



Published in final edited form as:

*J Pediatr.* 2009 August ; 155(2): 281–5.e1. doi:10.1016/j.jpeds.2009.02.035.

## The Health and Cost Impact of Care Delay and the Experimental Impact of Insurance on Delays: Evidence from a Developing Country

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### Abstract

**Objective**—To examine whether delays in seeking care are associated with worse health outcomes or increased treatment costs in children, and then assess if insurance coverage reduces these delays.

**Study design**—We use data on 4070 children under 5 years from the Quality Improvement Demonstration Study (QIDS), a randomized controlled experiment assessing the effects of increasing insurance coverage. We examined if delay in care, defined as greater than two days between the onset of symptoms and admission to the study district hospitals, is associated with wasting or having positive C-Reactive Protein (CRP) levels upon discharge, and with total charge for hospital admission, and, evaluated whether increased benefit coverage and enrollment, reduced the likelihood of delay.

**Results**—Delay is associated with 4.2 and 11.2 percentage point increase in the likelihood of wasting ( $p=0.08$ ) and having positive CRP levels ( $p=0.03$ ), respectively, at discharge. On average hospitalization costs were 1.9% higher with delay ( $p=0.04$ ). Insurance intervention results in 5 additional children in 100 to not delay going to the hospital ( $p=0.02$ ).

**Conclusions**—In this population, delayed care is associated with worse health outcomes and higher costs. Access to insurance reduced delays, thus, insurance interventions may have positive effects on health outcomes.

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Edited by RW and WFB

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## Keywords

Insurance; child health; health policy; delay in care; health care utilization; health care costs; child health outcomes

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Many studies conducted in developed countries have found that the uninsured have poorer access to health care services.<sup>1-3</sup> Children, in particular, are vulnerable.<sup>4-6</sup> If poor access is due to a delay in seeking care and starting treatment, children may not be able to recover or even survive.<sup>7</sup> Thus, insurance expansions targeted at children have been advocated and implemented where coverage of children is limited, for example in the United States<sup>8</sup>. Initial evaluations in wealthier countries show that insurance programs have been able to improve access by reducing delays in health seeking for newly insured children.<sup>9-13</sup> Initial evaluations show that these insurance expansions lead to better subjective health outcomes<sup>12, 14</sup> and lowered costs.<sup>6</sup> Reductions in delays can improve outcomes as children are brought to health facilities at less severe illness stages. These can partially mitigate the effects of other non-financial barriers to care, such as lack of education.

The finding that insurance reduces delays and improves health outcomes is especially important for low income countries where child health status is worse and relative out-of-pocket payments for care are high.<sup>15</sup> The supposition is that delays in care contribute to worse health outcomes and higher costs. A related question is whether insurance coverage mitigates against these delays, and if children seek care earlier when out-of-pocket payments are reduced through insurance. If we can show the same results in a middle income country setting, then this suggests insurance can be a potent instrument with which to improve access and improve health outcomes.

The presence of a unique randomized experiment in the Philippines provided us with an opportunity to replicate these results in a developing country setting where the financial burden of care is high. Using the child patient exit data from the Quality Improvement Demonstration Study (QIDS), a large randomized controlled experiment assessing the effects of increasing insurance coverage, we perform three analyses in this paper: (1) examine whether children who delay have a worsening of their health status, (2) estimate the impact of delays in health seeking on costs of treatment, and (3) assess whether the QIDS Access Intervention reduces delays.

## Methods

The children analyzed in this paper were part of the Philippine Child Health Insurance and Policy Experiment known locally as QIDS, a five year randomized controlled experiment that seeks to assess ongoing national health sector reforms, particularly the impacts of insurance interventions and quality of care bonuses on health outcomes of children under 5 years of age.<sup>16</sup> The study has been implemented in 30 districts, each with a corresponding district hospital, throughout 11 provinces in the Visayas islands of the Philippines. As part of the experiment, hospitals were matched into blocks and randomly assigned to (1) Access Intervention, which expands access to care by increasing the insurance benefit package for children under 5 years old and increasing enrolment of households into the insurance program, and (2) Control, in which no interventions were introduced. Baseline, or pre-intervention, assessments were conducted in 2003-2004 and post-intervention in 2006 in all sites, allowing a difference-in-difference analysis of Interventions and Controls. QIDS was conducted and approved in accordance with Human Subject Review standards and institutional review boards of the University of the Philippines and the University of California, San Francisco. We examine here

the impact of the Access Intervention on delays compared with the controls. (A full description of the study and sampling frame can be found in our previous publication.<sup>16</sup>)

