Luwal-Hati Project:

Converting Village Health Stations to Birthing Homes
Tayabas, Quezon Province, Philippines

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1 Executive Summary

This report conducts a cost-benefit analysis of the Luwal-Hati Project in Tayabas, Quezon Province of the Philippines. The appraisal of the conversion of village health stations to birthing homes finds a high cost-benefit ratio that indicates that benefits of the project greatly outweigh the costs. Moreover, the sensitivity analysis conducted strengthens the argument for continuation of the project. In spite of changes to the input parameters, the cost-benefit ratio remains high. The findings of this cost-benefit analysis of the Luwal-Hati Project suggest that the operation of birthing homes should be continued in Tayabas as well as implemented throughout the country. Replication of the project will likely contribute to decreasing the maternal and infant mortality rates of the Philippines. Furthermore, this report illustrates the potential usefulness of conducting cost-benefit analysis on other future health studies to assess projects that could improve a country's social policies.

The report begins with an overview of the project, which includes identifying the objectives of the Luwal-Hati Project and its intended impact on maternal and infant mortality rates, high costs of delivery at hospitals, and the number of homebirths in Tayabas. This is followed by a financial and economic assessment of the project and the results of the sensitivity analysis.

2 Introduction

2.1 Overview of the Project

Maternal and infant mortality are major health concerns in the Philippines. According to the World Bank (2012), the infant mortality rate in 2010 was 23 per 1000 live births and the maternal mortality ratio was 99 per 100,000 live births. The Philippine government has prioritized efforts in combating this national health issue, specifically targeting rural areas. Homebirths assisted by traditional birth attendants (TBAs) remain prevalent in rural areas because many mothers prefer to give birth in the comfort of their own homes rather than at crowded government hospitals with low-grade facilities and too few health professionals. Moreover, studies suggest that TBAs are more caring than midwives and doctors.[1] Homebirths are unregulated and can be extremely dangerous, as TBAs are not equipped to deal with complications that may arise during childbirth. Homebirths delivered by TBAs are considered to be a major contributor to the country's consistently high maternal and infant mortality rates due to the high risk of postpartum hemorrhage.[2]

Aside from homebirths, the only option available to pregnant women is to give birth in government hospitals, which are usually understaffed and overcrowded. In addition, traveling to these government hospitals can be costly and time-consuming, especially for those living in rural areas such as Tayabas. Given the high costs associated with going to a government hospital, significant portions of expectant mothers choose to give birth at home.

In the effort to combat these obstacles the Luwal-Hati Project was launched and implemented in 2002 by the Municipal Health Office in Tayabas, Quezon Province.[3] The goal of the project is to convert the existing 13 village health stations in the municipality to birthing homes. These village health stations are abundant and close to rural areas. As of 2009, all of the village health centers have been successfully converted. Tayabas Health Office employs 1

[1] Lavado, "Hilots getting on board facility-based deliveries."
[2] Ibid.
[3] Tayabas town in Quezon Province is 150 kilometers southeast of Manila. It has 66 barangays (villages), 19 of which are within the town center, while 47 are classified as rural areas. As of 2007, population is 80,917. Tayabas is considered as 6th class municipality based on local government income. Major agricultural activities include coconut, rice and livestock production. (www.tayabas.ph)

municipal health officer, 3 specialists, 7 public health nurses, 26 rural health midwives, and 453 barangay (village) health workers.

2.2 Objective of the Project

The primary objective of the project is to combat high maternal and infant mortality rates in Tayabas. The availability of birthing homes should lead to a decrease in the number of homebirths. The new facilities will provide expectant mothers with the best care, equipment, and trained professionals during pregnancy and childbirth. Unlike the TBAs who assist with homebirths, the midwives at the birthing homes are on duty 24 hours a day and are equipped to handle complications that may occur before and during delivery.

Furthermore, recognizing the burden of high costs on expectant mothers, the municipal health officer of Tayabas in Quezon Province developed a cost-sharing scheme for mothers utilizing the birthing homes. Under this cost-sharing mechanism, the government provides assistance by subsidizing half of the user cost.

2.3 Goal of the Study

The year 2012 marks the Luwal-Hati Project's tenth year. Subsequently, it is an opportune time to conduct a cost-benefit analysis on the effectiveness of the project. Moreover, an ex post cost-benefit analysis of the Luwal-Hati Project will determine the feasibility of replicating similar projects throughout the Philippines. In addition to the appraisal of general costs and benefits, this study will evaluate the impact of social benefits associated with birthing facilities on families and their communities. For example, the value of statistical life of both mother and infant will be used to measure the lives saved in monetary terms as a result of establishing these birthing homes. Furthermore, a sensitivity analysis will be conducted to assess the project's effectiveness when base parameters are changed.

