

ORIGINAL ARTICLE

## The impact of pulmonary tuberculosis morbidity on household production, consumption, investment and community participation in Prey Veng province, Cambodia

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### ABSTRACT

Tuberculosis (TB) is a major public health problem in Cambodia where its impact on household production is little known. This study aimed to assess the impact of pulmonary TB morbidity on the production, financial resources and rice seeds used for investment, satisfaction with food and non-food consumption, and participation in a community of households and to inform policy makers of better strategies to mitigate this impact. During October-November 2014, 186/186 TB /chronic disease cases were randomly recruited into the study. A TB case was defined as a household that had one patient diagnosed with pulmonary TB from one of the 24 health centers in Prey Veng Province, Cambodia. A chronic disease case was defined as a household that had a patient diagnosed with other chronic illnesses and lived in the same area of TB cases. Head of household completed the study questionnaire on socio-demographic and economic characteristics, satisfaction with food and non-food consumption, financial resources and rice seeds used for investment, and participation in the community. Mean (SD) ages of patients with TB and chronic disease were 47.8(12.9) and 51.7(9.6) years, respectively. Annual household expenditure of TB cases vs. chronic disease cases was US\$2,339.50 vs. US\$2,869.30, p=0.008. Reduction in household consumption, investment in assets, child education and community participation was reported for TB and chronic disease cases. Reduction of non-agricultural household production of TB cases was significantly more than that of chronic disease cases (US\$49.00 vs. US\$ 7.30), p=0.006. Annual household expenditure and income of TB cases were lower than that of chronic disease cases. This suggests that free health care for TB might help to reduce the household expenditure of TB cases; however, pulmonary TB morbidity still caused greater loss of household production, in particular, income earned from non-agricultural production than other chronic diseases did. Further studies are needed to determine the best way to assist TB patients' house production in rural areas during the treatment in a sustainable manner.

**Key words:** pulmonary tuberculosis, impact, household production, case-control survey, Cambodia

## INTRODUCTION

Tuberculosis (TB) is a communicable disease caused by *Mycobacterium tuberculosis* bacteria which accounts for one of the top 10 causes of death worldwide and the leading cause of death from a single infectious agent. The disease generally affects the lungs but can also affect other parts of the body. TB spreads from one person to another through air when a person with active TB expels bacteria into the air. TB is not only a disease of poverty but also causes economic distress, vulnerability, marginalization, stigma and discrimination for those who suffer from it.<sup>1</sup> Cambodia is among the top ten countries of the world with highest TB incidence.<sup>2</sup> Although tuberculosis treatment is free of charge in Cambodia<sup>3</sup>, incidence and mortality rates due to TB remained very high in the recent years.<sup>4</sup>

Chronic diseases are diseases that last for a long time which include heart disease, stroke, cancer, chronic respiratory diseases, diabetes, visual impairment and blindness, hearing impairment and deafness, oral diseases and genetic disorders. Chronic diseases are the major cause of death and disability worldwide and the impact of chronic diseases in many low- and middle-income countries is steadily growing.<sup>5,6</sup> According to WHO, in Cambodia, chronic diseases accounted for 34% of all deaths in 2002.<sup>5</sup> (Impact of Chronic Disease in Cambodia)

The burden of Tuberculosis and chronic diseases has major adverse effects on the quality of life of affected individuals and their households on different aspects. The objective of this study is, therefore, to investigate and compare the impact of TB and Chronic diseases on social-economic status of infected individuals and families.

Rural livelihoods in Cambodia usually contain one or more activities,

including cultivation, reciprocal or wage labour, trading, weaving, carving, hawking and etc. These activities generate foods, cash, and other goods to satisfy a variety of human needs. Some of these outputs are consumed immediately and others go into short or long-term stores to be consumed later or to be invested in other assets<sup>7</sup>. Investments happen when production leads to a surplus beyond requirements for the immediate consumption and households use the surplus willingly or unwillingly to invest in education, to build up physical stores of all sorts and to invest in claims by putting more resources into the community. Membership of a community usually involves an obligation to share resources<sup>8</sup> to maintain and strengthen social network that is the duties of household to contribute<sup>6</sup>. Household production activities include income generating activities, household maintenance activities and, outside work that generate wages, and the product of these activities might be agricultural or non-agricultural and it might be sold or consumed by the household. Household maintenance activities result in a good or services that is strictly for consumption within the household. Household consumption activities are defined as the satisfaction with material wants and needs through the provision of food, clothing, liquor and medical services, etc. Household investment activities are those involved in the use of its resources in order to create the potential for additional income in the next period. Household resources are allocated to consumption, production, investment activities and community participation.<sup>9</sup> From these points of views, we understand that rural livelihoods bring about production, consumption, and investment made by resources and for resources, and if livelihoods are affected it will result in unusual and undesirable production, consumption, investment and community participation.

