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Original Scholarship

"Pay for Success" Financing and Home-Based Multicomponent Childhood Asthma Interventions: Modeling Results From the Detroit Medicaid Population

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Policy Points:

- The Pay for Success (PFS) financing approach has potential for scaling the implementation of evidence-based prevention interventions in Medicaid populations, including a range of multicomponent interventions for childhood asthma that combine home environment risk mitigation with medical case management.
- Even though this type of intervention is efficacious and cost-saving among high-risk children with asthma, the main challenges for implementation in a PFS context include legal and regulatory barriers to capturing federal Medicaid savings and using them as a source of private investor repayment.
- Federal-level policy change and guidance are needed to support PFS financing of evidence-based interventions that would reduce expensive acute care among Medicaid enrollees.

Context: Pay for Success has emerged as a potential financing mechanism for innovative and cost-effective prevention programs. In the PFS model, interventions that provide value to the public sector are implemented with financing from private investors who receive a payout from the government only if the metrics identified in a performance-based contract are met. In this nascent field, little has been written about the potential for and challenges of PFS initiatives that produce savings and/or value for Medicaid.

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Methods: In order to elucidate the basic economics of a PFS intervention in a Medicaid population, we modeled the potential impact of an evidence-based multicomponent childhood asthma intervention among low-income children enrolled in Medicaid in Detroit. We modeled outcomes and a comparative benefit-cost analysis in 3 risk-based target groups: (1) all children with an asthma diagnosis; (2) children with an asthma-related emergency department visit in the past year; and (3) children with an asthma-related hospitalization in the past year. Modeling scenarios for each group produced estimates of potential state and federal Medicaid savings for different types or levels of investment, the time frames for savings, and some overarching challenges.

Findings: The PFS economics of a home-based asthma intervention are most viable if it targets children who have already experienced an expensive episode of asthma-related care. In a 7-year demonstration, the overall (undiscounted) modeled potential savings for Group 2 were $1.4 million for the federal Medicaid and $634,000 for the state Medicaid programs, respectively. Targeting children with at least 1 hospitalization in the past year (Group 3) produced estimated potential savings of $2.8 million to federal Medicaid and $1.3 million to state Medicaid. However, current Medicaid rules and regulations pose significant challenges for capturing federal Medicaid savings for PFS payouts.

Conclusions: A multicomponent intervention that provides home remediation and medical case management to high-risk children with asthma has significant potential for PFS financing in urban Medicaid populations. However, there are significant administrative and payment challenges, including the limited ability to capture federal Medicaid savings and to use them as a source of investor repayment. Without some policy reform and clear guidance from the federal government, the financing burden of PFS outcome payments will be on the state Medicaid program or some other state-level funding source.

Keywords: Pay for Success, social impact bonds, childhood asthma, home-based intervention, economic modeling.

INVESTING IN HEALTH AND HUMAN SERVICES PROGRAMS THAT ARE preventive in nature is challenging for the public sector. Allocating scarce public resources for potential and diffuse future gains can be difficult given more acute, immediate needs. In addition, the payoffs from upstream investments in prevention, especially those aimed at children, are often realized in different fiscal years under different administrations and are spread across a number of departments or agencies. The Pay for Success (PFS) financing model—also referred to as social

impact bonds—has emerged as a potential solution to these challenges and as a means to increase public spending on innovative and cost-effective prevention programs.[1]

In the PFS model, interventions that provide value to the public sector are implemented with financing from private investors who will receive a future payout from the government only if the metrics identified in a performance-based contract are met, based on a third-party evaluation.[2,3] As of December 2017, 18 PFS projects were launched in the United States, all of which focus on key social determinants of health and well-being, including education, employment training, housing, and psychosocial risk factors.[4] Although there are some challenges with the PFS model, the early experience in the United States suggests that this financing approach "holds great promise as a way to bring private-sector resources to efforts aimed at population health and decreasing health inequities."[5]

PFS is an innovative response to the challenges of implementing effective programs in the context of public-funding constraints and of investing in preventive interventions that result in government efficiency. These goals have particular relevance to Medicaid and the Children's Health Insurance Program, in which more than 70 million Americans were enrolled in November 2017, including more than 35 million children.[6] The nascent field of PFS is attempting to identify interventions with a strong evidence base that will provide value to the public sector in a reasonable time frame and also allow for payout to the private investors. This article presents an in-depth examination of the viability of using a PFS financing approach to implement an evidence-based multicomponent intervention for childhood asthma in an urban Medicaid population.

Background

Asthma is a serious and growing problem among children in the United States, especially those living in low-income urban communities with a degraded housing stock and poor air quality.[7] A number of high-quality research studies have concluded that multicomponent home-based interventions aimed at children and adolescents are effective both in controlling and reducing asthma symptoms and in reducing health care costs, including expensive emergency department visits and

hospitalizations.[8-13] Although there is some variation in program design, this intervention typically combines 2 home-based components: (1) an environmental assessment and subsequent tailored mitigation of major asthma triggers (eg, air pollutants, mold, dust mites, cockroach digestive material, mouse urine, and other allergens) through special cleaning processes, mattress and pillow coverings, air filters and air conditioning, and/or minor structural repairs and (2) case management that provides patients and their families with intensive education and supports to reduce asthma triggers, better manage symptoms and medications, and improve coordination among needed services.