3 Financial and Economic Analysis

3.1 Benefits

The benefits incurred from converting village health centers to birthing homes in Tayabas City will be determined by two key factors: First, by the number of mothers utilizing the facility, which will affect the revenue component of benefits, and second, by the number of infant and

maternal lives saved, which will influence the social benefits component. This project will not be using a traditional demand curve as it is an inappropriate method to measure the benefits derived from lives saved. Instead, the number of lives saved will be converted into monetary terms using different methods to value a statistical life. Therefore, total benefits will comprise of social benefit and revenue combined.

For this analysis, the assumed project period is 25-years.[4] Additionally, the assumed inflation rate of 5.7% is based on the average inflation rate of the Philippines from 1995 to 2011.[5] Moreover, the social discount rate recommended by the Asian Development Bank (ADB) for government-funded projects for the Philippines is 15%.[6] Finally, due to a lack of data on homebirths as well as infant and maternal mortality for the years prior to the Luwal-Hati Project launch year the project's base year will be set at 2002. This is feasible because while the project started in 2002, the birthing facilities did not begin admitting expectant mothers until 2003. The base year data will then represent the pre-project birth statistics for Tayabas and will be compared with the project data.

3.1.1 Revenue

The main source of revenue for this project is generated from the user charge per delivery, as prenatal check-ups are free. Mothers pay half of this user charge, while the government subsidizes the other half. *Table 1* details the breakdown of project revenue and the calculation of annual revenue.

Table 1: Revenue

Average number of deliveries per birthing home per year*		13.2	(1)
Number of birthing homes in Tayabas City		13	(2)
User charge per delivery	PhP	1,350	(3)
Annual Revenue [(1) x (2) x (3)]	**PhP**	**231,660**	

*Calculated based on WTP Survey (2001)[7]
Source: Municipal Health Office, Tayabas

[4] This is based on the minimum building lifespan for socialized housing projects of the government (Batas Pambansa blg. 220) http://www.fmh.ph/main.html
[5] Bangko Sentral ng Pilipinas
[6] Zhuang, et al. ", "Theory and Practice in the Use of Social Discount Rate for Cost-Benefit Analysis: A Survey."
[7] Cabegin, et al. "Willingness to Pay for Well-Family Midwife Services in the Philippines"

Based on 2011 prices, the calculated annual revenue is adjusted for the 25-year lifespan of the project (2002-2027) and to the assumed inflation rate of 5.7%.

3.1.2 Social Benefits

With 2002 as the base year, *Table 2* clearly indicates a trend in an increased use of birthing homes during the project's first six years of operation. Simultaneously, a steady decrease is observed in the number of homebirths for the same timespan. However, no clear trend for the use of hospitals can be seen. It can be concluded at this time that there is no correlation between the use of birthing homes and hospitals. Hence, this project will focus on the comparison between homebirths (the without project case) and birthing homes (the with project case).

Table 2: Place of Delivery

	2002	2003	2004	2005	2006	2007	2008	Avg. (2003-2008)
Birthing Home	0	26	261	312	616	960	1,116	549
Hospital	260	330	414	216	226	416	563	361
Home	1,265	1,175	884	931	685	228	226	688
Total	*1,525*							*1,598*

Source: Municipal Health Office, Tayabas

Despite small yearly fluctuations the number of total deliveries during the six years is relatively stable. This can be attributed to the short data collection period. Consequently, as shown below, the average number of lives saved can be derived by comparing the 2002 figures for infant and maternal mortality to the averages between 2003 and 2008.

Table 3: Mortality (counts)

	2002	2003	2004	2005	2006	2007	2008	Avg	Avg lives saved	% change in the number of deaths
Infant Mortality	36	28	30	25	29	46	35	32.17	3.83	-11
Maternal Mortality	0	1	1	2	1	0	3	1.33	-1.33	133

Source: Municipal Health Office, Tayabas

As *Table 3* indicates, there is an 11% decrease in infant mortality. Additionally, the average number of lives saved on a yearly basis is 3.83, which is rounded to 4 lives for the purposes of this analysis. On the other hand, a 133% increase is seen in maternal mortality. According to the municipal health officer, the increase in maternal deaths is attributed to the increasing number

of non-residents taking advantage of the subsidized delivery costs. These patients did not receive the recommended prenatal care necessary for safe deliveries which may have lead to mortalities. Moreover, this large figure is misleading given the already low numbers of maternal deaths; any small fluctuations will be reflected by a large percentage change in the number of deaths. For this reason, figures of maternal morality are disregarded in this analysis. It will be further assumed that the annual average number of lives saved for mothers is (+)1. This is to reflect the objective of the project to lower the maternal mortality rate.