Data came from exit surveys obtained at the sample district hospitals starting in 2003 for the baseline round, and from the post-intervention round in 2006. At the time of discharge, children were sequentially identified at the facility following an acute illness. Exit surveys obtained information on services provided, health facility utilization, and total expenses incurred related to the episode of illness. Household socio-economic information was also collected as part of the instrument. Licensed medical technologists were trained to conduct the interviews and collect anthropometric measurements and blood samples. We obtained written consent from the parents and guardians before information was collected from patient charts and face-to-face interviews, and before blood samples were collected.

To be eligible for the study a child had to be aged 6 months to 5 years and 11 months from families residing in the geographic catchment of the facility. A total of 4070 children, 1997 from the baseline and 2073 sample patients from the post intervention round, were surveyed in the 20 control and Access sites. Overall, 2027 sampled patients were from the Access sites, of which 985 were from those surveyed at baseline and 1042 were sampled post intervention.

In determining the impact of delays on health outcomes and total hospital charges we used data from the baseline sample to establish the no intervention scenario. This avoids problems brought about by the possible correlation of elapsed time before admission and interventions in the second round sample (which increases the estimates of standard errors).

We defined delay as the total number of days between the onset of symptoms and admission to the district hospital. Total cost is defined as the actual charges associated with a confinement. Drug charges in particular can be incurred outside of the hospital in the Philippines. Costs thus included total hospital charges, physician charges and out of pocket charges.

For our health outcome variables, we used both biologic and anthropometric assays to measure health status. Blood samples were collected at the point of discharge to measure whether a child had an elevated C reactive protein (CRP). CRP is an acute inflammatory marker that reliably indicates infection or other types of inflammation, as a general marker or indicator of response to treatment (not as a patient-specific test for disease or clinical care). We used established clinical procedures with established quality control methods for obtaining venous samples for the laboratory testing. CRP levels were tested using a rapid latex agglutination test manufactured by Teco Diagnostics (<http://www.tecodiag.com/>). Wasting, our anthropometric measure, is commonly used to indicate, illness, or poor nutritional status. Wasting was also constructed as a binary variable and was defined as whether the child had a ratio of weight to age below the normal range standardized for age and sex.<sup>20</sup>

## Data analysis

We developed a logit model to determine if health outcomes worsened when delays increased, controlling for other factors that may affect these outcomes such as any utilization or treatment obtained at another facility before the confinement, the age and sex of the child, the diagnoses (pneumonia or diarrhea), length of stay and prior hospitalization for the same illness condition as indicators of illness severity. Services and treatment intensity was modeled by the use of oral medications, the number of oral medications taken, whether intravenous drugs were administered to the patient, whether the child was visited by a specialist and whether the child had any laboratory tests done in the facility.

We used ordinary least squares to determine if delays in care resulted in higher costs. In addition to the same control variables used on the health outcomes model, we included whether a child

was a PhilHealth beneficiary to control for possible mark-ups imposed on insured patients. Father's education and type of room accommodation were also introduced to control for other potential sources of price mark-ups or discounts.

We estimated the likelihood that a delay, defined as more than two days before admission, would be less likely if the child were in the insurance intervention group in the logit model. We used our before and after data and compared control versus intervention groups in a difference in difference estimation to evaluate our hypothesis that insurance decreased utilization barriers imposed by resource constraints. We included the diagnoses variables to control for differences in symptoms that influence the likelihood to delay across illnesses, and treatment sought at another facility to partially control for physician decisions to admit patients. To compute for the differences in predicted probabilities of delay, we utilized the sample means for the control variables and imputed a value of one for the intervention variable. We used Stata 10 to estimate the three models and perform tests of significance for our variables (Copyright 1984-2007, StataCorp, College Station, Texas, USA).

