MEASURING THE BURDEN OF DISEASE AND ECONOMIC CONSEQUENCES OF TUBERCULOSIS IN THE PHILIPPINES

FINAL REPORT

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INTRODUCTION:

In 2000, the World Health Organization (WHO) estimated that there were 249,655 new cases of tuberculosis (TB) in the Philippines and of these our projections are 65,150 will die. Death from TB continues to rise — the main drivers are the high incidence of TB infection among Filipinos and the rapid population growth rate. In 2000, the World Health Organization reported that the Philippines had the seventh highest incidence in the world and the second highest in Asia (see Table 1). The Government of the Philippines, long concerned about these staggering figures has vigorously renewed its commitment to fight TB. One element of this effort is to obtain understanding of the national disease burden and economic cost borne by all Filipinos.

Table 1
TB Incidence* by Age and Gender in the Philippines and Other Countries

	Philippines**	Cambodia	China	Thailand	Viet Nam
Women					
0-14	23	2	2	0	0
15-24	82	84	33	24	38
25-34	190	282	33	40	78
35-44	284	504	31	36	120
45-54	145	818	31	62	202
55-64	355	1069	38	111	358
65+	810	831	29	160	484
Men					
0-14	50	2	2	0	0
15-24	326	93	42	33	67
25-34	549	331	51	100	211
35-44	1047	567	58	113	371
45-54	1582	824	73	156	540
55-64	1331	1502	104	224	687
65+	1004	1838	120	340	889
Overall	321	572	107	140	189

* estimated by smear-positive notification rate, per 100,000
source: Global TB Control. WHO Report 2002. WHO/CDS/TB/2002.295
**Source: 1997 NTPS

This report updates the current epidemiologic estimate of the burden of disease using DALYs Disability Adjusted Life Years and provides economic estimates of the costs of TB in the Philippines. We have applied sophisticated epidemiologic methodologies and econometric methods in our analysis. Our intention, however, is to make this document accessible to those working on the front lines confronted with the enormous challenges of policy making and allocating public resources. We therefore use boxes to describe our methodology and models (e.g., DALY calculations, Wage Differentiation, DOTS, Data Sources, and the TIPS Project) for those wishing more detail; we also have included tables used in our analysis (e.g., Population and Mortality data, and TB Prevalence Statistics in the Appendices.

Tuberculosis infects one third of the world population (33%) and kills 3 million people every year (JAMA August 1999). Over time, TB has likely caused more deaths than any other pathogen in the history of the human race. The epidemiology and clinical disease are complex but are important to understanding policy options (see Box 1).

Box 1. The Epidemiology and Clinical Course of Tuberculosis

Tuberculosis is caused by the bacillus *Mycobacterium tuberculosis*. It is transmitted from an infected person through aerosolized droplets. Droplets, formed from coughing and sneezing, are inhaled and create a primary infection that typically involves the lungs and nearby lymph nodes. Normally, these heal spontaneously forming granuloma visible on a chest XRay. During this primary stage, patients are rarely symptomatic. However, within the granuloma are dormant bacilli that can be reactivated at anytime. In a small portion of patients, when reactivation occurs, patients develop low-grade fever, increasingly productive cough occasionally mixed with blood, fatigue and weight loss.

Without treatment, the case fatality rate is very high (50-60%). Treatment, however, is highly effective and in 4-6 weeks most patients no longer have bacilli in their sputum and thus are not infectious. Because the bacilli can lie dormant, treatment is required for 6-9 months with multi-drug chemotherapy to affect a complete cure.

The clinical epidemiology of infection, is the basis for three policy implications for the Philippines. First, two-thirds of the Filipino population is infected and at risk for developing TB. Second, those who have the disease are often untreated and have a high concentration of bacillus in their sputum and thus are highly infectious. Third, treatment requires a coordinated and systematic approach to finance and deliver a long-term clinical intervention. Thus, the challenge facing Tuberculosis control can be summarized as follows:

1. Who has TB in the Philippines?
2. How many of these cases are diagnosed?
3. How many of the diagnosed cases are treated?
4. Where are they treated—in public or in private facilities?
5. How many of these receive effective therapy with DOTS?

I. SUMMARY OF FINDINGS

Each year our most conservative estimate is that over half a million (514,300 in 1997) Disability Adjusted Life Years (DALYs) are lost in the Philippines from TB. Premature mortality due to TB represents at least 9.0% of all potential years of life lost in the Philippines in Filipinos 10 years and older. Based on Sputum smear positive diagnoses, the gold standard measurement in public TB control programs, 212,704 (3.1 per thousand) Filipinos develop symptomatic TB (NTPS, 1997). It is likely that only 45% of all TB cases are diagnosed (JAMA. 1999). The National Tuberculosis Prevalence Survey done in 1997 found that only 38% of symptomatic TB patients (with bacteriologically confirmed disease) received professional treatment either from a public health center, private clinic, or hospital. In these same patients, half of those who did not seek treatment will die (JAMA. 1987). For those who did get care, 41% went to public health centers and paid between PhP 55 and PhP 162 NTPS and UHNP evaluation studies. Further, 9 out of 10 times these patients received DOTS chemotherapy. The remaining 59% went to other facilities, and paid PhP 756 to 1032 pesos a month. It is entirely unclear, however, what the quality of the diagnosis and continuity of treatment is for those who went to private sector facilities.

Box 2. If we could track 100 people with TB, what would happen to them?

How many people with TB are diagnosed and treated in the Philippines? This simple question is difficult to answer. Key pieces of data are missing and even when the data are present, they often only represent estimates or use older data and then rely heavily upon assumptions. Nevertheless, trying to understand what happens to patients with TB can be a very useful exercise because it makes the assumptions explicit, allows other analysts to change the model, and motivates interventions.

To illustrate, suppose we could follow the chain of events for 100 incident (new) cases of TB. For every 100 cases of TB in the Philippines, we believe that 45% are smear positive (SS+). Of the SS+, 60% of the cases are detected, 75% of these cases are detected in a DOTS program and 77% of these are registered where 89% of the time they receive effective treatment. This means almost 16 of the 45 smear positive cases are registered for treatment and 14 will complete treatment successfully and live disease-free. (This is equal to a 30% success rate for SS+ patients.) For the 40% of SS+ who are not detected (who by definition then are not treated) there is a case fatality rate of 70% and thus 13 of the 45 will die. Similarly, of the 45 SS+ who are detected but not registered, enrolled, or treated and assuming a CFR of (only) 30%, 5 more patients will die.

For the 55% of smear negative (SS-) cases, the estimates are more difficult. We conservatively assume that 40% of these patients are diagnosed by other means, such as CXR. Using the same figures as for SS+ case (the most optimistic scenario) where 75% are detected, 77% are registered and 89% receive effective therapy, 11 patients will live disease free. For the 60% who are not detected, assuming a CFR of 20%, 7 patients will die; and for the SS- cases that are detected, but not treated, 2 additional patients will die. These outcomes are summarized in the table below.

Phil TB Outcomes of 100 (New) Incident Cases

	Dead	Alive
Incident cases		
% SS+ 45%		
% SS- 55%		
SS+ Cases Successfully Treated (60% detection rate)		13.9
SS+ Cases Detected Not Completing DOTS	4.7	8.8
SS+ Cases Not Detected or Treated	12.6	5.4
SS- Cases Successfully Treated (40% detection rate)		11.3
SS- Cases Detected Not Completing DOTS	2.1	8.6
SS- Cases Not Detected or Treated	6.6	26.4
TOTAL	26.0	74.4

TOTALS do not add up to 100 due to rounding errors.