Additional research is needed to further understand the relative impact and benefits of the 2 components in different environments and among children with different allergies and sensitivities. Nonetheless, the Community Preventive Services Task Force recommends multicomponent home-based interventions (tailored to individual allergies) as an evidence-based approach to childhood asthma control, recognizing the diversity of programs and approaches.[8] This family of interventions appears to be appropriate for a PFS financing model for a number of reasons. First, the intervention is not only effective, but it has also been demonstrated to be cost-saving if targeted at children at highest risk for serious asthma attacks. Cost-benefit analyses indicate average savings of $5 to $14 in averted medical costs and lost productivity per dollar spent on the intervention.[8-13] Second, other than through the use of special federal demonstration authority under Section 1115 of the Social Security Act, no federal Medicaid funding is available for the intervention's environmental mitigation component (eg, fixing leaky pipes, filling in structural cracks that promote mold growth, removal of moldy carpeting, allergenic furniture coverings, pest control, HEPA filters). To date, only Massachusetts has received permission to pay for some of these costs using federal Medicaid funding as part of a broader 1115 Medicaid demonstration. Thus, private funding is essential to scale the delivery of this evidence-based intervention in the Medicaid population.

A PFS approach would allow private sector capital to be used to implement and spread an effective approach to addressing an important social determinant of health (housing-based asthma triggers). Indeed, there is growing interest in multicomponent childhood asthma interventions among PFS stakeholders and socially minded investors, with several projects under way nationwide. In a project in Fresno, California,

Social Finance, Inc. and Collective Health, with funding from the California Endowment, are undertaking a PFS "proof-of-concept" project to measure the health outcomes and costs of a multicomponent home-based asthma intervention.[14] In this demonstration, 200 Medicaid beneficiaries affiliated with a federally qualified health center and diagnosed with uncontrolled asthma are receiving home visits that include education, assessment and remediation of environmental triggers, and disease management.[14] The goal is to reduce emergency department visits by 30% and hospitalizations by 50%, which is projected to decrease average per-child health care costs by $1,000 to $5,000.[14,15]

Also in California, the Alameda County Department of Public Health is partnering with the county's Healthy Homes Department to conduct a feasibility analysis regarding the potential of a PFS approach to scale a case management and home remediation intervention aimed at children with persistent and serious asthma in Medicaid managed care organizations (MCOs). This project is one of the first nationally to investigate the potential for an MCO, rather than the government, to serve as the potential end payor.[16] Preliminary health improvements are impressive, suggesting significant reductions in emergency visits and hospitalizations in a 6-month period.[17]

A similar project is planned in Baltimore, Maryland, led by the Green and Healthy Homes Initiative (GHHI), a national nonprofit organization that provides technical assistance for root-cause housing assessments and remediation.[18] GHHI is working with private investors and a Medicaid MCO in Baltimore to bring about a PFS initiative in which 1,800 children who have been hospitalized or visited the emergency room for asthma will receive a multicomponent home-based intervention. If a rigorous evaluation demonstrates cost savings, the MCO would pay a portion of the savings to the investors. Based on this work, GHHI, in partnership with the Calvert Foundation, received a Social Innovation Fund grant from the Corporation for National and Community Service in 2014 to expand their work on housing and health. GHHI and Calvert solicited applications through an open competition to participate in regional home-based asthma projects that would further assess the PFS feasibility of this intervention. Projects for which GHHI/Calvert Foundation are providing technical assistance to community-based organizations and partners are under way in Buffalo, New York; Grand Rapids, Michigan; Memphis, Tennessee; Salt Lake County, Utah; and Springfield, Massachusetts.[18,19]

Research Objectives

There is clearly great interest in using PFS financing to scale multicomponent home-based childhood asthma interventions in low-income populations, including in the Medicaid population. Understanding the PFS potential of this intervention requires understanding of the costs and benefits to both state and federal Medicaid programs. We modeled the economics of one version of this intervention in an urban-based Medicaid population under different assumptions and time frames to better understand the benefits and costs in a PFS context. Our primary aim was to reveal the potential for and policy-related challenges of this type of PFS initiative, with information that complements the empirical results being produced by current demonstrations in the field.

Methods

Model

In order to understand the general economics of a PFS demonstration of a multicomponent childhood asthma intervention, this analysis employed methods developed by Altarum Institute researchers that synthesize existing knowledge about the impact of a prevention intervention on health outcomes and costs, and then simulate population-level outcomes with and without the preventive intervention, allowing for a comparative benefit-cost analysis.[20] The scenarios modeled were designed to estimate, under different sets of assumptions and target populations, the general range of potential state and federal Medicaid savings for different types or levels of investment, the time frames for savings, and some overarching challenges—all of which provide essential information upon which an actual PFS demonstration in this area could be designed.

The population context for this simulation was low-income children with asthma who are enrolled in Medicaid managed care in Detroit, a city with high rates of childhood asthma and an older, deteriorating housing stock. In 2016, approximately one-half of children in Detroit were enrolled in Medicaid, with 5 Medicaid MCOs covering the majority of beneficiaries.[21] For simplicity, the modeling exercises were conducted using the total population of Detroit children with asthma enrolled in Medicaid, rather than attempting to parse the population into specific MCOs. A PFS demonstration regarding this intervention could involve

a single MCO (and thus a portion of the total population) or could be a more comprehensive initiative orchestrated by the state that would include all of the MCOs serving children in Detroit.