## Results

The age of our sampled children ranged from 5 to 59 months with an average of 23.1 months and their parents had finished about 8 years of education, with some parents reporting no schooling at all. Nearly two-thirds of children were diagnosed with either pneumonia or diarrhea. Slightly more than one in four children were initially brought to another facility before admission to the hospital and, for around half of our sample, this hospitalization episode was not the first time that they were admitted for the same condition.

Close to 26% of the children took more than 2 days before seeking care. The average out-of-pocket cost was US\$ 32.77 per child (using the 2003 average exchange rate of PhP 54.203 to US\$ 1), with a maximum reported of US\$ 436.14. In the baseline sample, we observed that about 35% of the sampled children were wasted and around 27% had a positive CRP at the time they were discharged (Table I).

When more than two days elapsed between the onset of symptoms and the hospital admission, we found that a child was 11.2 % more likely to be CRP positive and thus more likely to have worse health status at the time of discharge relative to a child who was promptly admitted ( $p=0.03$ ). Diarrhea decreased the likelihood of being CRP positive, and those who required specialist visits, an indicator of illness severity, were more likely to be CRP positive (Table II; available at [www.jpeds.com](http://www.jpeds.com)). Similarly, there was a 4.6% increase in the likelihood that a child would be wasted if their admission was delayed than if it were not ( $p=0.08$ ). Wasting was also associated with longer lengths of stay with either diarrhea ( $p<0.001$ ) or pneumonia ( $p=.04$ ) compared with children with other illness. In summary, if the delay is minimized to less than two days for an 'average' child, the predicted probability of having a positive CRP levels at discharge is reduced by at least 5.7 percentage points, and the predicted probability of wasting is reduced by about 4.5 percentage points (Figure 1).

We estimated the incremental effect of the delays on total charges to be about PhP 270 or US \$ 4.98. This is the equivalent of 5 times the daily poverty threshold utilized by the World Bank ( $p=0.04$ ) (Table III; available at [www.jpeds.com](http://www.jpeds.com)). As expected, the increased costs were also associated with length of stay, insurance status, father's education, IV medication and specialist visit use and whether this was pneumonia. However, the interaction of delay and length of stay indicates that the cost reduction with early care seeking diminishes as the patient is more severely ill. Thus, for an average length of stay, the net effect of more than two days delay in admission was to increase costs by about 1.9 % of mean total charges (Figure 2).

When we examined whether insurance mitigated against delays in seeking care, we found that higher insurance coverage reduced the delays in health seeking. Delays were 5.29% lower in the intervention sites after the experimental introduction of the Access intervention compared with the control sites ( $p=0.02$ ), controlling for secular trends and differences across the sites at baseline. Thus, if a child was insured there were at least 5 fewer children in 100 with more than two days elapsing before hospital admission (Table IV).

Mother's education reduced the likelihood of delay but increased by 4.9 % if the child belongs to a household in the bottom income quintile. Interestingly, children with diarrhea were more likely to be brought to the hospital without delay than those with pneumonia but if the child was brought to another facility before the hospital, this increased the likelihood of more than two days elapsing before admission by about 5.1 %.

The presence of insurance reduces the proportion with delays from about 21.5% to about 16.7% (Figure 2). This translates to about 50 less children seeking admission more than two days after the onset of symptoms.

## Discussion

Using a unique longitudinal dataset from a randomized experiment, we tested whether experimentally introduced higher insurance coverage improved health outcomes and reduced costs of care. Our estimates show that a delay of more than two days before admission is associated with 4.2% higher likelihood of wasting and an 11.2% higher likelihood of positive CRP levels upon discharge. Costs of hospitalization also increase by about 1.9 % of average total costs with delay of more than two days. We find that reducing out-of-pocket payments through higher insurance coverage would result in about 5 more children in 100 going to hospitals less than three days after the onset of symptoms. The reductions were significant and could therefore translate into improved health status and reduced costs in general.