In total, just 25 of the 100 patients with TB will be diagnosed and treated. By contrast, 19 patients will die without ever being diagnosed and 7 more will be diagnosed without being treated. We will know surprisingly little about the remaining 45 patients. Some are diagnosed and not treated and some are partially treated. Of these, most will go on to be carriers while others will be partially treated and could eventually develop MDR. Overall, out of the 100 patients 26% died — out of 249,655 new cases that is equal to 65,160 new deaths.

The economic impact matches the oppressive human toll. TB robs an average worker of PhP 216 per day for women and PhP 451 per day for men (see Appendix 3).

The annual economic loss is staggering; the loss in wages alone is PhP 7.9 billion annually (Table 9). By contrast, the annual spending for TB drugs in the Philippines is a fraction of this - approximately PhP200 million per year. The cost of TB drugs per patient for a 6-month treatment is between PhP 1,000 and PhP 4,000 by far the greatest cost. Physician consultation fees would add between PhP 200 to PhP 700 and laboratory tests, such as sputum smear and culture, would cost between PhP 700 and PhP 1800 (Philippine Coalition Against TB). If these

costs are aggregated, even under the most expensive scenario (PhP 6,500 per patient), all untreated patients (est. 76,000) could be treated for just PhP 500 million annually, a fraction of the PhP 7.9 billion lost in wages. Meanwhile, premature deaths due to tuberculosis are causing approximately PhP 27 billion a year in foregone income.

II. DATA USED IN THIS STUDY

The two main data sources for this study are the 1997 NTPS survey and the 1998 APIS survey. The NTPS contains information on smear positive and radiographic prevalence of TB, but the NTPS lacks socioeconomic data. Conversely, the APIS data, based on self-reported TB prevalence, is useful for describing the economic consequences of TB in the population, but does not provide sufficiently precise nationwide, gender-specific and age-specific incidence of TB needed for the DALY calculations. The 2001 UHNP survey, also used in this study, is not a nationally representative sample, but does provide valuable data on incidence, treatment and out-of-pocket treatment expense. These sources of data, their strength and weaknesses are listed in Box 3, below.

Box 3. Data Sources Evaluated or Used in This Study

1. 1997 National TB Prevalence Survey (NTPS) – Nationally representative survey of individuals and households. Cluster sampling of 21,960 respondents. Contains data on prevalence rates, treatment seeking decisions, limited set of demographic variables – age, gender. Limitation – no socio-economic variables. Used to calculate BoD, diagnosis and treatment seeking by facility.

2. 1991 DOH-PIDS Survey of Households – Household survey, stratified cluster sampling, 2,798 respondent households, limited to 4 regions - Metro Manila, regions 2, 7, 10, contains socio-economic variables, treatment seeking decisions, limited treatment costs data. Limitation – data is dated, TB prevalence is quite low so (TB) data is limited.

3. 1991 DOH-PIDS Survey of Hospital Users – Hospital inpatient exit poll, stratified sampling, 1004 respondents, limited to 4 regions - Metro Manila, regions 2, 7, 10, contains socio-economic variables, detailed hospital bill data. Limitation – data is dated, TB prevalence is quite low so (TB) data is limited.

4. 1991 DOH-PIDS Survey of Outpatient Clinic Users – Clinic user exit poll, stratified sampling, 1300+ respondents, limited to 4 regions - Metro Manila, regions 2, 7, 10, contains socio-economic variables, detailed clinic fees data. Limitation – data is dated, TB prevalence is quite low so (TB) data is limited.

5. 2001 Urban Health and Nutrition Program (UHNP) Evaluation Survey – Survey of households in UHNP and Non-UHNP covered areas, stratified sampling, 2205 respondents, limited to Metro Manila, Cebu City, Cagayan de Oro City, contains socio-economic variables, TB incidence, treatment seeking and limited cost data. Limitation – enriched sample, data accessible. Courtesy of Dr. Orville Solon. Used to estimate TB prevalence rates, TB treatment seeking by facility, and calculate out-of-pocket TB treatment cost by facility.

6. 1998 Annual Poverty Incidence Survey (APIS) – Household survey with roster of family members, 39,000+ households and 195,000+ individuals, representative at provincial level, key cities and municipalities, contains age, gender, reported incidence of illness by cause (including TB), wage, and occupation group. Limitation – Lists out medical facilities visited by individual but does not associate the indicated facilities visited with the reports of TB. Relies on self-report of TB, which varies for NTPS by age profile. Used to generate information on reported TB prevalence by age, gender, and other demographic classifications, and to calculate average loss in wages due to TB by gender and by age group.

7. 1997 Philippine Health Statistics (PHS) – contains morbidity and mortality data. Limitation – summary tables only.

III. BURDEN OF DISEASE METHODOLOGY AND ESTIMATES

We used the Burden of Disease (BoD) methodology to provide a combined measure of TB mortality and morbidity that could be compared to TB to a wide range of other diseases. A BoD assessment allows comparisons of the disease burden across nations and between diseases by using standardized measure called the Disability-Adjusted Life Year (DALY) (See Box 4). In the following paragraphs, we describe how we used data from the NTPS 1997 survey and applied the BoD methodology to the specific case of tuberculosis in the Philippines.

Box 4. Calculating DALYs lost from TB in the Philippines

The BoD methodology and the assumptions underlying it are described in detail in the results of the Global Burden of Disease (GBD) study (Murray & Lopez,1996a, 1996b). The original study estimated the burden of 105 causes of disease (of which tuberculosis was one) in all regions of the world. The BoD methodology quantifies the burden of mortality (years of life lost) and of morbidity (years lived with disability).

Years of Life Lost (YLL). The mortality component of the DALY is the years of potential life lost due to premature mortality from a specific cause. Years of Life Lost (YLL) are calculated from annual mortality statistics for each disease. Remaining years of potential life at any age of death are calculated from a life table based on a life expectancy at birth of 82.5 years for females and 80.0 years for males (Murray & Lopez, 1996a, p. 17). For efficiency of calculation, counts of deaths are aggregated into 5-year groups of age at death for each gender, and the years of potential life lost are calculated based on the midpoint of the age range. YLLs are summed across age groups, and rates per 100,000 are calculated for each age/gender group and the population as a whole.

Years lived with Disability (YLD). The morbidity component of the DALY is the number of years of healthy life lost due to disability from a specific cause. Years Lived with Disability (YLD) due to a specific cause are calculated as the number of incident cases in a year, times the estimated duration of the disease, times the disability weight. The annual number of incident cases for a specific disease is derived from population estimates by age group and gender, plus available epidemiologic data on incidence rates. The GBD study developed disability weights for all major causes of disability using a Person Tradeoff Protocol (Murray & Lopez, 1996a). The weight for perfect health is 0, and that for death is 1. Weights for tuberculosis range from 0.264 to 0.294 for different age and gender groups. YLDs are calculated for each age and gender group and summed across the population. Rates are calculated per 100,000 as for YLLs.
Disability-Adjusted Life Years (DALY). DALYs are the sum of YLLs and YLDs. Since YLDs are calculated for broader age groups than for YLLs, data are presented by these broader groups.

The DALY calculation also incorporates 2 adjustment factors, discounting and age weighting (Murray & Lopez, 1996a). Discounting is the standard economic rate of time preference; a discount rate of 3% is used. Age weighting assigns a higher social value to lost years of life should be weighted more heavily in the early and middle adult years and less heavily in the earliest or latest years of life.

