices were compared with those found in control practices to identify incremental changes in the treatment practices. A negative net difference reflects savings to the Monroe Plan. A positive net difference reflects increases in costs to the Monroe Plan in intervention years.

To analyze return on investment, we combined PMPM payment data with intervention investment and operating costs reported by the Monroe Plan to conduct a discounted cash flow analysis. PMPM payments were annualized by multiplying by the number of months and by the number of eligible Monroe Plan-enrolled children with asthma in each intervention period. Total PMPM savings or payment increases as well as costs of operating the PACE intervention in each of the three intervention years were discounted back to the baseline period using a discount rate of 3% to reflect inflation and time preferences based on discussions with the Monroe Plan. We added discounted operating costs to the initial, baseline period investment costs to arrive at total intervention costs. Next, we subtracted total costs of the intervention from discounted PMPM savings (or cost increases) to arrive at the project's net present value. A positive net present value indicates the dollar contribution of the intervention to the Monroe Plan. A negative net present value means that the intervention had negative value; that is, benefits from the intervention were not enough to cover actual and opportunity costs.

Results

Characteristics of the participating practices are shown in Table 1. There were 3721 eligible children seen by treatment practices and 4010 seen by control practices. Among treatment practices, ~20% were small (<100 eligible children), 40% were medium (100–300 eligible children) and 40% were large (>300 eligible children) compared with 14% small, 44% medium and 42% large for control practices. The differences were not statistically significant. There were no statistically significant differences in populations of children seen by treatment versus control practices except for race/ethnicity. Control practices saw a higher percentage of children who were black (32.9 versus 21.5%) while treatment practices saw a higher percentage of children who were Hispanic (23.7 versus 12.8%). Less than 20% of children in both the treatment and control groups had ED visits for asthma in the baseline period, and <1% had hospital admissions for asthma. There were no significant differences between treatment and control groups in terms of baseline ED or hospital utilization.

Results of the difference-in-differences regressions are shown in Table 2. Across the sources of care, the highest expenditures were found for pharmacy and office-based claims followed by ED and outpatient care. Across all practices, average expenditures on office-based

Table 1 Characteristics of Monroe plan study population (percentages, unless otherwise specified)

	Treatment	Control	Difference	*P*-value
Number of Beneficiaries	**3721**	**4010**		
Age on date of eligibility				
2–5 years	36.2	37.7	−1.5	0.615
>5–12 years	38.7	38.9	−0.2	
>12–15 years	13.5	12.1	1.4	
>15–19 years	11.7	11.3	0.3	
Male	55.2	56.0	−0.8	0.522
Race/Ethnicity				
White	25.4	24.3	1.1	<0.01
Black	21.5	32.9	−11.4	
Hispanic	23.7	12.8	10.9	
Native American	0.1	0.1	0.0	
Asian/Pacific Islander	0.8	1.2	−0.4	
Other	1.1	1.5	0.4	
Unknown/missing	27.4	27.2		
Practice size				
Small (<100 children with asthma)	20.4	14.3	6.1	0.883
Medium (100–300)	40.3	44.0	−3.7	
Large (>300)	39.3	41.7	−2.4	
Prior evidence of asthma[a]				
One visit	31.6	38.1	−6.5	0.261
2–5 office visits	25.4	25	0.4	
6–9 office visits, 1–4 ED visits, or 1 hospitalization	39	33.8	5.2	
>9 office visits, 1 hospitalization, or 4 ED visits	4.1	3.1	1	
Common comorbid conditions				
Acute respiratory infection	33.2	28.9	4.3	0.196
Ear infection (otitis media)	33.8	32.8	0.9	0.845
Attention deficit disorder	33.2	28.9	4.3	0.196
Pneumonia	12.4	9.6	2.8	0.132
Allergies	33.2	28.9	4.3	0.196
Obesity	11	9.5	1.5	0.609
Child's first date of eligibility				
1 January 2009	45.3	45.2	0.1	0.967
2 January 2009–31 December 2009	27.5	27.9	−0.4	
1 January 2010–31 December 2010	26.1	25.7	0.5	
1 January 2011	1.6	1.4	0.1	
Mean number of months enrolled	19.9	20.1	−0.1	0.849
Percentage enrolled for (months):				
Fewer than 12	24.2	23.6	0.6	0.125
12–fewer than 24	31.7	31.4	0.3	
24–30	44.1	45.1	−0.9	
ED visits for asthma				
0 visits	81.4	83.7	−2.3	0.694
1 visit	14.1	12.2	2.0	
2 or more visits	4.5	4.2	0.3	
Hospitalizations for asthma				
0 admissions	99.6	99.7	−0.1	0.620
1 admission	0.4	0.3	0.1	
2 or more admissions	0.0	0.0	0.0	