To monetize the number of lives saved in *Table 3,* the Value of Statistical Life (VSL) is used. There is no established method for calculating VSL, particularly in the case for infants and children. VSL in existing literature is tailored to research conducted in developed countries. One method for calculating VSL is the application of the willingness to pay (WTP). Health studies indicate an individual's WTP to maintain his or her basic level of health. The base VSL used for this analysis was adopted from a previous study on the WTP for improved air quality in the Philippines, which is PhP 11,000,000.[8] The value of this WTP is not adjusted for inflation as this study assumes that VSL is commonly calculated for a fixed span of time. The VSL is held constant for the 25-year period of the project.

As prior literature notes parents value their WTP for their children's health at approximately twice their own.[9] Accordingly, the VSL for infants in this analysis is calculated as double that of adults. As indicated in *Table 4,* this base value is the lowest VSL this study will utilize. However, in the sensitivity analysis alternate VSLs will be examined.

Table 4: Value of Statistical Life (VSL) for Mother, Infant

VSL for adults	PhP 11,000,000 per statistical life
VSL for infants	PhP 22,000,000 per statistical life

SOURCE: Shah and Nagpal (Eds.) "Urban Air Quality Management Strategy in Asia: Metro Manila Report." and Blomquist, Glenn C. "Self Protection and Averting Behavior, Values of Statistical Lives, and Benefit Cost Analysis of Environmental Policy."

[8] Shah and Nagpal (Eds.) "Urban Air Quality Management Strategy in Asia: Metro Manila Report."
[9] Blomquist, Glenn C. "Self Protection and Averting Behavior, Values of Statistical Lives, and Benefit Cost Analysis of Environmental Policy."

Therefore, as previously discussed, multiplying the number of maternal and infant lives saved with their respective VSLs will derive the monetary value of the annual lives saved:

Equation 1: Annual Average Social Benefits

$$\text{Annual Avg. Social Benefits} = \text{Avg. Infant Lives Saved} \times \text{VSL for infants} + \text{Avg. Maternal Lives Saved} \times \text{VSL for adult} = 4 \times 22{,}000{,}000 + 1 \times 11{,}000{,}000 = \mathbf{PhP\ 99{,}000{,}000}$$

This annual average social benefit of PhP 99,000,000 will be constant throughout the project lifespan.

Table 5 summarizes the benefit estimates of Luwal-Hati Project.

Table 5: Benefit Estimates of Luwal-Hati Project

Item	Total Benefit
General Benefit	
Project Revenue (Annual)	PhP 231,660
Social Benefit	
VSL x Number of Lives Saved (annual average)	PhP 99,000,000
Total Benefit	**PhP 99,231,660**

3.2 Costs

3.2.1 General Costs

The general costs of the project include operating costs, construction costs, user charge subsidy paid by the government through taxes, and user charge paid by mothers. The operating costs include supplies and utilities (PhP 288,538), and salaries (PhP 2,577,497). The PhP 520,000 annual construction cost is derived from a one-time construction cost of PhP 13,000,000 for all birthing homes in Tayabas, which is spread out over the 25-year project lifespan. Since this construction cost is a one-time expense it is not adjusted for inflation. However, all other costs are adjusted at the 5.7% inflation rate.

As noted under the revenue section, both the government and mothers pay 50% of the user fee. While the user charge from mothers is collected as revenue, it is also a transfer of funds and therefore considered a general cost. In addition, the government subsidy is also considered a cost component.

3.2.2 Social Costs

The following scenario is assumed for deriving social costs in this analysis. A mother during pregnancy makes five round trips to a birthing facility. Four of these visits will be for pre-natal check-ups and the last visit for delivery. The round trip travel cost to a birthing facility is PhP 60. Therefore, the total transportation cost for one mother is PhP 300.

It is further assumed that one pre-natal check-up lasts an hour and delivery leads to the loss of eight working hours. Consequently, the total visiting hours to a facility is 12 hours. Additionally, the travel time of a round-trip visit is 30 minutes. Hence, the total travel time of five round trips consists of two and a half hours.

To calculate the opportunity costs minimum wage per hour is measured to be PhP 43.75. This is based on Quezon province's daily minimum wage of PhP 350[10] and an 8-hour working day. This means opportunity cost per mother based on wages is PhP 634.38.