The overall formula for calculating DALYs is:

$$DALY_j = \sum YLL_j + YLD_j$$

$$\text{Where: } YLL_j \text{ or } YLD_j = \int_a^{a+L} D_j (Cxe^{-\beta x}) e^{-r(x-a)} dx$$

$a = \text{Age of death or onset}$

$L = \text{Remaining life expectancy}$

$D_j = \text{Disability weight } (= 1 \text{ for death})$

$Cxe^{-\beta x} = \text{Age} - \text{weighting term}$

$e^{-r(x-a)} = \text{Discounting term}$

Calculation of DALYs are performed using spreadsheets (http://www3.who.int/whosis/menu.cfm?path=whosis,burden,burden,burden_estimates&language=english) containing solutions to this integral for standard GBD parameters (*C,* □*, r*) and disease-specific input parameters (mortality, incidence, duration, disability weight).

Population, mortality and incidence data are needed to calculate the burden of tuberculosis in the Philippines and comes from the following several sources.

- **Population.** Population data for the study's base year, 1997, by age and gender, were derived from the 1997 Philippine Health Statistics report.
- **Mortality.** The most recent complete mortality statistics for the Philippines is the 1997 Philippine Health Statistics. This report provides breakdowns of TB deaths by gender and by 5-year age groups. Deaths were aggregated for "TB Respiratory," TB Meningitis," and "TB Other Forms." Breakdowns of deaths and age groups over 70 were based on supplementary data obtained by Drs Tan and Perez. (See Appendix 1, Population and TB Mortality Data. The proportion of TB deaths urban vs. rural was based on respiratory TB deaths in each of the areas in the 1997 Philippine Health Statistics report.
  - Note, the 26,102 TB deaths reported for 1997 should be considered the lower bound estimate for actual TB deaths, as many TB deaths are thought to be either unreported or misreported as due to other causes.
- **TB Incidence.** TB incidence was estimated from several sources. A 1999 WHO global summary estimated that TB prevalence in the Philippines was 314/100,000 in 1997 (Dye et al, 1999). However, no breakdowns by age and gender are given. The 1997 Philippines National Tuberculosis Prevalence Survey (NTPS) estimated TB prevalence rates for persons over 10 ears of age. Incidence was calculated from prevalence by assuming that 45% of cases are SS+ and using disease duration of 2.2 years and incidence was assumed to be zero for persons under age 10. The 1997 incidence was calculated as 321/100,000 nationwide. A detailed reconciliation of NTPS prevalence rates, and incidence rates calculated from them, was conducted to ensure that NTPS-based values are consistent with the 1999 WHO article and the 2002 WHO Global Tuberculosis Control Report. The other assumptions used in our modeling are listed in Box 5.

Box 5. Modeling Assumptions Made in This Analysis

- Duration of disease, 2.2 years (Dye et al, 1999)
- Incidence derived from smear positive cases was felt to be the most reliable estimate
- Percent TB cases that are sputum smear positive (SS+) is 45% (Dye et al, 1999)
- Children <10, rarely have bacteriologically positive TB (NTPS, 1997)
- The 81% public hospital and 19% private hospital ratio from the UHNP data set was used to breakdown the 12.1% hospital ratio reported by the NTPS summary tables.
- An annual increase of 1% in annual risk of infection results in 49/100,000 new smear positive cases.
- The ratio of TB/HIV in the Philippines is 0.4%. The incidence of HIV in the Philippines is low. (WHO Global TB Cortiol Report, 2002)
- The inflation rate from 1998 to 2002 is 22% and based on the National Consumer Price Index.
- Multi-drug resistance of MDR is 3.2% in the Philippines.
- Members of the workforce who were not employed and not studying were assumed to have zero wages.
- Prevalence / 100,000 = Incidence / 100,000 x Average duration of disease (in years)

We calculated that the burden of tuberculosis is very large in the Philippines—514, 300 total DALYs alone in 1997. That is, over a *half-million years* of healthy life are lost due to illness and premature mortality from TB in the Philippines *annually*. As shown in Table 2, over two-thirds of the burden is due to premature mortality (YLL), because TB kills people in the prime of life. We also see that burden of TB is dramatically higher among men than among women.

Table 2. Burden of Tuberculosis in the Philippines, 1997

	YLL	YLD	DALY
Male	237,272	125,640	362,912
Female	117,610	33,778	151,388
Total	**354,882**	**159,418**	**514,300**

TB prevalence and mortality rise sharply with age. As shown in Table 2 DALY rates peak at over 3,600/100,000 in males aged 60-69, and at over 2,000/100,000 in females aged 70-79. Figures 1 and 2 show these age trends graphically. These DALY estimates are based on numbers of reported deaths due to TB. Because many deaths are unreported, and a large fraction of TB deaths are misreported as due to other causes, the actual number of DALYs due to TB is certainly larger. If the number of actual TB deaths were double the number reported (a plausible assumption given the high incidence and case fatality rate of TB in the Philippines), there would be over 52,000 TB deaths annually. The number of YLLs attributable to TB would rise to 709,764, and the total number of DALYs to 869,182.

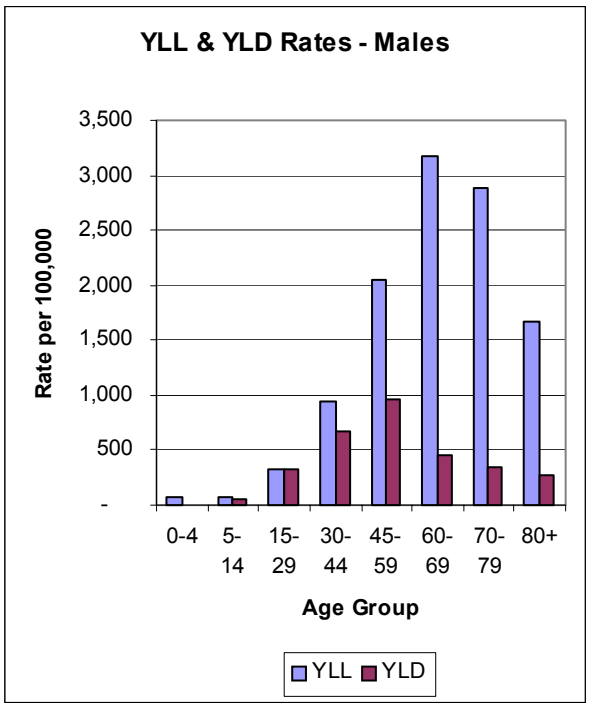

Figure 1

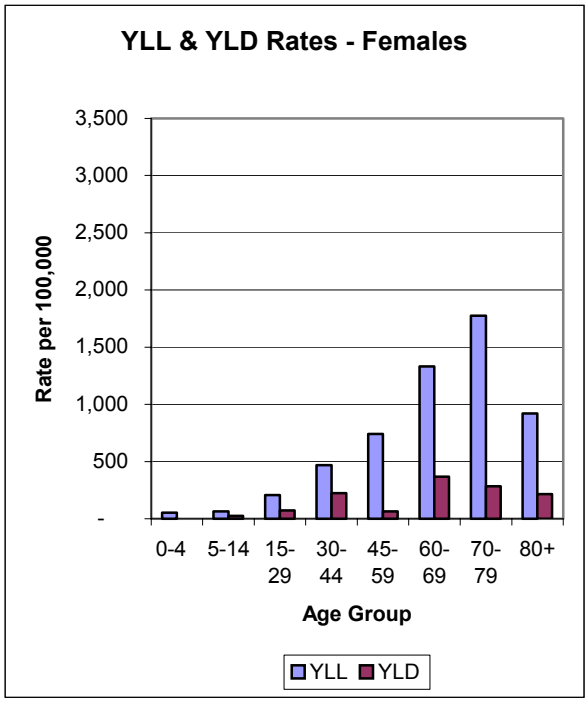

Figure 2

We performed a sensitivity analysis to assess the impact of better TB control on reducing mortality and morbidity. If TB control programs achieved the WHO target of detecting 70% of SS+ cases in DOTS programs, and maintained a successful treatment rate of 85%, the number of deaths due to TB would drop by 22.7%. This would reduce the number of YLLs due to TB by 80,655. A reduction in the average duration of disease from 2.2 years to 1.5 years would reduce the number of YLDs by 49,213, or 30.9%.