Source: Monroe Plan for Medical Care medical claims and enrollment data.

Includes all children with asthma who are enrolled in the Monroe Plan, are at least 2 years old and younger than 19, have a diagnosis of asthma (493.xx) on any medical claim during the year before or in the intervention period (before January 2010), and are affiliated with a treatment or control group practice.

Children were not required to be continuously enrolled during the entire study period; therefore, we weight results according to the number of days enrolled in the Monroe Plan during the intervention period. We normalize weights so that they sum to the total number of sample members. We adjusted standard errors for clustering at the practice level.

[a] We classified an ED visit, office visit, or hospital admission as being for asthma if any diagnosis was for asthma.

care increased in the first intervention year, and the increase was statistically significant. Average expenditures on ED visits increased in both the first and third intervention years, and expenditures on outpatient care increased in all years. For practices enrolled in PACE, expenditures on ED visits increased more than in control practices in both the first and second intervention years. There were no other statistically significant differences between treatment and control practices in any of the specific spending categories; however, despite lower spending

Table 2 Difference-in-difference estimates of the change in Monroe plan PMPM payments (in US dollars)

	Treatment	Control	Change from baseline		Difference
			Treatment	Control	
Inpatient care					
Baseline	13.38	20.51	–	–	−7.13
Year 1	20.40	27.37	7.02	6.86	0.16
Year 2	22.98	25.00	9.60	4.49	5.11
Year 3	16.69	24.75	3.31	4.24	−0.93
Outpatient care					
Baseline	22.93	29.65	–	–	−6.72
Year 1	28.09	34.28	5.16	4.63*	0.53
Year 2	28.94	39.41	6.01	9.76**	−3.75
Year 3	32.48	37.24	9.55	7.59**	1.96
Office-based care					
Baseline	44.02	39.55	–	–	4.47
Year 1	47.45	43.05	3.43	3.50**	−0.07
Year 2	46.85	42.53	2.83	2.98	−0.15
Year 3	46.29	43.62	2.27	4.07	−1.80
ED care					
Baseline	26.23	29.71	–	–	−3.48
Year 1	38.78	34.25	12.55	4.54*	8.01*
Year 2	36.96	30.50	10.73	0.79	9.94*
Year 3	40.66	32.71	14.43	3.00**	11.43
Pharmacy					
Baseline	73.77	74.07	–	–	−0.30
Year 1	73.90	78.32	0.13	4.25	−4.12
Year 2	83.02	85.65	9.25	11.58	−2.33
Year 3	70.56	78.24	−3.21	4.17	−7.38
Ambulance, home health, capitation and other					
Baseline	12.18	16.10	–	–	−3.92
Year 1	10.76	16.01	−1.42	−0.09	−1.33
Year 2	12.10	16.45	−0.08	0.35	−0.43
Year 3	11.91	17.46	−0.27	1.36	−1.63
All services					
Baseline	192.51	209.59	–	–	−17.08***
Year 1	219.38	233.28	26.87	23.69***	3.18
Year 2	230.85	239.54	38.34	29.95***	8.39*
Year 3	218.59	234.02	26.08	24.43***	1.65

Source: Monroe Plan Claims Data.

Baseline, 1 January–31 December 2008; Year 1, 1 January–31 December 2009; Year 2, 1 January–31 December 2010; Year 3, 1 January–30 June 2011.

*$P < 0.05$.

**$P < 0.01$.

***$P < 0.001$.

on all services at baseline, spending in treatment practices grew at a greater rate than in control practices in the second intervention year.