There are only a few rigorous studies that have analyzed the effects of insurance on access to and utilization of care for either adults or children, or the effects of insurance on health outcomes whether measured by specific health conditions or by more general measures of morbidity and mortality.<sup>1</sup> Studies focused on children, however, have largely come from quasi experimental settings without a control group (i.e., special insurance programs for children,<sup>12,21</sup> expansion of Medicare and Medicaid and other private insurance,<sup>6,13-14,22</sup> and more recently, the implementation of various State Children's Health Insurance Programs in the United States.<sup>9-11, 23-24</sup>). The unique experimental nature of our dataset allowed us to more rigorously assess the impact of a randomized insurance intervention on a large number of children in a developing country setting where the financial burden of care is high.

Prior studies found insurance coverage improves self-reported perceived health status and reduce activity limitations in children.<sup>12,14</sup> We differ from these studies in two aspects. Firstly, we use health status measures that are based on objective biologic and anthropometric measures that are less prone to subjective differences in health perceptions over time. Secondly, we are able to investigate specific mechanisms through which insurance affects outcomes. We find that insurance coverage affects outcomes by influencing the characteristics of utilization, in particular delay in utilization.

Studies that have assessed the cost implications of providing insurance coverage have focused on the increases brought about by moral hazard in the form of increased utilization of care.<sup>25</sup> Other studies support the finding that insurance may reduce costs of care only by implication, i.e., that costs can be mitigated by more appropriate utilization, for instance by the utilization of ambulatory care vs. emergency department utilization,<sup>10,26</sup> and by utilizing a usual source of care or primary care.<sup>11,14</sup> We substantiate these findings by directly estimating differences

in total charges owing to delays in utilization of hospital care and showing that insurance coverage can reduce the proportions of children with delayed hospital admission.

Our finding that insurance coverage improves access by reducing delays in health seeking is consistent with other studies that show reductions in the proportions of children that delayed care after enrolling in children's health insurance programs. These studies have reported changes in utilization at both the national<sup>9</sup> and state levels.<sup>10-12</sup> They also point to the importance in the continuity in insurance coverage, which in our population was accounted for by looking at access across the three year study period.<sup>13</sup> Our findings extend these studies in that our measure of delay is associated with hospitalization, rather than ambulatory visits as is typically used. Among the advantages, we expect the impact to be higher on costs and health status and recall bias to be less because we obtained data from the parent or guardian at the point of discharge.

Controlling for diagnosis and services received by child patients, we found those who were admitted more than two days after the onset of symptoms are discharged with worse health status, which is consistent with the literature.<sup>27-29</sup> Delays in utilization likely result in children being brought to facilities at later stages of diseases, requiring more intensive treatment. From a family perspective, a delay in utilization inflates the resource requirements related to an illness episode, as more medical interventions and household resources outside of the hospital setting are needed to restore the child to full health. This intuition is supported by our finding that reductions in the number of days from the onset of symptoms to the hospitalization reduce total charges, especially for those with shorter lengths of stay. Because the length of stay of the patient is one of our indicators for illness severity, the effects of delay on charges will be felt more on less ill patients.

Our study has some limitations. We did not have the data to link the introduction of insurance, which clearly decreased care delays, to longer term improvements in health status although we infer this from the association of delays and poor health outcomes at baseline. We also did not have anthropometric measures upon admission that would allow us to definitively rule out wasting as a pre-existing condition; however we were able to control for expected predictors of wasting: parental socioeconomic status and insurance. We cannot distinguish how much of the delay is due to delay in health seeking versus delay in recognizing serious illness by either the parent or the providers. Similarly, we are unable to determine how quality of care at intake or the route of admission impacts the delay. It is possible that some providers systematically fail to recognize whether the condition requires hospitalization, albeit this would be primarily a concern in borderline cases. We further note that due to the unavailability of some supplies and medicines in primary care facilities, some patients are referred to the district hospitals not because of their illness but because more supplies are available at the hospital than the clinic. If this were the case, this would partly explain the reductions in costs observed for reducing delays in admissions for relatively shorter lengths of stay or less severe illnesses.

Lastly, further studies would help establish causal links between delays and adverse outcomes taking into account poor nutritional status, an important co-factor in illness in developing countries. Benefits in terms of health outcomes should also be placed in relation to costs of interventional changes, which we have begun to explore in a forthcoming publication.<sup>30</sup>

## Acknowledgments

This study is funded by the U.S. National Institute of Child Health and Development (NICHD) through an R01 grant (HD042117). Operational support of the interventions was provided by the Philippine Health Insurance Corporation (PHIC).