The intervention evaluated was a single-year multicomponent home-based demonstration project that included a home assessment followed by a "moderate" level of remediation for environmental triggers, as well as home-based education and case management with a trained professional to improve asthma management. Moderate remediation consists of providing households with allergen-impermeable mattress and pillow covers, small air filters and dehumidifiers, pest control services, professional cleaning services, and minor structural improvements (eg, patching holes, cleaning mold). This remediation is more intensive than simply providing fabric covers while less expensive than major home modifications (eg, removing carpet, replacing ventilation systems, or major structural projects).[22]

Using data regarding the Detroit Medicaid population under age 18 in 2014 and the diagnosed prevalence of persistent childhood asthma in Detroit in 2010 (the most recent year for which data were available), we examined 3 potential target groups for the intervention, based on the severity of the child's asthma: Group 1, all children under age 18 diagnosed with persistent asthma; Group 2, those with at least 1 asthma-related emergency department (ED) visit in the past year; and Group 3, those with at least 1 asthma-related hospitalization in the past year.

In 2014, the Detroit Medicaid population included 126,982 children under the age of 18, of whom 7,619 (6.0%) were computed to be in Group 1, 3,642 (3.9%) were in Group 2, and 510 (0.4%) were in Group 3, using the 2010 prevalence rates, the most recent data available for the Detroit population.[23,24] These data were used to approximately characterize the Detroit asthma population in 2016, the assumed intervention year.

In all scenarios, Medicaid savings occur through a reduction in health care costs, primarily through reduced ED visits and hospitalizations from asthma. The reduced costs for care are assumed to result in reduced per-member, per-month capitation payments (paid to the MCO by the state) that begin 2 years after the initial intervention year. The intervention impact was tracked for 5 subsequent years. Thus, each scenario has a 7-year duration: the intervention occurs in year 0, capitation rates are reset during year 1, and savings are realized in years 2 through 6.

Methods and Data

The analysis was based on recent historical rates of asthma prevalence and ED/hospitalization usage among children enrolled in Medicaid in Detroit, assuming that those rates would remain constant during the intervention period in the absence of the intervention: annual ED visits were estimated at 405.8 per 10,000 and hospitalizations were estimated at 48 per 10,000 in the absence of the intervention.[24] We also assumed that 70% of target population homes would accept the home remediation component of the intervention, based on prior research.[25]

We modeled the impact of a home-based asthma intervention similar to those used in previous, rigorous academic studies (ie, home assessment followed by "moderate" remediation plus case management).[22,25,26] Using data from previous studies, we estimated the expected costs of the intervention as follows: $1,187 per household in year 0, $71.22 per household per year for subsequent monitoring and follow-up, inflated by 2.02% per year using the average growth in the Medical Care Consumer Price Index (CPI) over the previous 5 years from the Bureau of Labor Statistics.[27] (Previous studies of "moderate" remediation quote intervention costs per household that range between $518 and $2,131; we selected $1,187 as a central value among these estimates.) These intervention costs reflect additional services to be provided through the intervention, beyond the services currently covered by Medicaid in Michigan. Added to the costs of the intervention was an additional $75,000 each year for administrative and data costs and a rigorous third-party evaluation, which is required in a PFS contract.

Based on the published results of randomized trials of this intervention, we estimated an expected 36% reduction in ED visits and 37% reduction in hospitalizations, persistent over the duration of the demonstration.[8,9,21,25-27] The model, in turn, estimated the impact of these reductions on total asthma-related costs for Medicaid, assuming a cost per hospitalization of $3,827 and a cost per ED visit of $561.[28,29] These costs were inflated by 2.02% per year using average growth in the Medical Care CPI.

The total projected savings to Medicaid as a result of this intervention are the number of ED visits and hospitalizations averted multiplied by the cost to Medicaid of each visit or hospitalization. To estimate state versus federal Medicaid savings, we apportioned between federal and state governments in proportion to the federal and state share of

Medicaid spending from fiscal year 2014 for Michigan, with 69% of the savings accruing to the federal government and the remainder to the state.[30] Given that the scenario is in an MCO environment, we estimated potential savings to state and federal Medicaid (in contrast to MCO-level savings) that could potentially result from a future lower capitation rate (the per-member, per-month rate paid to the MCO by the state per child). We assumed 1 year would be required to conduct the intervention and another year would be needed to establish the lower capitation rate based on reductions in ED visits and hospitalization. The projected Medicaid savings were therefore delayed 2 years to account for the lag required to adjust the Medicaid capitation rate.

States set capitation rates (fixed periodic payments for a defined package of benefits) for Medicaid MCOs under federal statutory and regulatory authority, which includes requirements that these rates be actuarially sound. In the face of an expenditure reduction in an MCO as the result of an intervention, a state Medicaid program might decide not to immediately readjust the capitation rate, continuing instead with current assumptions regarding the costs associated with asthma-related emergency care and hospitalizations. This would enable MCOs and their private investor partners to carry out the intervention and evaluate its health and economic effects over a longer period of time.

To guard against excessive profit-taking in lieu of social investments, a state might set net revenue target expectations in its contracts, thereby promoting ongoing MCO investment in environmental interventions. In this way, an MCO could use the revenue it captures from capitation payments to invest in the continuation of the intervention while repaying its investor. In either case, a cost-saving intervention funded by a private investor is providing social impact (improved housing stock and decreased asthma emergencies) in the Medicaid population. However, the public sector would realize a return only after sufficient time had elapsed to enable accurate measurement of the impact of such investment and to incorporate the results into the rate-setting system.