Equation 2: Opportunity Cost for a mother

$$\text{Opportunity Cost for a mother} = \text{Minimum Wage Per Hour} \times (\text{Travel Time} + \text{Visting Hours})$$

$$= \text{PhP } 43.75 \times (2.5 + 12) = \mathbf{PhP\ 634.38}$$

By adding opportunity cost for a mother to the transportation cost derived earlier, the social cost for a mother is calculated.

Equation 3: Social Cost for a mother

$$\text{Social Cost for a mother} = \text{Opp. Cost for a mother} + \text{Transporation Cost for a mother}$$

$$= 634.38 + 300 = \mathbf{PhP\ 934.38}$$

This figure is then multiplied by the average number of deliveries for all birthing homes per year (refer to *Table 2*), which equals PhP 160,339.

The general and social cost components are summarized in *Table 6.*

[10] National Wages and Productivity Commission, Department of Labor and Employment

Table 6: Cost Estimates of Luwal Hati Project for 2011 Base Year

Item	Total Cost
General Cost	
Operating Cost	PhP 2,866,035
Construction Cost	PhP 520,000
User Charge Subsidy	PhP 231,660
User Charge	PhP 231,660
Social Cost	
Transportation/Time Cost	PhP 160,339
Total Cost	**PhP 4,009,694**

Source: General Fund Annual Budget, Tayabas

3.3 Cost-Benefit Ratio (CBR) and Net Present Value (NPV)

Taking into consideration the 15% social discount rate and the 25-year project lifespan, the Cost Benefit Ratio (CBR) and Net Present Value (NPV) can be derived for the Luwal-Hati Project. The present value of total benefits is PhP 2,604,973,144 and the present value of total costs is PhP 95,538,058. Therefore, the NPV is PhP 2,509,435,085 and the CBR is 27.

Equation 4: Cost-Benefit Ratio (CBR)

$$CBR = \frac{[PV(B)]}{[PV(C)]} = \frac{2{,}604{,}973{,}144}{95{,}538{,}058} = \mathbf{27}$$

Equation 5: Net Present Value (NPV)

$$NPV = PV(B) - PV(C) = 2{,}604{,}973{,}144 - 95{,}538{,}058 = \mathbf{2{,}509{,}435{,}085}$$

Based on both CBR and NPV it can be inferred that the benefits of the project greatly outweigh the costs.

3.4 Cost-Effectiveness (CE) Ratio

For this study, the cost effectiveness ratio will be derived by dividing the total cost (general and social cost) by the number of lives saved. Ideally, the CE ratio of the birthing home project should be compared to the CE ratios of homebirths and hospital deliveries; however, due to lack of available data, this study only reports the CE for the birthing home project relative to the status quo.

The total cost for the birthing home project is PhP 4,009,694 while the number of lives saved (both mother and infant) is five. This gives a CE ratio of PhP 801,938.80.

Equation 6: Cost-Effectiveness (CE) Ratio

$$\text{CE} = \frac{\text{cost}_{\text{new strategy}}}{\text{effect}_{\text{new strategy}}} = \frac{\text{cost of birthing home project}}{\text{number of lives saved}} = \frac{\text{PhP } 4{,}009{,}694}{5 \text{ lives saved}} = \text{PhP } 801,938.80$$

This CE ratio indicates that the government should implement this project before other similar projects that saves five lives and costs more than PhP 801,938.80.

4 Sensitivity Analysis

According to the sensitivity analysis conducted on the Luwal-Hati Project, the manipulation of input parameters alters this study's conclusions. The results are summarized in *Table 6* and *Table 7*.

First VSL was adjusted holding all other parameters constant. The first alternate VSL is based on income potential for adults. According to available data for the Philippines, annual income of PhP 350,000[11] was multiplied by the number of working years between 15 and 64 years of age (49 years). This results in a VSL based on income potential for adults of PhP 17,150,000. Prior literature states that the VSL for children based on income potential for adults is one-third greater than that of adults.[12] Hence, in this scenario it is assumed that VSL for infants is PhP 22,809,500. Consequently, this alternate VSL based on income potential increases the NPV from the base and also improves the CBR from 27 to 30.

The second alternate method for valuing lives of mothers and infants is VSL based on WTP to avoid an increase in risk of health. In this case, VSL for adults is PhP 18,189,000. As previously stated in the social benefits section of this analysis, VSL for infants based on WTP is double an adult's WTP to mitigate risk to their own health. Therefore, it can be implied that VSL

[11] Shah and Nagpal (Eds.) "Urban Air Quality Management Strategy in Asia: Metro Manila Report."
[12] Blomquist, Glenn C. "Self Protection and Averting Behavior, Values of Statistical Lives, and Benefit Cost Analysis of Environmental Policy."

for infants is PhP 36,378,000.[13] Again, the NPV improves substantially to PhP 4,208,350,909 and the CBR increases drastically to 45.