IV. ECONOMIC BURDEN METHODOLOGY AND ESTIMATE

The economic consequences of tuberculosis in the Philippines can be measured by looking at the following:

- Prevalence of TB across age and income quintiles
- A model assessing prevalence risk controlling for social and demographic factors
- An analysis of economic losses using wage differentials for those with TB

The impact of poverty. Tables 4, 5 and 6 report on TB prevalence across 5 income groups or quintiles. As expected, TB prevalence is much higher among the poor as shown in Table 4. The distribution between urban versus rural residents is shown in Table 5 and 6 and reveals that the highest prevalence is overwhelming amongst the elderly poor with a slightly higher prevalence amongst urban dwellers.

Table 4. Reported TB Prevalence by Age by Economic Class

Age Group	Economic Class - Household Income Quintile				
	Poorest	2nd	3rd	4th	Highest
0-14	0.18	0.22	0.2	0.32	0.22
15-44	0.39	0.33	0.21	0.25	0.15
45-64	1.33	1.59	1.01	0.95	0.71
65 and above	3.3	2.38	2.55	2.24	1.09
All	0.66	0.52	0.39	0.44	0.3

Source: 1998 APIS

Table 5. Reported TB Prevalence by Age by Economic Class (Rural)

Age Group	Economic Class - Household Income Quintile				
	Poorest	2nd	3rd	4th	Highest
0-14	0.16	0.17	0.08	0.25	0.12
5-44	0.35	0.33	0.25	0.12	0.19
45-64	1.23	1.26	1.11	0.69	0.53
65 and above	3.72	1.77	3.18	1.61	1.19
All	0.63	0.44	0.4	0.31	0.27

Source: 1998 APIS

Table 6. Reported TB Prevalence by Age by Economic Class (Urban)

Age Group	Economic Class - Household Income Quintile				
	Poorest	2nd	3rd	4th	Highest
0-14	0.25	0.3	0.29	0.34	0.25
5-44	0.46	0.33	0.19	0.29	0.14
45-64	1.56	2.09	0.92	1.06	0.75
65 and above	2.52	3.16	2.13	2.5	1.08
All	0.71	0.65	0.39	0.5	0.31

Source: 1998 APIS

Modeling social and economic risk factors. Clinical tuberculosis is subject to numerous social and economic influences. To evaluate these effects, we asked what factors predict prevalence[1] of TB in the Filipino population. In Table 7 we show the results of our model. As we saw with the BoD analysis (when we used the NTPS data), prevalence rises with age and is much more common in men (26%) than women. The model also gives us a more rigorous quantification of the impact of poverty: specifically for every ten percent increase in income, TB prevalence declines by 2%. By region, the model shows that Southern Luzon and the NCR rank 1 and 2 is prevalence and not to surprisingly correspond to the most densely populated regions of the country[2]

[1] This model relies on APIS data, which collected self reported prevalence not smear positive or clinically diagnosed cases on TB.

[2] The model specifies rurality by region, which serves as a more precise measure of population density and overwhelms the effect of urban vs. rural.

Table 7. Marginal Effect of Socio-economic factors on TB Prevalence

Dependent = TB Incidence	Marginal Effect	% Change	z-statistic	p-value
Age	1.01	1.01	18.48	0.00
Male	0.26	25.95	7.65	0.00
Urban	0.03	2.64	0.44	0.66
Per Capita Household Income	-0.24	-0.24	-5.84	0.00
Ilocos	0.05	4.80	2.71	0.01
Cagayan Valley	0.05	5.09	3.50	0.00
Central Luzon	0.14	14.36	3.75	0.00
Southern Luzon	0.26	26.33	4.42	0.00
Bicol Region	0.11	10.82	5.43	0.00
Western Visayas	0.15	14.56	5.64	0.00
Central Visayas	0.06	5.78	2.50	0.01
Eastern Visayas	0.05	5.49	2.65	0.01
Western Mindanao	0.05	4.73	2.21	0.03
Northern Mindanao	0.04	4.41	2.15	0.03
Southern Mindanao	0.06	6.49	3.61	0.00
Central Mindanao	0.05	5.02	2.66	0.01
NCR	0.21	20.78	5.82	0.00
CAR	0.04	3.53	1.63	0.10
ARMM	0.02	1.73	0.56	0.57
Employed in Formal Wage Sector	-0.12	-12.18	-6.13	0.00

Source: 1998 APIS

The individual economic loss due to TB. We know the sick have a harder time finding work and, should they find work were less likely to be productive. The intuition here goes back to the DALY calculations—even if TB is not fatal (YLL) it affects a person's ability to be economically productive (YLD). Logically, a person with TB will make less money than someone who does not and so we asked how much that would be? Modeling this effect is somewhat encumbered by 1) the fact that some people (with or without TB) might not choose to work; 2) some workers are unpaid; and 3) the TB patients are more likely to be in a study about TB patient. Appendix 4 shows that men with TB earn PhP 451 less per day compared to those who don't have TB. Women earn PhP 216 fewer Pesos/day as shown in Appendix 6. Even after taking into account other factors, those without TB have wages that rise faster and see the wage benefits from college education faster than those that do.

Box 6. Calculation of Wage Differentials for Individuals with TB

The daily wage rate is computed as the ratio between total income during a quarter and the total number of full days worked during the same (third) quarter (APIS only collects data on this variables during the third quarter, July to September). In turn, the total number of full days worked is the sum of full days worked plus total number of hours worked during less than full days worked divided by 8.

It can be seen from Table 8 that there is a large difference in the daily wage rates of the TB afflicted relative to those not afflicted with TB across age groups.

Table 8. Daily Wage Rate by Age Group by TB Prevalence

	Not Afflicted w/ TB		Afflicted w/ TB	
Age Group	Female	Male	Female	Male
0-4				
5-14	70	73	0	0
15-29	223	210	65	35
30-44	315	293	72	88
45-59	350	349	29	74
60-69	273	298	17	27
70-79	167	310	1	4
>80	161	139	0	0
All	283	271	23	39

Source: 1998 APIS **Daily wage rates are in 2002 Philippine Pesos*

The point that TB has repercussions in terms of foregone earnings is better served through the generation of a point estimate of foregone wages. The study derives this point estimate of foregone wages through regression analysis of daily wage rates. There are several operational difficulties in carrying out this regression that must be overcome.

The first is that there are unobserved wages in the (APIS) sample. It is understandable some people choose not to work and this must be accounted for. To deal with this problem, the study employed a probit regression to account for the endogeneity of the decision to work i.e., the sub-sample not reporting wages may not necessarily earn zero wages. If the decision to work can be expressed through a regression equation then the problem is that of simultaneity. That is, to estimate wage determination properly, the decision to work and wage determination would have to be estimated jointly. The study addresses this issue through the use of Heckman's two-step sample selection estimator.

The second is the presence of reported zero wages. The study assumes that these zero wages are associated with unpaid workers, for example those who work for the family. To deal with the second issue on reported zero wages, an unpaid family worker dummy variable is included as an instrument in the right-hand side of the daily wage rate regression. The presence of the endogenous right hand side TB sick variable in the daily wage rate regression can be treated as a selectivity problem similar in character to the unobserved wage problem. To deal with this estimation issue, a treatment effects model is used to account for the endogeneity of the TB sick variable in the daily wage rate regression.