The largest cost associated with the PACE intervention was the incentive payments made to participating practices in the treatment group which accounted for 52, 65 and 80% of the total costs to operate the PACE intervention in Years 1, 2 and 3, respectively (Table 3). After the incentive payments, the next highest cost category was personnel time. While the majority of personnel costs were not new, and thus were not truly incremental, the full reported cost is used to capture the opportunity cost associated with the time spent developing the PACE intervention and online chart audit tool, monitoring data collection, and interacting with practices. Other costs included the chart audit software, office, travel and training, and indirect costs.

The Monroe Plan experienced increases in annualized net claims payments during the PACE intervention of $99 216 and $293 180 in the first and second years, and $29 363 for the 6 months of the intervention's third year (values discounted at 3% are shown in Table 4). Only expenditures in the second year, however, were statistically significantly different from zero. Overall, the Monroe Plan experienced a loss on the PACE intervention as reflected by the negative net present value of $785 095.

Discussion

In the two and a half years that the PACE intervention was active, it was not able to demonstrate a positive business case. In contrast to expectations, the PACE intervention did not reduce expensive ED visits or hospital care. In fact, we found evidence of increases in spending on ED visits among treatment practices relative to control practices in two of the intervention years. In addition, the design of the PACE incentive may have contributed to the challenge of achieving a business case.

First, the cost of the intervention to the Monroe Plan was high. Due to the significant financial investment in PACE, the intervention would need to have achieved at least $386 000 in utilization-related savings

Table 3 Costs incurred by the Monroe plan to develop and operate the PACE intervention (in US dollars)

	Investment costs	Year 1 operating	Year 2 operating	Year 3 operating[a]
Personnel	$37 743	$36 521	$41 681	$22 050
Contracted services	0	7220	0	0
Office/travel/training	394	403	365	178
Equipment/software	8954	954	954	0
Incentive payments		53 060	86 955	96 945
Indirects	3272	3166	3547	2090
Total costs	$50 363	$101 324	$133 501	$121 263

Source: Costs collected and reported directly by the Monroe Plan.

Baseline, 1 January–31 December 2008; Year 1, 1 January–31 December 2009; Year 2, 1 January–31 December 2010; Year 3, 1 January–30 June 2011.

[a]Year 3 reflects only 6 months of cost from 1 January to 30 June 2011. Costs were not annualized as claims data also reflected 6 months. Incentive payments were reported in the period in which they were disbursed.

Table 4 Return on investment to the Monroe plan for the PACE intervention (in US dollars)

	Baseline	Year 1	Year 2	Year 3	Total
Investment in the PACE intervention					
Discounted costs[a]	$50 363	$98 373	$125 838	$110 973	$385 547
Returns from the PACE intervention					
Discounted claims payment reductions (increases)[a]		96 326	276 350[b]	26 871	$399 548
Return on investment					
Net present value[c]					$785 095

Source: Authors' calculations based on intervention costs and PMPM payments.

[a]Costs and claims payments are discounted at a rate of 3%.

[b]Increase in claim payments is statistically significantly different from zero in Year 2 only.

[c]Net present value = total discounted payment increases minus total discounted costs.

(an ~3.6% reduction in total PMPM payments), discounted over 3 years, in order for the Monroe Plan to have achieved a positive return on investment. A previous study of Medicaid-enrolled children with asthma found, similarly, that primary care case management and medical homes, two interventions aimed at increasing guideline-concordant care, resulted in increased spending relative to traditional fee-for-service Medicaid despite decreases in ED and hospital use. The higher spending was driven, in part, by greater access to outpatient services and medications among children in these enhanced care models. However, the payer's investment in monthly case management and medical home program fees also played an important role, suggesting that quality improvement may come at a cost [22].

Second, from the perspective of many of the practices participating in the PACE intervention, the absolute size of the incentive was relatively small, and the amounts received by practices were not proportional to the numbers of chart audits performed. Providers received incentive payments per eligible member rather than per chart audit conducted. As a result, practices with many Monroe Plan-enrolled children with asthma received substantial incentive payments, yet audited a smaller percentage of patient charts relative to smaller practices. For example, one large practice conducted 193 chart audits and received total incentive payments of $32 100. In contrast, one small practice conducted 110 chart audits, but only received incentive payments of $7135.