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## Abbreviations

### **QIDS**

Quality Improvement Demonstration Study

### **PHIC or PhilHealth**

Philippine Health Insurance Corporation

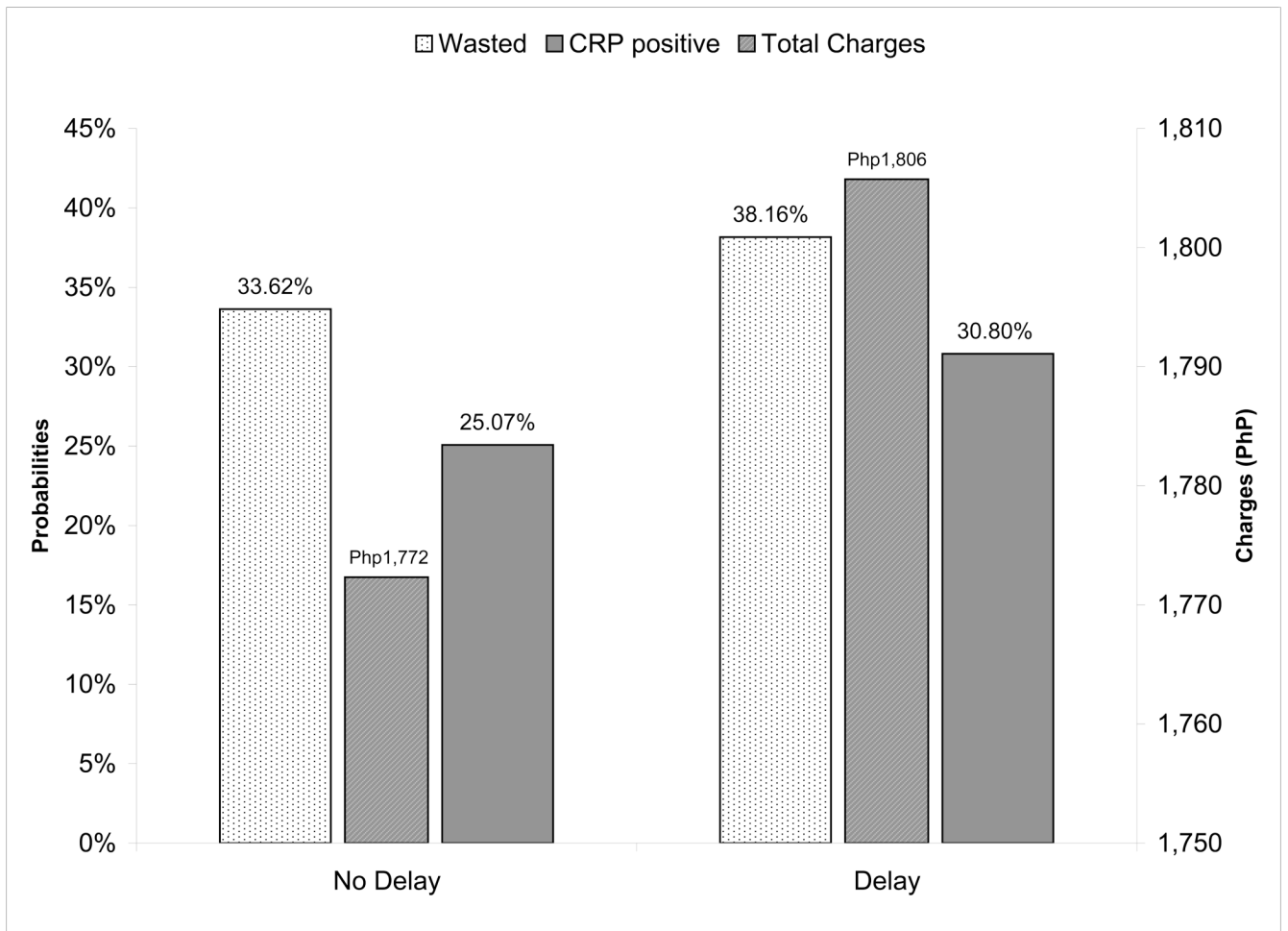
### **CRP**

C-reactive protein

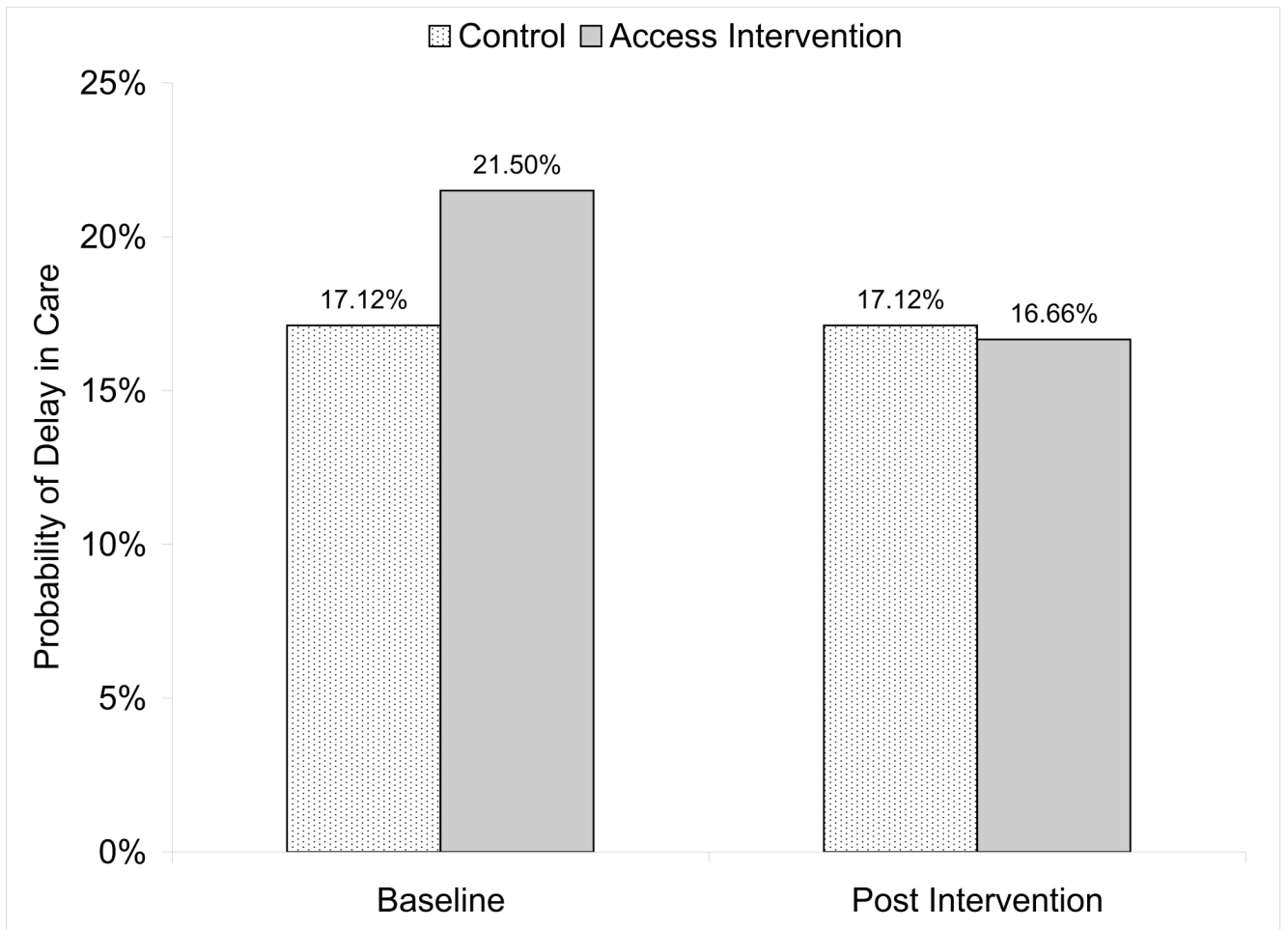
### **SCHIP**

State Children's Health Insurance Programs





**Figure 1.** Predictions: Total Charges and Probabilities of CRP and Wasting, Delay vs. No Delay



**Figure 2.**  
Predicted probabilities of delay, differences across intervention sites

**Table 1**  
Descriptive Statistics, Baseline Sample (N=1997)

Variable	Mean	SD
Delay of more than two days	0.27	0.44
Child was wasted upon discharge	0.35	0.48
CRP positive upon discharge	0.27	0.45
Total charges inside and outside the facility (PhP)	1776.44	1447.45
Male child	0.56	0.50
Age in months	23.10	14.07
Child has Pneumonia	0.26	0.44
Child has Diarrhea	0.28	0.45
Length of stay	3.35	1.85
Delay of more than 2 days*Length of stay	1.01	2.07
Number of oral medicines	2.16	2.01
Child used IV meds in the facility	0.69	0.46
Child was visited by a specialist	0.09	0.29
Child received oral medicines in the facility	0.44	0.50
Child underwent laboratory tests in facility	0.90	0.30
Child was hospitalized before for same condition	0.46	0.50