The third and last consideration is that the reported TB prevalence variable by construction is endogenous so ordinary least squares estimation would yield biased estimates. Unobserved factors that affect TB prevalence could also influence the earning capacity.

Table 9. Wage Loss Due to TB in 1997

Age Group	Deaths	Loss Due to Deaths	Incident Cases	Loss Due to Morbidity	Total Annual Loss
0-4	160	0	0	0	0
5-14	317	13,762	9,848	160,542	174,304
15-29	1,615	96,365,971	46,830	874,460,651	970,826,622
30-44	3,829	450,869,829	77,376	2,572,306,223	3,023,176,052
45-59	6,598	720,194,388	61,855	2,150,601,807	2,870,796,195
60-69	6,155	417,383,140	22,940	362,117,647	779,500,787
70-79	5,098	170,839,003	10,356	85,042,026	255,881,029
80+	2,330	25,371,541	3,831	9,769,722	35,141,263
Total	26,102	1,881,037,634	233,036	6,054,458,617	7,935,557,729

Source 1998 APIS (in 2002 prices)

Using the calculated daily loss in wages, we apply this to the (age and gender stratified) DALY estimations to estimate annualized income loss. The estimated total wages lost shown in Table 11 in 1997 was almost 8 billion pesos (see Appendix 5 for separate tables for men and women).

Foregone income stream due to TB. Using the YLL calculations and the projected income stream, we estimate that the country loses around PhP26.4 billion due to premature deaths from TB. This estimate does not include direct and indirect costs of treatment, productivity loses, and income losses due to disability from TB.

Table 10. Foregone Income Stream due to Premature TB deaths

	Foregone Income (in thousands)
MALES	Ph P 18,716,121
FEMALES	Ph P 7,687,180
TOTALS	**Ph P 26,427,303**

V. THE PUBLIC AND PRIVATE SECTOR RESPONSE TO TB

The Department of Health has embarked on a National Health Sector Reform Agenda that places TB control on top of its agenda through the following objectives:

- Maintain the quality of the DOTS implementation program
- Secure sufficient human resources for program implementation
- Strengthen a weak quality control system, including the laboratory network

- Sustain political and financial commitment as the GOP has decentralized authority for budget allocations to Local Government Units (LGUs), cities and municipalities
- Strengthen the national drug procurement and distribution system, and
- Bring private sector providers into compliance with the national DOTS strategy.

The National TB Program was integrated with the Infectious Disease Office, under the National Center for Disease Prevention and Control (NCDPC). Overall projected spending from the national and international sources is expected to be around PhP 250 million. In addition, USAID began to implement in November last year the Tuberculosis Initiative Project for Private Sector, a 3-year $8.9 million intended to strengthen private sector participation in TB control (*See Box 7)*.

Box 7. The NICC, the National TB Policy Assessment Project and the TIPS Project

Philippine Tuberculosis Initiative to Strengthen Private Sector Participation (TIPS)

Overview and Rationale for Strengthening TB Services through Private Providers
The delivery system and financing of health care in the Philippines is heavily dominated by the private sector. In previously published National Health Account 60 percent of total health expenditures are estimated to come from the private sector and about half of these costs were borne by the patients themselves. Based on the number of accredited hospitals by the DOH, private sector facilities comprise about 65% of the total number in the country.

Philippine TIPS Project Tasks and Objectives
The Philippine TIPS Project aims to help reduce the prevalence of tuberculosis in the Philippines through a more active participation of the private sector in the delivery of the Directly Observed Treatment Services to TB patients.

The project intends to enable the for-profit private sector, to collaborate with the public sector and, successfully treat TB patients. The project will develop policy initiatives to create private sector incentives to participate in DOTS treatment, develop site-specific private sector service models in at least 25 strategic urban cities and large municipalities nationwide, identify strategies to improve and expand DOTS implementation in the private sector, develop, improve teaching and training in medical professional schools, and develop national health care financing schemes that strengthen private sector delivery of TB control and cure service developed and implemented.

At the individual level, the response to the TB pandemis is also suboptimal. Most Filipinos recognize that TB is treatable (96%), but only half recognize that medicine needs to be taken daily. 13.29% of Filipinos know or live with a person with TB and most likely know how contagious the disease is since 84.67% of all persons with TB had an infected HH member and 32.76% had an infected neighbor (UHNP 2001). The lack of acceptable treatment seeking behavior by individuals is especially alarming. While 99.9% of all people said they would seek appropriate care (UHNP data), only 39% (NTPS data) of those with TB actually went to either a public or private facility (Table 8) for suitable antibiotic therapy.

Table 11. Observed TB Treatment Provider of Choice

Action taken by TB symptomatics w/ bacteriologically confirmed TB	Percent
None	34.50
Self-medication	22.40
Family Member	1.70
Traditional Healer	3.40
Health Center	15.50
Public Hospital	9.81
Private MD	10.40
Private Hospital	2.29
Total	100.00

Source: 1997 NTPS
**Hospital provided treatment is broken by public-private using 2001 UHNP*

The decision to seek care from public or private hospitals and clinics is an important policy variable. Two surveys suggest that private care is the choice of about 1/3 of patients (31.5% in the UHNP study and 38.3% in the NTPS study, which used bacteriologically confirmed diagnoses (see Table 10). The majority of the time (59%) costs, either monetary or temporal were the primary reason for choosing a provider. Interestingly, while the out of pocket cost of care was dramatically lower in Health Centers only 44% of patients went there for care. Otherwise, as shown in Table 11, costs in the private sector where competitive with the public sector. These findings suggest that if a person did not go to a health center, they split their choices between public and private providers.

Table 12. Distribution of TB Treatment Out-of-Pocket Cost by Providers

Provider	Cost per Month	Cost per 6 Months	NTPS Use Rate
Health Center in our Area	162	969	38.07
Health Center in Other Areas	55	327	2.72
Government Hospital	869	5217	25.80
Private Clinic	756	4534	27.37
Private Hospital	1032	6192	6.04
All Providers	556	3339	

Source: 2001 UHNP Evaluation Survey
**Treatment costs are in 2002 prices*

At the provider level, DOTS therapy is the standard of treatment (see Box 8).

Box 8. Directly Observed Treatment (DOTS)

Developed in 1993 by WHO's Global Tuberculosis Programme, DOTS (Directly Observed Treatment, Short-course) is believed to be the most effective strategy for controlling the TB epidemic. DOTS has five key components: (1) Government commitment to sustained TB control activities (2) Case detection by sputum smear microscopy among symptomatic patients self-reporting to health services (3) Standardized treatment regimen of six to eight months for at least all confirmed sputum smear positive cases, with directly observed treatment (DOT) for at least the initial two months (4) A regular, uninterrupted supply of all essential anti-TB drugs (5) A standardized recording and reporting system that allows assessment of treatment results for each patient and of the TB control programme overall. Standardized treatment regimens depend on whether the patient is classified as a new case or as a previously treated case; the most common drugs used are isoniazid, rifampicin, pyrazinamide, streptomycin, ethambutol and thioacetazone. With DOTS, the patient, health care workers, public health officials, governments, and communities share the responsibility to effective treatment and control of TB.

Source: What is DOTS? WHO Report, 1999. WHO/CDS/CPC/TB/99.270

The DOH Instituted DOTS in 1996 and by 2002, 89% of all public clinics have implemented this regimen (compared to 17% in 1998). As a result, cure rates have reached 87% in this group. By contrast, although one-third of all patients receive care in the private sector, it is unknown what % receives DOTS or is adequately treated. By subtraction, we estimate that this percentage is low.