Finally, the implementation of the chart audit and feedback process did not necessarily ensure that all providers received feedback on their individual performances. There was often a lead physician at each of the treatment practices that took responsibility for the chart audit activity. This physician then met with the Monroe Plan medical director to discuss the performance feedback. It was left up to these lead physicians to share performance data with providers within their practices.

This study has several limitations that should be noted. First, our study relies on claims data. Administrative data are designed for billing and reimbursement purposes and not for research; therefore, it is possible that there may be errors in coding of diagnoses or procedures. Additionally, claims data do not provide any direct information about asthma severity or control for patients in our study population. Still, claims data were the only available source of information on our study population and the use of PMPM measures and randomization diminishes the effects of any errors on our results. Moreover, analysis of baseline utilization of ED visits and hospital admissions for asthma suggested no significant differences in asthma control between treatment and control group practices. Still, it is possible that unmeasured differences existed in asthma severity or control which may have affected our ability to identify the effects of the intervention.

Second, there were significant differences in the racial and ethnic makeup of treatment and control group practices. Race and ethnicity have been shown to be associated with asthma control, use of the ED and compliance with proposed therapies [23]; therefore, these differences could have affected our results. Third, factors external to the intervention might have had an impact on its final outcome. In particular, the H1N1 pandemic in 2009 and other asthma education efforts going on in the Rochester, New York area might have influenced utilization of health care services during the intervention period. Randomization of practices helps to reduce the chances for bias; however, if these events had systematically different effects on treatment and control practices, this would cause us to inappropriately attribute effects to the intervention.

Internationally, public and private payers are seeking interventions that can support the delivery of high-quality care to low-income populations at a sustainable cost [24, 25]. Mate *et al.* provide a framework for insurers, describing the levers by which they can help drive quality improvement. Among these levers are the following: (i) providing access to and encouraging the use of clinical guidelines or protocols, (ii) incentivizing or requiring collection of data on compliance with evidence-based care and (iii) investing in provider education. The framework authors note that insurance strategies must be used within the local context and in combination with coordinated activities by other stakeholders [26]. Consistent with this notion, this study suggests that an insurer-led pay-for-reporting intervention tied to audit and feedback, alone may not be enough to produce the meaningful short-term reductions in utilization of high-cost services in pediatric asthma that would be needed to produce a positive return on investment. Still, findings from this study provide valuable lessons to inform the future design of reimbursement strategies to encourage quality improvement programs.

Acknowledgements

The authors are grateful for the advice and support of Allison Hamblin, our program officer at the Center for Health Care Strategies. The authors also acknowledge excellent programming assistance provided by Carol Porter (deceased) and Stephanie Pierson of the Cecil G. Sheps Center for Health Services Research and Mark Flick and Maxwell Benjamin from Mathematica Policy Research, Inc. Finally, we would like to thank Joseph Stankaitis, MD, MPH, Howard Brill, PhD, Laura Weisbein, PhD, and Severin Flanigen of the Monroe Plan for providing the data that made this study possible. The Public Health-Nursing Institutional Review Board of the University of North Carolina at Chapel Hill reviewed and approved this study.

Funding

This work was supported by the Center for Health Care Strategies with funding from the Commonwealth Fund and the Robert Wood Johnson Foundation.