Since the primary goal of this analysis was to estimate potential *public* savings in reduced Medicaid childhood asthma-related health care costs, we assumed a fairly rapid readjustment of capitation rates. Although other scenarios are possible, this analysis provides an estimate of potential public savings, which is useful (rather than proscriptive) information for policymakers.

Limitations

The analysis ignored any benefits of the intervention to other children in the household who were not specifically targeted for the intervention, assuming that full intervention costs would be incurred for each targeted child, even if multiple children with asthma lived in the same household. This assumption likely underestimates the benefits of the intervention. We also assumed that the predicted decreases in ED and hospitalization use from the intervention would persist for 5 years following the intervention, an assumption supported by prior research.[26,27] The modeling did not take into account compensating behaviors by hospitals in the face of decreased asthma admissions, additional costs of tailoring interventions based on child allergic sensitization tests, decreases in Medicaid enrollment over time, or children aging out of coverage. We discuss the implications of the latter omission in the next section. In addition, we assumed that the children in Group 2 and Group 3 would exhibit similar ED and hospitalization use in the intervention year as in the past year. Our sensitivity analysis (described in the next section) estimates the potential impact of this assumption.

Findings

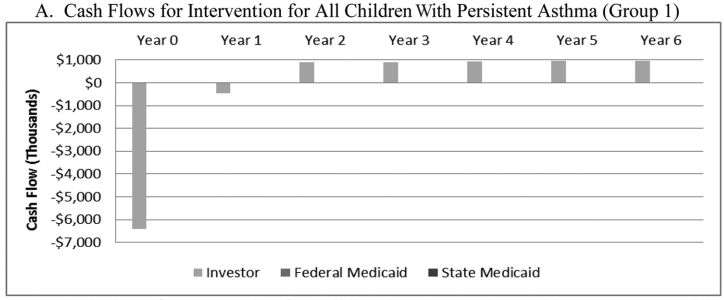
For each of the 3 target group scenarios, modeling exercises produced estimates of the total and per-capita pre-intervention frequency and costs of asthma-related hospital admissions and ED visits per year (in 2016 dollars), the total intervention cost including for a PFS demonstration and evaluation, and the effect of the intervention on averted hospitalizations and ED visits if 70% of the children in each targeted group accept the intervention (Table 1). (The assumption of a 70% participation rate is not critical to the analysis. Except for the relatively small fixed costs of program administration and evaluation, both costs and benefits of the intervention are proportional to this rate.) The results reveal that as the intervention population becomes more narrowly targeted and focused on asthma severity (Groups 2 and 3), the total intervention costs decrease and the economic impact of the intervention per targeted child increases. Because we assumed, absent the intervention, the same ED and hospitalization use in the intervention year as in the past year, the number of averted ED visits is the same for Groups 1 and 2, and the number of averted hospitalizations is the same for all 3 groups (these

Table 1. Detroit Medicaid Childhood Asthma Population and Results for 3 PFS Scenarios

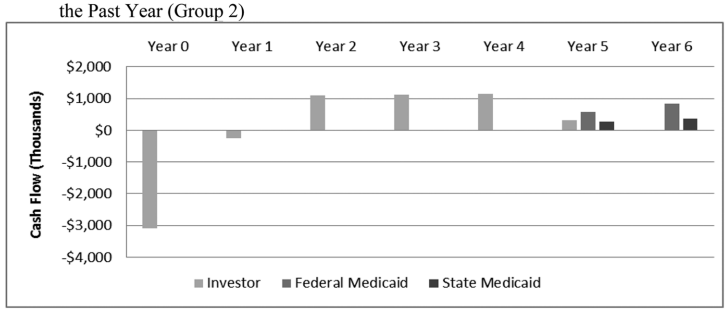
		Before Intervention				With Intervention	
		Annual Services		Associated Medicaid Costs		Annual Services Averted	
Target Population	Number in Population	ED Visits	Hospital Admissions	Total	Per Capita	ED Visits	Hospital Admissions
Group 1: All children with asthma	7,619	5,153	609	$9,304,196	$685	1,334	153
Group 2: Children with ≥1 ED visit in the past year	3,642	5,153	609	$5,218,370	$1,432	1,334	153
Group 3: Children with ≥1 hospital admission in the past year	510	719	609	$2,733,622	$5,360	186	153

Figure 1. Estimated Cash Flows for Home-Based Asthma Intervention in Different Target Groups (Investor Repaid First)

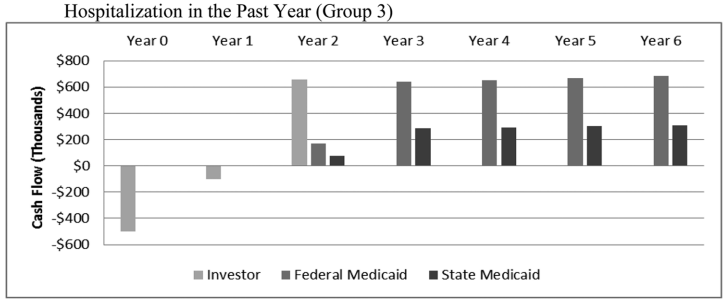
A. Cash Flows for Intervention for All Children With Persistent Asthma (Group 1)



B. Cash Flows for Intervention for Childhood Asthma Patients With at Least 1 ED Visit in the Past Year (Group 2)



C. Cash Flows for Intervention for Childhood Asthma Patients With at Least 1 Hospitalization in the Past Year (Group 3)



assumptions are relaxed in the sensitivity analysis described later in this section).