VI. ADDITIONAL CONCLUSIONS

In closing, we draw the following conclusions.

1. Key pieces of data are still needed to identify policy options:
   - BoD by income and region using smear positive prevalence data
   - Cost (production) estimates by facility and provider type and facility
   - Indirect cost estimates are needed and underscore that our economic analysis is biased downward.
   - Health manpower training requirements if services are upgraded or expanded
   - The expansion of DOTS since 1998 will alter the duration of illness and CFR affecting future assessments of the BoD and related economic consequences because these estimates herein are very sensitive to TB surveillance data (SS+ and prevalence) a new NTPS survey will be needed soon.
2. The staggering burden of disease and enormous economic consequences may well overwhelm the benefits of targeting any group beyond the poor or the elderly. Thus, clinicians should maintain a high degree of clinical suspicion for any patient with persistent cough and fever, especially in elderly men and demand side interventions, such as subsidized or capitated insurance coverage should be targeted towards the working poor.
3. The burden of disease from tuberculosis disproportionately affects the selected populations of the poor, elderly and male.
4. Supply side interventions will hinge on better knowledge of the private sector
5. Supply side interventions, however, need to focus on better diagnosis. This may hinge on improving the diagnostic abilities and resources of private providers.

Little is known about the quality of private sector treatment. This has three implications:

- Survey data on the quality of private clinical practice is a very high priority.
- In the absence of data or the quality of care, strategies that increase the incentives of private providers to diagnose and refer patients to public facilities are warranted. The private provision of TB care (with available information) does not appear justifiable.

Appendix 1

Mortality: TB, All Forms By Age (Philippines 1997 & 1998)

Age Group	1997 Number	1998 Number
All Ages	26,151	28,041
Under 1	33	71
1-4	127	156
5-9	129	167
10-14	188	177
15-19	314	316
20-24	504	536
25-29	797	837
30-34	981	985
35-39	1307	1324
40-44	1541	1657
45-49	1951	2110
50-54	2109	2340
55-59	2538	2812
60-64	3095	3284
65-69	3060	3336
70-74	2716	2811
75-79	2382	2588
80-84	1369	1410
85 & Over	961	1082
Not Stated	49	42

Source: National Statistics Office
National Epidemiology Center, DOH

Appendix 2

Binary Logit Regression of Reported TB Prevalence

Dependent = TB Incidence	Coefficient	Std. Error	z-stat	p-value
Age	0.04	0.002	18.53	0.00
Male	0.51	0.07	7.65	0.00
Urban	0.04	0.10	0.44	0.66
Per Capita Household Income	-0.000020	0.000003	-5.85	0.00
Ilocos	1.01	0.37	2.71	0.01
Cagayan Valley	1.38	0.39	3.50	0.00
Central Luzon	1.47	0.39	3.75	0.00
Southern Luzon	1.73	0.39	4.42	0.00
Bicol Region	1.97	0.36	5.44	0.00
Western Visayas	2.00	0.35	5.64	0.00
Central Visayas	1.00	0.40	2.50	0.01
Eastern Visayas	1.00	0.38	2.65	0.01
Western Mindanao	1.11	0.50	2.21	0.03
Northern Mindanao	0.86	0.40	2.15	0.03
Southern Mindanao	1.29	0.36	3.61	0.00
Central Mindanao	1.14	0.43	2.66	0.01
NCR	2.03	0.35	5.82	0.00
CAR	0.82	0.50	1.63	0.10
ARMM	0.33	0.58	0.56	0.57
Employed in Formal Wage Sector	-0.73	0.12	-6.13	0.00
Intercept	-8.19	0.36	-22.98	0.00
Pseudo R2	0.085			

Marginal Effects of Logit Regression of TB Prevalence (Elasticities)

Dependent = TB Incidence	Marginal Effect	% Change	Std. Err.	z-statistic	p-value
Age	1.01	1.01	0.05	18.48	0.00
Male	0.26	25.95	0.03	7.65	0.00
Urban	0.03	2.64	0.06	0.44	0.66
Per Capita Household Income	-0.24	-0.24	0.04	-5.84	0.00
Ilocos	0.05	4.80	0.02	2.71	0.01
Cagayan Valley	0.05	5.09	0.01	3.50	0.00
Central Luzon	0.14	14.36	0.04	3.75	0.00
Southern Luzon	0.26	26.33	0.06	4.42	0.00
Bicol Region	0.11	10.82	0.02	5.43	0.00
Western Visayas	0.15	14.56	0.03	5.64	0.00
Central Visayas	0.06	5.78	0.02	2.50	0.01
Eastern Visayas	0.05	5.49	0.02	2.65	0.01
Western Mindanao	0.05	4.73	0.02	2.21	0.03
Northern Mindanao	0.04	4.41	0.02	2.15	0.03
Southern Mindanao	0.06	6.49	0.02	3.61	0.00
Central Mindanao	0.05	5.02	0.02	2.66	0.01
NCR	0.21	20.78	0.04	5.82	0.00
CAR	0.04	3.53	0.02	1.63	0.10
ARMM	0.02	1.73	0.03	0.56	0.57
Employed in Formal Wage Sector	-0.12	-12.18	0.02	-6.13	0.00

Source: APIS, 1998

Appendix 3

Treatment Effects Regression of TB Impact on Daily Wage Rate (Male)

Dependent = Daily Wage Rate	Estimates	Std. Err.	z-statistics	P-Value
Age	10.66	2.63	4.05	0.00
Age Squared	-0.11	0.03	-3.42	0.00
Elementrary Graduate	-2.58	10.63	-0.24	0.81
High School Graduate	8.37	9.56	0.87	0.38
Vocational School Graduate	28.92	12.59	2.30	0.02
College Graduate	161.12	14.04	11.48	0.00
Urban	14.31	8.24	1.74	0.08
Formal Wage Sector	104.43	9.72	10.74	0.00
Ilocos	25.49	26.55	0.96	0.34
Cagayan Valley	35.85	27.08	1.32	0.19
Central Luzon	38.38	23.37	1.64	0.10
Southern Luzon	43.26	22.43	1.93	0.05
Bicol Region	25.58	25.17	1.02	0.31
Western Visayas	6.89	25.21	0.27	0.79
Central Visayas	20.09	25.26	0.80	0.43
Eastern Visayas	34.72	27.09	1.28	0.20
Western Mindanao	1.72	27.43	0.06	0.95
Northern Mindanao	18.88	26.40	0.72	0.47
Southern Mindanao	18.90	25.94	0.73	0.47
Central Mindanao	9.03	26.99	0.33	0.74
NCR	152.94	23.80	6.43	0.00
CAR	40.22	27.40	1.47	0.14
ARMM	-34.55	26.44	-1.31	0.19
Agriculture	-25.51	41.21	-0.62	0.54
Mining	39.94	57.62	0.69	0.49
Manufacturing	20.07	42.06	0.48	0.63
Power and Water	163.60	53.95	3.03	0.00
Construction	16.80	41.88	0.40	0.69
Wholesale and Retail Trade	-31.79	42.35	-0.75	0.45
Transportation and Telecommunication	7.30	41.93	0.17	0.86
Banking and Finance	96.92	22.61	4.29	0.00
Public Admn. And Defense	120.44	42.88	2.81	0.01
Sanitary Services	-39.27	131.13	-0.30	0.77
Public Education Services	132.13	50.72	2.60	0.01
Private Education Services	12.37	58.82	0.21	0.83
Public Health Services	98.36	73.76	1.33	0.18
Private Health Services	-7.08	64.42	-0.11	0.91
Other Personal Services	41.05	42.26	0.97	0.33
Inverse Mills Ratio (Working)	40.47	22.10	1.83	0.07
TB Afflicted	-370.08	136.73	-2.71	0.01
Intercept	-233.41	78.87	-2.96	0.00
Treatment = TB Sick				