Child was initially brought to another facility	0.27	0.44
Initial treatment prior to hospitalization	0.21	0.41
Years of mother's education	8.86	3.36
Years of father's education	8.41	3.66
PhilHealth beneficiary	0.32	0.47
Child stayed in charity ward	0.35	0.48
Household belongs to lowest income quintile	0.21	0.41

**Table 2**  
Regression Models Estimating Effect of Delay on Health Outcomes

Variables	CRP Positive Logit, N=1945		Wasted Logit, N=1872	
	Marginal effects	P>z	Marginal effects	P>z
<b>Delay of more than two days</b>	<b>0.112</b>	<b>0.032</b>	<b>0.046</b>	<b>0.078</b>
Length of stay	0.006	0.378	0.020	0.002
Delay of more than two days*Length of stay	-0.016	0.149		
Age in months	0.004	0.183	0.001	0.436
Age in months squared	0.000	0.296		
Child is male	-0.025	0.203	-0.029	0.189
Child has Pneumonia	-0.001	0.971	0.058	0.045
Child has Diarrhea	-0.081	0.000	0.110	0.000
Child received oral meds in the facility	0.102	0.000		
Child received IV Meds in the Facility	0.011	0.642	-0.002	0.926
Child was initially brought to another facility	0.000	0.986		
Child was visited by a specialist	0.170	0.000		
Child underwent laboratory tests in the facility	0.075	0.013		
Number of oral meds			-0.004	0.486
Child was hospitalized before for same condition			0.004	0.866
Child received initial treatment prior to hospitalization			-0.036	0.179