Table 7 summarizes the different VSL based on the alternate methods.

Table 7

Parameter	Value	NPV	CBR
VSL based on income potential for adults	PhP 17,150,000	PhP 2,755,944,749	30
VSL based on income potential for infants	PhP 22,809,500		
VSL based on WTP to avoid an increase in risk of health for adults	PhP 18,189,000	PhP 4,208,350,909	45
VSL based on WTP to avoid an increase in risk of health for infants	PhP 36,378,000		

From these two alternate cases it can be concluded that the base scenario VSL for adults and infants based on WTP for improved air quality is the minimum value of VSL in this research. As a result, the two higher alternate values of VSL used in the sensitivity analysis produce drastic improvements in both NPV and CBR. Therefore, it can be concluded that an increase in VSL will result unfailingly in a higher level of benefits compared to costs.

The sensitivity analysis was further explored by changing the social discount rate. As noted previously, the initial social discount rate of 15% was based on the ADB recommendation for government-funded projects in the Philippines. *Table 8* presents the results for the different social discount rates.

Table 8

Parameter	Value	NPV	CBR
Social Discount Rate	10%	PhP 2,262,982,800	25
	15% (baseline)	Php 2,509,435,085	27
	20%	PhP 2,939,684,506	29

The results from this sensitivity analysis contradict the expectations that a decrease in social discount rate would lead to improvements in both NPV and CBR. Simultaneously, an increase in

[13] Markandya, A. "The Valuation of Health Impacts in Developing Countries."

the social discount rate was expected to decrease NPV and CBR. As the results of the sensitivity analysis contradicts expectations; a possible explanation for this phenomenon is the fact that the base VSL was not adjusted for inflation during the 25-year project lifespan. Furthermore, when the VSL based on WTP for improved air quality is adjusted for inflation the results align with initial assumptions. However, VSL is not typically adjusted for inflation and therefore initial findings are maintained for this analysis.

All the alternate scenarios analyzed by changing VSLs and the social discount rate prove the resilience of our initial hypothesis that benefits of birthing facilities outweigh the costs. Even when the social discount rate is decreased to 10%, it has a minimal impact on the corresponding decrease in NPV and CBR.

5 Secondary Market

The secondary market for the Luwal-Hati Project can be identified as the services provided by TBAs. Unfortunately, this report is unable to analyze the effects on this market due to a lack of available data. However, it can be assumed that an increase in user charge for mothers that equals or exceeds the fee for TBAs will lead to a decrease in users for birthing homes and increase births at home. Taking into consideration the objectives of this project, which include decreasing the number of home births, it is advisable that the government avoids cutting the user fee subsidy.

6 Conclusion

The Luwal-Hati Project was implemented to combat the high maternal and infant mortality rates in Tayabas, decrease the number of homebirths, and alleviate the burden of high costs on mothers. To analyze the effectiveness of the conversion of village health centers to birthing homes in achieving these objectives, revenue, social benefits, general costs, and social costs were identified. In particular, social benefits had to be measured in a way that reflected the impact of lives saved as a result of the birthing homes. The preliminary findings reflect the value of birthing homes to mothers, and to test the resilience of this initial conclusion a sensitivity analysis was conducted. This confirmed the findings and further indicated that improvements could be made from the base scenario. As a result, it can be concluded that the benefits greatly outweigh the costs and thus, the project should be continued in Tayabas City and replicated throughout the country.

While the conclusion confirmed initial findings, several limitations were encountered as the analysis was conducted. First, the only data available for this report was for a six-year time period of a ten-year project. For instance, no information on maternal and infant mortality rates prior to 2002 were accessible for this analysis. Furthermore, the lack of available data meant that this analysis was unable to identify the impact of birthing homes on the secondary market. Ideally, the effect of birthing homes on the services provided by TBAs and their livelihoods would have been included. Second, as there is no established method for calculating the VSL and prior literature concentrates on calculating VSL in developing countries, this issue was overcome by utilizing several methods. Finally, several assumptions were made throughout the report and every effort was made to ensure any impact on benefits were conservative, and that costs were reflected as realistically as possible.

Furthermore, an analysis of this kind indicates the usefulness of a cost-benefit analysis in evaluating the effectiveness of future health studies. As in this report, depending on the VSL that is utilized, the analysis of similar projects could signify the potential for improvements to a nation's social policy. This in turn will impact the type of policies that are formulated by the government in advancing projects that are beneficial to society.

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