Figure 1 depicts the positive and negative annual cash flows associated with the 3 target populations (Groups 1-3). In each scenario, the analysis assumes that the investor is repaid first, with up to a 10% return on

investment if the intervention generates sufficient savings, before any savings are realized by Medicaid. Separate cash flows are shown for the investor, federal Medicaid savings, and state Medicaid savings. In each of the 3 scenarios, positive returns are realized starting in year 2, the year in which lower capitation payments from the state to MCOs begin. While the structure of an actual PFS payout would be more complicated due to legal constraints and would likely be spread out over the demonstration period (as discussed later), the results elucidate whether or not the intervention would generate Medicaid savings sufficient to repay investors with a return on the investment in each of the 3 scenarios.

For Group 1 (the target population of all children with persistent asthma in the Detroit Medicaid population), the costs of implementing the intervention include an initial investment of $6.4 million in year 0 and investments in years 1 through 6 of $465,000 to cover annual administrative and evaluation costs and continued education and case management. In subsequent years, the investor is repaid as Medicaid savings are generated. As shown in Figure 1, Panel A, this broad targeting of patients does not generate sufficient savings to fully repay an investor by the end of year 6, and it produces no net savings to Medicaid. Assuming a 3% discount rate, the net present value (NPV) for the entire flow of funds to all 3 parties at year 6 is a negative $2.6 million, and the investment generates an overall internal rate of return (IRR) of –9% at year 6. *In summary, the target population of all children with persistent asthma (Group 1) is not economically viable for a 7-year PFS demonstration premised on Medicaid savings.* It would cost significantly more to implement the intervention in this broad target population than the Medicaid savings that would be generated.

For Group 2 (a more narrow target population of children with asthma who incurred at least 1 ED visit in the past year), there is an initial investment of $3.1 million to implement the intervention and investments of $260,000 to cover annual evaluation and case management costs in subsequent years (Figure 1, Panel B). In this scenario, an investor could be repaid with a 10% success payment in year 5 (6 years after the intervention is initiated). Assuming a reduction in the per-member capitation rate paid by the state to the MCO, Medicaid would realize savings by year 5 (approximately $586,000 for the federal government and $262,000 for the state government) and somewhat larger savings (approximately $827,000 for the federal government and $372,000 for

the state) in year 6. The NPV at year 6 is $1.7 million and the overall IRR is 15%, suggesting a significant overall return. *As such, the target population of all children with asthma with at least 1 ED visit in the past year (Group 2) appears to be economically viable for a 7-year PFS demonstration premised on Medicaid savings.*

For Group 3 (children with persistent asthma with a least 1 hospitalization in the past year), an initial investment of $499,000 in year 0 and subsequent investments in years 1 through 6 of $101,000 to cover annual evaluation and case management costs are needed. In this scenario, with a smaller yet higher-risk population, the investor could be fully repaid with a 10% return in year 2 with some additional modest savings to Medicaid in that year (totaling approximately $247,000 for the combined federal and state savings; see Figure 1, Panel C). Savings to Medicaid in subsequent years range from $640,000 in year 3 to $683,000 in year 6 for the federal government, and from $287,000 to $307,000 for the state (these annual values grow gradually as a result of inflation in the cost of ED visits and hospitalizations). At year 6, the NPV is $3.5 million, and the overall IRR at year 6 is 86%, suggesting a large overall financial return. *In summary, the target population of all children with asthma with a hospitalization in the past year (Group 3) appears to be the most economically viable for a 7-year PFS demonstration premised on Medicaid savings.*

For Groups 2 and 3, the estimated savings from the intervention are *underestimated* to the extent that other child Medicaid beneficiaries with asthma live in or visit the same household as the high-risk child targeted for the intervention. The estimated 5 years of savings postintervention, however, are also an overestimate given that the model does not account for attrition from the intervention population due to migration and the loss of Medicaid eligibility for various reasons, including aging beyond 18 years. Further, there could be additional costs to Medicaid for prescription drugs if adherence to self-management of asthma protocols improves as a result of the education and case management components of the intervention. Although some children on Medicaid remain on Medicaid as adults, many will age out of the program at age 19. For Group 3, this overestimation bias in the results is not a serious concern, given that the savings through year 2 are sufficient to repay the investor with an incentive payment (Figure 1, Panel C). For Groups 1 and 2, the overestimation bias may further reduce the potential cost savings, which, as discussed, are already limited.

Figure 2. Medicaid Savings Summary in 7-Year Demonstration (Groups 1-3)