Our literature review suggested that many studies focussed only on the economic impact of TB, specifically direct and indirect costs of TB at individual or household levels<sup>10-22</sup> and others on social and economic impacts of TB.<sup>23-26</sup> There was limited empirical evidence about the impact of TB as well as chronic diseases on household production. Therefore, we aimed to assess the impact of pulmonary TB morbidity on household production, financial resource and rice seeds used for investment, satisfaction with food and non-food consumption, and community participation, and compare with the impact of other chronic diseases in order to inform policy makers to better develop strategies to mitigate this impact.

## METHODS

### *Study design and materials*

A formative study (20 key informant interviews and 4 focus group discussions) was conducted from June to December 2012 for refining questionnaire, feasibility for household survey and contribution with plausible explanation to findings of the survey. Community mapping followed by enumeration survey was performed from January 2013 to March 2014 to identify eligible TB cases and chronic disease cases for the household survey. A pilot study was conducted to test the questionnaire in local language (Khmer) with 15 TB cases and 15 chronic disease cases that were excluded from the household survey. A cross-sectional, household-based survey was conducted from 20 October to 28 November 2014 in the catchment areas of 24 health centers of Svayantor and Preah Sdach districts, Prey Veng province, Cambodia. This province was selected because of its high reported TB notification rate of 47% and its location in rural areas with variety of socio economic and cultural background. Structured questionnaires in Khmer and

face-to-face interview were the instrument and method used for data collection in this household survey.

### *Inclusion and exclusion criteria*

Inclusion criteria for TB cases were households that each had one pulmonary TB patient aged 15-64 years, who had human immunodeficiency virus antibody test negative and had TB registration and treatment card and received TB treatment at the study health center for at least 3 months. The patient had resided in the household for more than 6 months prior to the commencement of study. TB cases were well-established, and their members lived in the study location for at least 2 years. Exclusion criteria for TB cases were households in which any member had died from any causes within the last 2 years and the patient had any other chronic illness associated with pulmonary TB. Chronic disease cases were used to establish the net impact attributable to the study morbidity on household production, satisfaction with food and non-food consumption, financial resource used for investment, and participation in community. Inclusion criteria for chronic disease cases were households that each had one person aged 15-64 years affected with any chronic illness rather than TB and had received treatment for at least 3 months at private clinic or public hospital, but lived in the same catchment area of the study health center. Chronic disease cases were well-established, and their members lived in the study location for at least 2 years. The patient had resided in the household for more than 6 months prior to the commencement of study. Exclusion criteria for chronic disease cases were households in which any member had died from any causes within the last 2 years.

### *Definition of terms used*

**Production:** this composite variable referred to income earned from

agricultural and non-agricultural activities, quantity of agricultural and non-agricultural products for consumption, level of household maintenance activities, and wages and outside work that the study household produced within a year before and after the household suffering from the disease as well.

**Satisfaction with food consumption:** this was defined by the state of the study household having enough food: rice/other cereals, vegetables, fruits, meats (fish, chicken, duck, pork, beef), eggs, milk and milk products, vegetable oil and animal fat that the household produced and purchased in order to take for each meal within a month treatment of the patient in the household to fulfill the needs of the household members.

**Satisfaction with non-food consumption:** this was defined by the state of the study household having enough non-food items: clothes, beverages (soft drink, alcohol) tobacco, fuel (firewood and charcoal for cooking, gasoline for vehicle, fuel for lighting), water, personal hygiene materials, education service, religion and social services to consume within a six-month period of treatment of the patient in the study household to fulfill the needs of the household members.

**Financial resources used for investment:** these were defined as amount of annual expenses that the study household used for their investment in rice farming, in assets (productive assets: tools or assets to serve occupation; financial stocks: saving accounts and money loaned out; physical stores of wealth: jewelry and livestock; land and buildings) and in child education within a year before and after the study household suffering from the disease as well.

#### ***Unit of analysis and data collection***

Based on the equation for the test of difference in two independent proportions, 186 TB cases and 186 chronic disease cases were randomly drawn from the sample lists

of 275 eligible TB cases and 260 eligible chronic disease cases. The unit of analysis for this study was the household, so heads of TB cases and chronic disease cases were interviewed to complete the questionnaire of this household survey by 10 trained surveyors. Data on socio-demographic characteristics and health condition of the patient, data on household economic characteristics (annual income and expenditure), household production, household satisfaction with food and non-food consumption, household financial resources and rice seeds used for investment, and household participation in community for maintaining and strengthening it before and after suffering from the disease were collected.