Age	0.02	0.00	15.97	0.00
Urban	0.08	0.05	1.50	0.13
Per Capita HH Income	-0.000009	0.00	-3.68	0.00
Ilocos	0.17	0.19	0.93	0.35
Cagayan Valley	0.28	0.18	1.49	0.14
Central Luzon	0.13	0.17	0.76	0.45
Southern Luzon	0.21	0.17	1.27	0.20
Bicol Region	0.16	0.17	0.92	0.36
Western Visayas	0.70	0.17	4.14	0.00
Central Visayas	-0.26	0.19	-1.34	0.18
Eastern Visayas	-0.04	0.20	-0.19	0.85
Western Mindanao	0.00	0.20	-0.02	0.98
Northern Mindanao	0.01	0.20	0.07	0.94
Southern Mindanao	0.21	0.19	1.11	0.27
Central Mindanao	0.06	0.19	0.29	0.77
NCR	0.54	0.17	3.10	0.00
CAR	-0.19	0.20	-0.95	0.34
ARMM	-0.56	0.21	-2.66	0.01
Formal Wage Sector	-0.82	0.05	-15.49	0.00
Inverse Mills Ratio (Working)	0.23	0.05	4.53	0.00
Intercept	-3.17	0.17	-18.33	0.00
Hazard				
Inverse Mills Ratio (TB Sick)	139.76	57.17	2.44	0.01
Rho	0.22			
Sigma	624.37			

Source: APIS, 1998

Marginal Effects Associated with Factors of Daily Wage Rate (Male)

	Worker w TB	Worker w/o TB
Age	14.46	17.37
Age Squared	-0.19	-0.19
Elementrary Graduate	5.06	5.06
High School Graduate	17.01	17.01
Vocational School Graduate	32.33	32.33
College Graduate	188.17	188.17
Urban	21.53	30.86
TB Sick (= -370.08)		
Per Capita HH Income	0.00111	0.00004
Formal Wage Sector	209.19	110.02
Ilocos	3.23	24.55
Cagayan Valley	0.80	34.20
Central Luzon	21.41	37.71
Southern Luzon	16.43	42.15
Bicol Region	5.12	24.74
Western Visayas	-81.86	0.46
Central Visayas	52.97	20.98
Eastern Visayas	39.41	34.88
Western Mindanao	2.25	1.74
Northern Mindanao	17.12	18.82
Southern Mindanao	-8.04	17.72
Central Mindanao	1.72	8.76
NCR	84.28	148.92
CAR	65.23	40.93
ARMM	38.43	-33.08
Agriculture	-25.51	-25.51
Mining	39.94	39.94
Manufacturing	20.07	20.07
Power and Water	163.60	163.60
Construction	16.80	16.80
Wholesale and Retail Trade	-31.79	-31.79
Transportation and Telecommunication	7.30	7.30
Banking and Finance	96.92	96.92
Public Admn. And Defense	120.44	120.44
Sanitary Services	-39.27	-39.27
Public Education Services	132.13	132.13
Private Education Services	12.37	12.37
Public Health Services	98.36	98.36
Private Health Services	-7.08	-7.08
Other Personal Services	41.05	41.05
Inverse Mills Ratio (Working)	11.11	39.44

Source: 1998 APIS (daily wage rates are in 1998 pesos, the average loss to TB of Php 370 multiplied by 1.22% yields Php 451

Appendix 4

Treatment Effects Regression of TB Impact on Daily Wage Rate (Female)

Dependent = Daily Wage Rate	Estimates	Std. Err.	z-statistics	P-Value
Age	13.83	1.74	7.93	0.00
Age Squared	-0.15	0.02	-7.41	0.00
Elementrary Graduate	-12.11	5.48	-2.21	0.03
High School Graduate	11.73	5.25	2.23	0.03
Vocational School Graduate	15.42	6.13	2.51	0.01
College Graduate	139.27	7.76	17.96	0.00
Urban	27.26	3.79	7.19	0.00
Formal Wage Sector	97.47	4.39	22.20	0.00
Ilocos	43.60	12.50	3.49	0.00
Cagayan Valley	47.44	12.65	3.75	0.00
Central Luzon	32.32	11.22	2.88	0.00
Southern Luzon	40.07	10.73	3.73	0.00
Bicol Region	21.02	11.77	1.79	0.07
Western Visayas	22.42	11.96	1.87	0.06
Central Visayas	20.23	11.68	1.73	0.08
Eastern Visayas	10.69	12.79	0.84	0.40
Western Mindanao	6.30	13.46	0.47	0.64
Northern Mindanao	27.91	12.45	2.24	0.03
Southern Mindanao	19.52	12.40	1.57	0.12
Central Mindanao	27.69	12.74	2.17	0.03
NCR	106.04	11.44	9.27	0.00
CAR	36.90	12.57	2.94	0.00
ARMM	-5.20	13.63	-0.38	0.70
Agriculture	-20.88	14.70	-1.42	0.16
Mining	-19.30	68.05	-0.28	0.78
Manufacturing	23.50	14.71	1.60	0.11
Power and Water	199.02	29.73	6.69	0.00
Construction	46.25	27.93	1.66	0.10
Wholesale and Retail Trade	-20.54	14.55	-1.41	0.16
Transportation and Telecommunication	74.93	20.20	3.71	0.00
Banking and Finance	61.64	16.37	3.76	0.00
Public Admn. And Defense	136.39	15.52	8.79	0.00
Sanitary Services	42.55	64.90	0.66	0.51
Public Education Services	218.90	15.70	13.94	0.00
Private Education Services	65.34	17.72	3.69	0.00
Public Health Services	157.16	19.19	8.19	0.00
Private Health Services	-12.08	14.08	-0.86	0.39
Other Personal Services	28.93	14.66	1.97	0.05
Inverse Mills Ratio (Working)	96.73	16.64	5.81	0.00
TB Afflicted	-177.27	48.52	-3.65	0.00
Intercept	-412.32	55.79	-7.39	0.00

Treatment = TB Sick				
Age	0.03	0.00	13.84	0.00
Urban	0.06	0.06	0.89	0.37
Per Capita HH Income	-0.000007	0.00	-2.75	0.01
Ilocos	5.31	0.26	20.12	0.00
Cagayan Valley	5.15			
Central Luzon	5.65	0.22	26.24	0.00
Southern Luzon	5.61	0.20	27.43	0.00
Bicol Region	5.59	0.21	26.36	0.00
Western Visayas	6.13	0.21	29.30	0.00
Central Visayas	5.35	0.22	23.81	0.00
Eastern Visayas	5.51	0.24	22.96	0.00
Western Mindanao	5.62	0.25	22.15	0.00
Northern Mindanao	5.42	0.25	21.57	0.00
Southern Mindanao	5.53	0.25	22.33	0.00
Central Mindanao	5.68	0.23	24.27	0.00
NCR	6.21	0.22	28.74	0.00
CAR	5.22	0.26	20.29	0.00
ARMM	5.38	0.26	20.44	0.00
Formal Wage Sector	-0.83	0.08	-10.37	0.00
Inverse Mills Ratio (Working)	0.29	0.08	3.74	0.00
Intercept	-9.08	0.23	-39.21	0.00
Hazard				
Inverse Mills Ratio (TB Sick)	66.06	21.13	3.13	0.00
Rho	0.31			
Sigma	210.63			

Source: APIS, 1998

Marginal Effects Associated with Factors of Daily Wage Rate (Female)