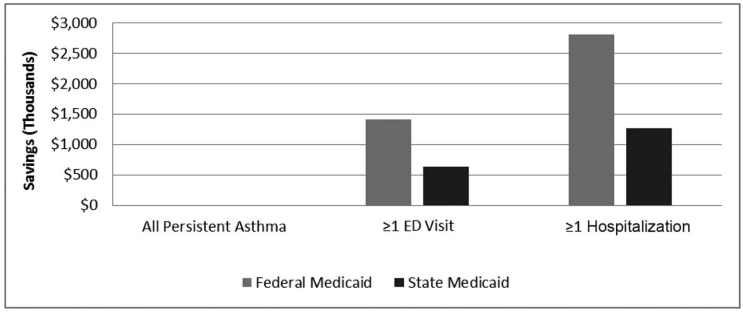


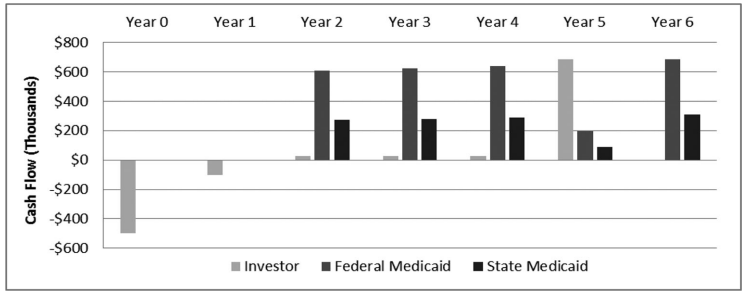
Figure 2 summarizes the overall (undiscounted) savings to federal and state Medicaid for each of the 3 target population scenarios in a 7-year demonstration. Targeting all patients with at least 1 ED visit in the past year (Group 2) yields a savings of $1.4 million to the federal government and $634,000 to the state government. Targeting only those patients who had at least 1 hospitalization in the past year (Group 3) results in a savings of $2.8 million to the federal government and $1.3 million to the state.

Payments to an investor in scenario 3—the most economically viable scenario for a childhood asthma PFS program—could be paid out over time instead of at the end of a demonstration project. A payout structure could use a "fixed-debt" model in which the investor is paid interest (assumed to be 4%) on the initial investment in each year after the initial investment, followed by repayment of the initial loan and any success payment (up to 10%) in year 5. The cash flows for this model for scenario 3 are presented in Figure 3. The overall results are similar to those shown in Figure 1, Panel C, although the total savings to Medicaid is slightly lower given the additional interest payments to the investor.

Sensitivity Analysis

We have conducted sensitivity analyses on some of the assumptions used for the Group 3 results shown in Figures 1 and 2. These results

Figure 3. Cash Flows for Intervention for Children With Asthma With at Least 1 Hospitalization in the Past Year (Group 3), Fixed-Debt Model



were based on an assumption that the intervention would target the most expensive patients based on their ED and/or hospital use in the year before the intervention (Groups 2 and 3), and that, absent the intervention, the average annual use of these resources by this group of patients would be the same as in the previous year. In reality, the target population might experience future utilization rates that differ from those observed before the year of the intervention. Prior research has observed the regression-to-the-mean phenomenon, in which many of the highest users of health care in a population in a given year typically do not have a similar high rate of use the following year.[31,32] To investigate the impact of the assumption of unchanged utilization rates over time, we conducted sensitivity analysis by varying the annual number of hospitalizations that would occur without the intervention in Group 3 from 100% of the hospitalizations observed in the year before the intervention (likely an overestimation of the intervention effect) down to 5% of that hospitalization rate. The results reveal small positive savings to Medicaid with a hospitalization rate as low as 10% of its pre-intervention level and substantial savings for smaller reductions in the rate. For example, if the hospitalization rate drops to as low as 50% of its pre-intervention level, federal Medicaid savings fall from $2.8 million to $1.3 million and state savings are reduced from $1.3 million to $574,000. The reductions in savings are necessarily less for hospitalization rates between 50% and 100%.

The effect sizes used in our analysis were based in part on results from single-group pre- and posttest design studies, in which some of the perceived benefit of the intervention might be caused by the problem of regression to the mean noted above. Another way to investigate this issue is to infer our estimate of effect sizes only from randomized controlled trials (RCTs) involving both an experimental group and a control group. Including only RCT results in our effect size estimates decreased the predicted effectiveness of the intervention to a 16% reduction in hospitalizations and an 11% reduction in ED visits. At these lower levels, the intervention remains capable of repaying investors and producing substantial savings to Medicaid, generating $721,000 in savings to the federal government and $324,000 in savings to the state.

Our assumption that the benefits of the intervention would persist for the duration of the demonstration project was based on a single study in which persistence was tracked for 1 year postintervention. We therefore tested the sensitivity of our results to the duration of persistence of the intervention. If the benefits persist for as little as 2 years following the intervention, enough savings would be generated to repay investors, save the federal government $597,000, and save the state $268,000. If, however, no benefits remain after a single year following the intervention, the project would not produce sufficient savings to repay investors.

Discussion: How to Capture Savings to Pay Back the Investors

The modeling results presented earlier demonstrate that a multicomponent home-based intervention targeting high-risk children on Medicaid has the potential to save costs since the savings from the predicted reduction in ED visits and hospitalizations are greater than the costs of delivering the intervention. A key component of any PFS initiative, however, is how to capture the potential public savings to make a payout to the private investors. Given current Medicaid law and regulation, it is generally not permissible for the federal Medicaid program to make payments to private investors, especially when the services involved are outside of "medical assistance" or what Medicaid is authorized to cover. Even if an intervention produces significant state and federal Medicaid savings, there can be no federal financial participation (FFP) or federal

matching funds in a state Medicaid program payout to investors. As such, capturing both state and federal Medicaid savings for a PFS investor repayment is quite challenging.

In the current Medicaid legal/regulatory context, we have identified 4 general options for structuring a payout to a private investor in a PFS childhood asthma initiative: (1) the MCO makes the payout to the investor; (2) through a Medicaid MCO incentive agreement with the state, the MCO repays investors using financial incentive payments for which limited FFP would be available; (3) the state Medicaid program makes the payout to the investor using state savings only; and (4) the payout comes from a state and/or federal fund outside of the Medicaid program, allocated for PFS outcome payments. These sources of success payments are not mutually exclusive, and PFS initiatives involving Medicaid would likely involve more than one of these funding strategies.