**Table 3**  
Regression Model Estimating Effect of Delay on Total Charges

Variables	Total Charges	
	Coefficient	P>t
	OLS, N=1841	
<b>Delay of more than two days</b>	<b>270.325</b>	<b>0.037</b>
Length of stay	386.694	0.000
Delay of more than two days*Length of stay	-70.712	0.025
Child has Pneumonia	191.429	0.006
Child has Diarrhea	-228.701	0.001
Child received oral meds in the facility	-215.781	0.001
Child received IV Meds in the Facility	191.963	0.005
Child was visited by a specialist	225.025	0.022
Child stayed in charity ward	-382.542	0.000
Years of father's education	22.181	0.004
PhilHealth beneficiary	665.100	0.000
Constant	164.715	0.153

**Table 4**  
Regression Model Estimating Effect of the Access Intervention on Delay

	Delay of more than two days	
	Logit, N=3963	
	Marginal Effects	P>z
<b>Difference in Difference</b>	<b>-0.0529</b>	<b>0.024</b>
Male Child	0.0117	0.380
Mother's Education	-0.0079	0.000
Child has Pneumonia	0.1040	0.000
Child has Diarrhea	-0.0575	0.000
Lowest Income Quintile	0.0490	0.005
Age of child in months	-0.0036	0.071
Age of child in months squared	0.0001	0.057
Child initially brought to another facility	0.0511	0.001
Baseline Access vs Baseline Control	0.0438	0.031
Post-intervention Control vs Baseline Control	0.0304	0.121
Post-intervention Access vs Baseline Access	-0.0224	0.197