	Worker w TB	Worker w/o TB
Age	15.30	16.96
Age Squared	-0.19	-0.19
Elementrary Graduate	-14.49	-14.49
High School Graduate	17.27	17.27
Vocational School Graduate	21.04	21.04
College Graduate	178.31	178.31
Urban	29.85	33.22
TB Sick (= -177.27)		
Per Capita HH Income	0.00045	0.00001
Formal Wage Sector	148.10	99.14
Ilocos	-173.79	-128.71
Cagayan Valley	-168.00	-116.67
Central Luzon	-207.39	-138.70
Southern Luzon	-225.13	-101.23
Bicol Region	-205.31	-160.28
Western Visayas	-206.66	-189.80
Central Visayas	-205.31	-146.06
Eastern Visayas	-206.18	-175.29
Western Mindanao	-208.28	-188.82
Northern Mindanao	-190.43	-150.60
Southern Mindanao	-200.05	-164.97
Central Mindanao	-190.43	-167.47
NCR	-138.26	-96.26
CAR	-179.64	-130.66
ARMM	-218.65	-185.87
Agriculture	-20.88	-20.88
Mining	-19.30	-19.30
Manufacturing	23.50	23.50
Power and Water	199.02	199.02
Construction	46.25	46.25
Wholesale and Retail Trade	-20.54	-20.54
Transportation and Telecommunication	74.93	74.93
Banking and Finance	61.64	61.64
Public Admn. And Defense	136.39	136.39
Sanitary Services	42.55	42.55
Public Education Services	218.90	218.90
Private Education Services	65.34	65.34
Public Health Services	157.16	157.16
Private Health Services	-12.08	-12.08
Other Personal Services	28.93	28.93
Inverse Mills Ratio (Working)	78.85	96.30

Source: 1998 APIS (daily wage rates are in 1998 pesos, the average loss to TB of PhP 177 multiplied by 1.22% yields PhP 216))

Appendix 5
Foregone Wages Due to TB Mortality

Males

Age Group	Population	Deaths	YLLs	YLL per 100K	Average Annual Wage	Foregone Income	Foregone Income per 100k
<1	1,007,719	27	818	81	55,702	45,575,395	4,522,629
1-4	3,890,959	63	1,896	49	58,797	111,496,387	2,865,525
5-9	4,602,469	69	2,043	44	62,255	127,210,878	2,763,970
10-14	4,192,269	105	3,038	72	65,284	198,303,957	4,730,230
15-19	3,774,185	189	5,330	141	68,347	364,314,880	9,652,809
20-24	3,359,916	303	8,323	248	70,888	589,981,898	17,559,424
25-29	2,963,907	499	13,242	447	72,647	961,953,837	32,455,601
30-34	2,585,627	648	16,478	637	72,729	1,198,404,074	46,348,683
35-39	2,220,868	851	20,578	927	73,095	1,504,131,203	67,727,177
40-44	1,858,943	1,091	24,769	1,332	72,689	1,800,463,963	96,854,178
45-49	1,523,783	1,434	30,148	1,979	71,453	2,154,185,015	141,370,852
50-54	1,206,329	1,559	29,883	2,477	69,131	2,065,840,486	171,250,172
55-59	933,795	1,909	32,604	3,492	65,406	2,132,464,124	228,365,340
60-64	706,266	2,228	32,902	4,659	62,014	2,040,399,386	288,899,563
65-69	516,101	2,109	26,005	5,039	57,378	1,492,129,119	289,115,719
70-74	354,103	2,245	22,358	6,314	56,832	1,270,636,033	358,832,326
75-79	202,345	1,283	9,955	4,920	48,234	480,168,655	237,302,464
80-84	101,172	641	3,721	3,678	36,311	135,113,491	133,547,928
85+	50,586	321	1,175	2,324	36,878	43,349,216	85,693,855
Total						18,716,121,998	2,219,858,447

Females

Age Group	Population	Deaths	YLLs	YLL per 100K	Average Annual Wage	Foregone Income	Foregone Income per 100k
<1	943,495	6	183	19	52,897	9,687,178	1,026,733
1-4	3,677,881	64	1,941	53	55,835	108,401,194	2,947,382
5-9	4,358,013	60	1,793	41	59,120	105,995,508	2,432,198
10-14	4,052,530	83	2,432	60	60,926	148,188,390	3,656,688
15-19	3,708,794	125	3,577	96	63,847	228,354,817	6,157,118
20-24	3,339,230	201	5,610	168	66,258	371,699,322	11,131,288
25-29	2,960,981	298	8,067	272	67,061	541,010,770	18,271,335
30-34	2,571,687	333	8,674	337	66,512	576,919,503	22,433,504
35-39	2,196,902	456	11,366	517	65,146	740,470,502	33,705,213
40-44	1,831,524	450	10,613	579	63,566	674,630,205	36,834,363
45-49	1,503,256	517	11,412	759	61,362	700,245,001	46,581,886
50-54	1,206,643	550	11,232	931	58,301	654,847,020	54,270,154
55-59	954,603	629	11,612	1,216	52,484	609,421,711	63,840,331
60-64	745,104	867	14,198	1,906	46,390	658,670,685	88,399,832
65-69	573,293	951	13,338	2,327	38,324	511,174,196	89,164,563
70-74	437,256	1,469	16,926	3,871	38,271	647,785,585	148,147,901
75-79	249,861	839	7,587	3,036	38,375	291,147,309	116,523,911
80-84	124,930	420	2,830	2,265	32,719	92,595,122	74,117,434
85+	62,465	210	837	1,341	19,032	15,936,941	25,513,335
Total						7,687,180,959	845,155,170

Appendix 6

Wage Lost Due to TB in 1997 (Men)

Age Group	Days Worked per year	Wage Lost per day	Deaths	Loss Due to Deaths	Incident Cases	Disabling Weight	Loss Due to Morbidity	Total Annual Loss
0-4	0	0	90	0		0.294	0	0
5-14	9	9	174	13,762	6,904	0.294	160,542	174,304
15-29	147	549	991	79,911,146	38,282	0.264	814,952,410	894,863,555
30-44	265	576	2,590	395,666,969	58,183	0.264	2,346,551,389	2,742,218,358
45-59	253	524	4,902	650,594,342	57,923	0.274	2,106,389,034	2,756,983,376
60-69	192	447	4,337	371,138,975	12,273	0.274	287,771,936	658,910,911
70-79	128	376	3,082	147,893,061	5,259	0.274	69,146,292	217,039,353
80+	51	318	1,408	22,623,677	1,852	0.274	8,153,650	30,777,327
Total			17,574	1,667,841,931	180,676		5,633,125,252	7,300,967,183

Wage Lost Due to TB in 1997 (Women)

Age Group	Days Worked per year	Wage Lost per day	Deaths	Loss Due to Deaths	Incident Cases	Disabling Weight	Loss Due to Morbidity	Total Annual Loss
0-4	0	0	70	0		0.294	0	0
5-14	4	0	143	0	2,944	0.294	0	0
15-29	80	329	624	16,454,825	8,548	0.264	59,508,241	75,963,066
30-44	149	299	1,239	55,202,859	19,193	0.264	225,754,834	280,957,693
45-59	157	262	1,696	69,600,046	3,932	0.274	44,212,773	113,812,819
60-69	114	223	1,818	46,244,165	10,667	0.274	74,345,711	120,589,876
70-79	62	184	2,016	22,945,943	5,097	0.274	15,895,733	38,841,676
80+	21	140	922	2,747,864	1,979	0.274	1,616,072	4,363,936
Total	588		8,528	213,195,703	52,360	2.212	421,333,365	634,590,545

SOURCE: 1998 APIS

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