#### ***Measurements***

**Household economic characteristics:** data on the characteristics included those on monthly household income, monthly expenditure on basically daily needs (foods, and necessary everyday needs other than foods), annual expenditure on basically non-daily needs (health service, education, cloths, transportation), and expenses for religion and social activities per year. Annual household income was measured by multiplying reported monthly household income by twelve; annual household expenditure was measured by summing up reported annual household expenditure on basically non-daily needs with annual expenses for religion and social activities and with reported monthly household expenditure on basically daily needs that was multiplied by twelve.

**Household production:** data on this production included those on annual income earned from agricultural production, annual income earned from non-agricultural production, monthly wage from outside work, annual quantity of agricultural and non-agricultural products for consumption, and the level of household

maintenance activities: cooking, washing, water and firewood collection, child and elderly care that were produced before and after suffering from the disease. Annual household income earned from agricultural and non-agricultural production, monthly wage, and annual quantity of products for consumption, after suffering from the disease, were subtracted with those before for measuring the different amounts of such incomes and quantities between before and after. They were recorded in local currency (Riels) and converted into US dollars (1US\$=4,100 Riels), except annual quantity of products that was recorded in kilogram (Kg). Level of household maintenance activities was measured by ranking the household attitude towards such maintenance before suffering from the disease and also after based on a five point Likert Scale (1=poor, 2=moderate, 3=good, 4=very good, 5=well done). The score compared the differences between before and after to measure the pattern of household maintenance activities produced. When the score was the same it meant the level of maintenance had "no change". When it changed from a higher to a lower score it meant "decrease", and when it changed from a lower to a higher score it meant "increase".

**Household satisfaction with food consumption:** data about satisfaction with food (rice/other cereals, vegetables, fruits, meats, eggs, milk/milk product, oil/fat) consumption within a month-treatment period were measured by ranking the household attitude towards such consumption based on a five point Likert Scale (1=very dissatisfied, 2=dissatisfied, 3=neutral, 4=satisfied, 5=very satisfied). The level of these satisfaction was then regrouped into three levels: 1=dissatisfied, 2=neutral, 3=satisfied.

**Household satisfaction with non-food consumption:** data on this satisfaction with non-food (clothes, beverages, tobacco/cigar, water, personal hygiene

materials, education service, religion and social services) consumption within a six-month treatment period were measured by ranking the household attitude towards such consumption based on a five point Likert Scale (1=very dissatisfied, 2=dissatisfied, 3=neutral, 4=satisfied, 5=very satisfied) then the levels of these satisfactions were regrouped into three levels: 1=dissatisfied, 2=neutral, 3=satisfied.

**Household financial resources used for investment:** data on this household financial resources used for investment included annual financial resources used for rice farming, for assets (tools to serve occupation, money loaned out and saving account, jewellery and livestock, land and house or building) and for child education. Annual financial resources used for each type of assets before household suffering from the disease were summed up together for measuring the resources used for assets before and thus were also applied for measuring the resources used for assets after. Rice seeds used and also annual financial resources used for investment in assets and in child education after suffering from the disease were subtracted with those before for measuring the different amount of financial resources used between before and after. Rice seeds were recorded in Kg and all annual financial resources used were recorded in Riels and converted into US dollars (1US\$=4,100 Riels).

**Household participation in community activities:** data on this household participation included those on the frequency (sometimes, often, and very often) of the household participation before and after suffering from the disease, and time each household spent on participation in community activities before and after infection. The proportion of household participation (with "often" frequency) before infection was subtracted with that after infection for measuring the changed proportion of household participation from

before to after suffering from the disease. This was also applied for measuring the changed proportion of household participation (with “spent most”) from before to after.

#### **Statistical analysis:**

Percentage, mean and standard deviation (SD) were computed to describe socio-demographic and economic characteristics of TB cases and chronic disease cases. Median and interquartile range (IQR) were computed to describe the different amount of annual household production (income earned from agricultural production and non-agricultural production, quantity of agricultural and non-agricultural products for consumption) between before and after suffering from the disease and the different amount of annual household financial resources used for the investment (farming, assets, child education) between before and after.

Independent-sample t-test was performed when data were normally distributed to compare mean annual household income and mean annual household expenditure between TB cases and chronic disease cases. Cross tabulation was performed to compare the level of household maintenance activities, household satisfaction with food consumption and non-food consumption, the frequency and also time most of the household spent for participation in community between TB cases and chronic disease cases. Mann-Whitney U test was performed to compare median different amount of each variable of household

production and financial resources used for investment.