Payment Source 1: MCO Savings

To the extent that the PFS intervention reduces the cost of serving plan enrollees below the amount of capitation revenue the MCO receives from Medicaid, the MCO may retain these savings and use them to repay private investors. This form of savings does not immediately produce state or federal savings because the amount paid by Medicaid to the MCO was negotiated and set in advance. In addition, the MCO savings might not continue indefinitely since future capitation rates need to be actuarially sound, reflecting the fact that actual managed care costs have declined below the original rate. The shifting downward of MCO capitation revenue because of a successful asthma intervention can be viewed as penalizing the MCO for prevention success, yet this is the only way for the public sector to actually save money in a managed care context.[33]

If an MCO reduces its costs below the capitation rate, the state does not necessarily have to reduce the rate accordingly, including if the costs of care were not reduced for most persons in the broader Medicaid population. Nonetheless, it is the reduction in the capitation rate for a particular MCO that produces state and federal Medicaid savings. Otherwise, the public expenditures remain the same while the MCO uses its savings to repay the investor.

Payment Source 2: MCO Incentive Payments

As described in the preceding segment, if the intervention is successful in reducing health care use, the MCO could use the resulting savings from within its capitation payment to make success payments to the investor. In addition, Medicaid regulations permit state contracts with MCOs to have "incentive arrangements" that include additional payments above negotiated capitation rates for achievement of agreed-upon outcomes.[34] As such, the state Medicaid program could make "incentive payments" to the MCO, which also could contribute to investor repayment. Incentive payments that qualify for federal Medicaid matching funds are limited to 5% of the approved capitation payments attributable to the enrollees and/or services covered by the incentive arrangement.[34] For example, for a $150 monthly capitation payment, the MCO could receive an additional $7.50 incentive payment for enrollees with asthma. The state and federal government would each pay a portion of the $7.50, according to the Federal Medical Assistance Percentage (FMAP) formula for the state.

Incentive payments in the Medicaid program are structured to reward MCOs for reducing the costs of covered services while maintaining quality. These small incentive payments were *not* designed to finance upstream social interventions outside of "medical assistance" that produce later Medicaid savings. Thus, while this arrangement allows federal Medicaid funds to be used in a PFS demonstration with an MCO, the 5% cap significantly limits the amount of federal matching funds a state can use in the incentive agreement with an MCO. As such, while this approach allows for some federal financial participation in an MCO's success payment to an investor, the state bears the majority of the burden of capturing savings and making a payout to the private investor.

Payment Source 3: State Medicaid Program Savings Alone

Given the restrictions faced by the federal Medicaid program in capturing savings for success payments to private investors, a third option is to use only state Medicaid savings (primarily through lowered capitation rates) in such payouts. As long as the state Medicaid program is willing to forgo FFP in such payments, making success payments (including a rate of return) to PFS investors is legally permissible.

Nonetheless, as revealed in the economic analyses previously discussed, this model is only feasible in the third scenario, in which the target population receiving the intervention is those high-risk children who had a hospitalization for asthma in the past year. In the Detroit environment, it would cost approximately $1.1 million to implement and evaluate the intervention in this population, for an estimated $1.3 million in net savings to the state Medicaid program over the next 6 years. This is close to a break-even point, which does not allow for much of a return on the investment or for any unexpected challenges with the intervention implementation or its anticipated impact. This model, in which the state Medicaid program absorbs the full repayment to the investors, could also be feasible in the other scenarios if the state were to prioritize cost-effectiveness (the value provided by the intervention is worth the costs) over actual public savings.

Given the current FMAP in Michigan, the federal Medicaid program would realize approximately $2.8 million in net savings from this intervention over a 7-year period and would keep all of the savings, while the Michigan Medicaid program would come close to breaking even in terms of economic benefits and costs. From a broad PFS perspective, this is a successful model in which the public sector writ large works with the private sector to launch a successful prevention effort that improves health outcomes and reduces public expenditures at no risk to taxpayers. Even so, the fairness of the distribution of the economic benefits between the state and federal Medicaid program can be questioned.

Payment Source 4: PFS Fund Authorized Outside of Medicaid Program

The challenges and limitations in using federal Medicaid savings to repay private PFS investors suggest an important role for the establishment of special, centralized public funds, separate from Medicaid or other public programs, that can be used for PFS outcome payments. Such flexible PFS funding would also help resolve the "wrong pocket" problem, in which an intervention produces savings to more than one government program and/or government level, but no single agency or program has the resources or financial incentive to entirely fund the intervention.

The establishment of such funds or appropriations is recommended by a number of organizations in the PFS field, including Third Sector

Capital Partners and the Urban Institute. In addition, a Government Accountability Office (GAO) report recommended that the federal government could play a number of different roles in supporting and incentivizing PFS demonstration projects, including the further development of funding mechanisms that are outside of specific federal programs, departments, or agencies.[35]

Several local and state governments have already established and appropriated centralized funds that will be used to pay back investors if the success metrics of PFS contracts are met. For example, in 2012, Massachusetts became the first state to implement authorizing legislation for PFS initiatives, including the Social Innovation Financing Trust Fund "for the purpose of funding contracts to improve outcomes and lower costs for contracted government services" via PFS public-private partnership initiatives.[36]

In addition, federal legislation has been introduced to incentivize PFS initiatives and other social impact partnership projects at the federal, state, and local levels, including the establishment of funding for success payouts within the Treasury Department. Most recently, H.R. 576 and S. 963 (both named Social Impact Partnerships to Pay for Results Act) were reintroduced in the 115th Congress. These bills encourage partnerships between the private and public sectors to improve domestic social programs through pay-for-performance activities that scale effective social interventions and to establish oversight authority and a funding source for investor payouts within the US Department of the Treasury.[37,38] The establishment of such funds or trusts at the local, state, and federal levels is critically important to PFS activities in that it formally signals strong political and economic support for the PFS model and appropriates funds for investor payouts that are outside of the rules and regulations that govern funds within specific agency or program budgets.