References

1. Rodney J, Dinakar C. Pediatric pay-for-performance in asthma: who pays? *Curr Allergy Asthma Rep* 2010;**10**:405–10.
2. Doran T, Fullwood C, Kontopantelis E *et al*. Effect of financial incentives on inequalities in the delivery of primary clinical care in England: analysis of clinical activity indicators for the quality and outcomes framework. *Lancet* 2008;**372**:728–36.
3. US Department of Health and Human Services. Medicaid Cost-Savings Opportunities 2011. http://www.hhs.gov/news/press/2011pres/02/20110203tech.html (16 October 2012, date last accessed).
4. Goodman DC, Stukel TA, Chang C. Trends in pediatric asthma hospitalization rates: regional and socioeconomic differences. *Pediatrics* 2000;**101**:208–13.
5. Adams K, Corrigan J. Priority areas for national action: transforming health care quality. Washington, DC: National Academies Press, 2004.
6. Bravata DM, Sundaram V, Lewis R *et al*. *Closing the Quality Gap: A Critical Analysis of Quality Improvement Strategies (Vol. 5: Asthma Care)*. Rockville, MD: Agency for Healthcare Research and Quality, 2007.
7. Ducharme FM, Bhogalb SK. The role of written action plans in childhood asthma (review). *Curr Opin Allergy Clin Immunol* 2008;**8**:177–88.
8. Ducharme FM, Zemek RL, Chalut D *et al*. Written action plan in pediatric emergency room improves asthma prescribing, adherence, and control. *Am J Respir Crit Care Med* 2011;**183**:195–203.
9. Dinakar C, Van Osdol TJ, Wible K. How frequent are asthma exacerbations in a pediatric primary care setting and do written asthma action plans help in their management? *J Asthma* 2004;**41**:807–12.
10. Coffman JM, Cabana MD, Halpin HA *et al*. Effects of asthma education on children's use of acute care services: a meta-analysis. *Pediatrics* 2008;**121**:575–86.
11. Gibson PG, Powell H, Coughlan J *et al*. Self-management education and regular practitioner review for adults with asthma. *Cochrane Database Syst Rev* 2003;**1**:1–84.
12. Zemek RL, Bhogal SK, Ducharme FM. Systematic review of randomized controlled trials examining written action plans in children. *Arch Pediatr Adolesc Med* 2008;**162**:157–63.
13. National Asthma Education and Prevention Program Coordinating Committee. Guidelines for the Diagnosis and Management of ASthma (EPR-3). National Heart Lung and Blood Institute, 2007. http://www.nhlbi.nih.gov/guidelines/asthma/ (16 October 2012, date last accessed).
14. Ross TT, Sin DD, Sharpe HM *et al*. Management of asthma among community-based primary care physicians. *J Asthma* 2005;**42**:163–7.
15. Ivers N, Jamtvedt G, Flottorp S *et al*. Audit and feedback: effects on professional practice and healthcare outcomes (Review). *Cochrane Database Syst Rev* 2012: http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000259.pub3/abstract (24 March 2015, date last accessed).
16. Foels TJ. *Second-Generation P4P: Rational Design, Purposeful Implementation, Proven Results*. Presentation at National Pay for Performance Summit, Los Angeles, CA, February 7, 2006.
17. Leatherman S, Berwick D, Iles D *et al*. The business case for quality: case studies and an analysis. *Health Affairs* 2003;**22**:17–30.
18. Perlin JB, Horner SJ, Englebright JD *et al*. Rapid core measure improvement through a "business case for quality". *J Healthc Qual* 2014;**36**:50–61.
19. Reiter KL, Kilpatrick KE, Greene SB *et al*. How to develop a business case for quality. *Int J Qual Health Care* 2007;**19**:50–5.
20. Micklethwaite A, Brownson CA, O'Toole ML *et al*. The business case for a diabetes self-management interventionin a community general hospital. *Popul Health Manag* 2012;**15**:230–5.
21. McKethan A, Brammer C, Jain SH. Toward a business case for performance improvement. *Am J Manag Care* 2011;**17**:e459–61.
22. Domino ME, Humble C, Lawrence WW Jr *et al*. Enhancing the medical homes model for children with asthma. *Med Care* 2009;**47**:1113–20.
23. Centers for Disease Control. Asthma Prevalence and Control Characteristics by Race/Ethnicity – United States, 2002. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5307a1.htm (20 January 2015, date last accessed).
24. Singh K, Speizer I, Handa S *et al*. Impact evaluation of a quality improvement intervention on maternal and child health outcomes in Northern Ghana: early assessment of a national scale-up project. *Int J Qual Health Care* 2013;**25**:477–87.
25. Rahimzai M, Amiri M, Burhani NH *et al*. Afghanistan's national strategy for improveing quality in health care. *Int J Qual Health Care* 2013;**25**:270–6.
26. Mate KS, Sifrim ZK, Chalkidou K *et al*. Improving health system quality in low- and middle-income countries that are expanding health coverage: a framework for insurance. *Int J Qual Health Care* 2013;**25**:497–504.