Conclusions and Policy Implications

We conducted a series of modeling exercises to estimate the total amount of savings to both state and federal Medicaid programs that could result from a home-based multicomponent childhood asthma intervention in an urban Medicaid population in the context of PFS financing. Under different assumptions regarding targeting and some general assumptions

about evaluation and administrative costs and a 10% return on investment for investors, the modeling results reveal a number of general conclusions.

First, assuming a goal of Medicaid cost savings or breaking even, this intervention is economically viable in a PFS context only if the target population is children with persistent asthma who have experienced at least 1 ED visit and/or hospitalization in the past year. Focusing the intervention on the target population of children with a recent prior hospitalization for asthma (Group 3) would likely be the most attractive scenario to investors because of the higher rate of return on the investment and the shorter time period in which significant Medicaid savings are realized. For the broad population of all children with asthma (Group 1), Medicaid savings would not be sufficient to pay for the intervention. The obvious downside of such narrow targeting is that it does not capture the long-term value to Medicaid of mitigating health risks to children who in the future easily could, without intervention, fall into the highest risk category. The need to produce shorter-term savings is an inherent limitation of the PFS financing model.

Second, there are legal impediments to capturing the significant federal Medicaid savings that would be realized for investor repayments. If the success payments are financed entirely through state Medicaid savings, the target group must be the highest-risk children (Group 3) and it will take a relatively long time (7 years) to recoup the savings needed to repay the investor. In this financing model, the state Medicaid program would essentially break even while the federal Medicaid program would retain significant savings. The state, however, would likely be capturing some additional savings due to the improved health of children and their siblings, increased school attendance, increased employment attendance and productivity of parents, improved housing stock, etc—savings that are difficult to observe and estimate.

Third, to overcome the investor payout challenges in the Medicaid program, the establishment of centralized government PFS funds at the state and federal levels is critically important if PFS financing is to be successful in improving outcomes and reducing costs in the Medicaid population. It should be noted that there are many other barriers to launching PFS projects in addition to the challenges associated with the public sector making performance-based payments to private investors.[3,5] Nonetheless, the investor payout challenge is fundamental and must be overcome in any PFS initiative.

In summary, our modeling results add additional support to current efforts to spread the use of multicomponent home-based interventions for childhood asthma in urban low-income populations through the PFS financing model. However, even though the intervention is clearly efficacious and cost-saving among high-risk children, there are significant challenges for implementation in a PFS context, including the limited ability to capture federal Medicaid savings and to use them as a source of investor repayment. Federal Medicaid policy does not recognize states' ability to share savings with private investors, even when these savings are well documented and relate to evidence-based interventions of proven public health value. This puts the financing burden of PFS success payments primarily on the state Medicaid program.

The revised Centers for Medicare and Medicaid Services (CMS) managed care regulations that went into effect in June 2016 might hold some promise for states "to create broadly applicable value-based purchasing frameworks that enable managed care entities to undertake service-delivery innovation and, if desired, finance the projects using Pay for Success mechanisms."[39] It appears that under these regulations a state and an MCO could enter into an agreement that includes a value-based purchasing program for a home-based asthma intervention that targets a specific, high-need population based on medical need. It also, importantly, appears that such services could be considered as "medical expenses" to be counted in the numerator of the medical loss ratio formula.[39] These and other changes allow for greater flexibility in funding nonmedical interventions and the ability to capture Medicaid dollars in success payments to investors.[39] Although organizations like the Green and Healthy Homes Initiative are cautiously optimistic about the ability of these new regulations to support PFS financing of environmental and other types of public health interventions in Medicaid populations, additional clarity and guidance are greatly needed from CMS.

Another policy solution to these challenges would involve amending federal Medicaid law to expand the definition of what constitutes medical assistance to include evidence-based interventions that can complement covered services for children, which would enable states to pay for such interventions as part of coverage itself. Medicaid offers important coverage flexibility not found in private health insurance in the form of payment for intensive care management, preventive counseling, and anticipatory guidance to families. These services are all part of Medicaid's Early and Periodic Screening, Diagnostic and Treatment

(EPSDT) benefit, of historic importance in the evolution of child health policy.[40] Furthermore, states have the flexibility to cover EPSDT benefits when furnished in home-based and other nontraditional locations found outside clinical settings.

It would not be a huge stretch to expand the definition of EPSDT to include certain types of supplies, equipment, and home-based services associated with environmental risk reduction in an asthma context. Given EPSDT's preventive purpose, such services could be made available not only to children who already have severe asthma but also to those who live in households in which high levels of triggering risks are determined to be present. Under such a scenario, a PFS approach would not be needed. The federal and state governments could jointly make such investments, and any savings would stay within the programs rather than be shared with private investors. In the absence of changes in the federal statute to permit such an expanded definition of medical assistance for EPSDT purposes, the federal government could allow such an approach to proceed as a Section 1115 demonstration. As such, clear CMS guidance is also needed in regard to using incentive payments or value-based purchasing as a way to make payments to private investors if success outcomes are realized.

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