#### **Ethics approval**

The study was approved by National Ethics Committee for Health Research, Ministry of Health Cambodia (approval number obtained: 048 NECHR) and the Institutional Review Board of Mahidol University, Thailand. All respondents provided written informed consent before participating in the study.

## **RESULTS**

### ***Characteristics of TB cases and chronic disease cases***

Overall, 186 TB cases and 186 chronic disease cases were recruited into the study. The mean (SD) age of patients was 47.7 (12.9) years for TB cases and 51.7 (9.6) years for chronic disease cases ( $p = 0.001$ ), 51.6% of patients in TB cases and 71% in chronic disease cases were female ( $p=0.001$ ), 57% of patients in TB cases and 52.2% in chronic disease cases attained primary school ( $p=0.541$ ), and 80.1% of patients in TB cases and 69.4% in chronic disease cases were farmer ( $p=0.017$ ). The average annual household income of TB cases (US\$ 3,072.30) and chronic disease cases (US\$ 3,107.90) was not significantly different ( $p = 0.90$ ). The average annual household expenditure of TB cases (US\$ 2,339.50) was significantly less than chronic disease cases (US\$ 2,869.30); ( $p=0.008$ ). The patients of 34.9% of TB cases and 25.3% of chronic disease cases were in severe condition (Table 1).

**Table 1:** Household characteristics of TB cases (n=186) and chronic disease cases (n =186)

Characteristics	TB cases n (%)	Chronic disease cases n (%)
Mean (SD) age of patients, years	47.7 (12.9)	51.7 (9.6)
Age group of patients, years		
<Mean – 1 SD	34 (18.3)	53 (28.5)
Mean $\pm$ 1 SD	117 (62.9)	101 (54.3)
>Mean + 1 SD	35 (18.8)	32 (17.2)
Sex of patients		
Male	90 (48.4)	54 (29.0)
Female	96 (51.6)	132 (71.0)
Education attainment of patients		
Never studied/attended informal class	35 (18.8)	43 (23.1)
Primary school	106 (57.0)	97 (52.2)
Secondary school or higher	45 (24.2)	46 (24.7)
Occupation of patients		
Farmer	149 (80.1)	129 (69.4)
Non-farmer	37 (19.9)	57 (30.6)
Mean (SD) annual household income, US\$*	3,072.3 (2,569.1)	3,107.9 (2,705.1)
Mean (SD) annual household expenditure, US\$	2,339.5 (1,339.2)	2,869.3 (2,350.4)
Condition of the sick		
Mild	78 (42.0)	90 (48.4)
Moderate	43 (23.1)	49 (26.3)
Severe	65 (34.9)	47 (25.3)

\* 1 US\$= 4100 riel

#### Comparison between TB cases and chronic disease cases:

- Age of patients: t-test ( $t=-3.352, p=0.001$ )
- Sex of patients: Chi-squared test  $\chi^2=14.684, p=0.000$ )
- Education attainment: Chi-squared test  $\chi^2=1.231, p=0.541$ )
- Occupation of patients: Chi-squared test  $\chi^2=5.694, p=0.017$ )
- Annual household income: t-test ( $t = -.130, p = 0.897$ )
- Annual household expenditure: t-test ( $t = -2.669, p = 0.008$ )
- Condition of the sick: Chi-squared test  $\chi^2=4.141, p=0.126$ )

#### ***Household production of TB cases and chronic disease cases***

Median annual household income earned from agricultural production and median annual household quantity of agricultural products for consumption of TB cases and chronic disease cases were not changed, but the reduction of median annual household income earned from non-agricultural production of TB cases (US\$-49.00) and chronic disease cases (US\$-7.30) was significantly different between before and after suffering from the disease ( $p = 0.006$ ). Median annual household quantity of non-agricultural products for consumption of TB cases (-3Kg) and control (-1Kg), and median monthly household wage earned from outside work of TB cases (US\$-24.40) and chronic disease cases (US\$-14.60) were not significantly different ( $p = .891$ ). Level of household maintenance activities of TB cases (62%) and chronic disease cases (63%) were decreased after suffering from the disease ( $p = .859$ ) (Table 2).

**Table 2:** Household production of TB cases (n=186) and chronic diseases cases (n=186) between before and after suffering from the disease

Items	TB Household	Chronic disease household	Comparison
	Median (Q1,Q3, IQR)	Median (Q1.Q3, IQR)	
Annual household income earned from agricultural production, US\$ (n =120)	0.0 (-207.3, 0.0, 207.3)	0.0 (-89.3, 0.0, 89.3) (n=98)	p = .204
Annual household income earned from non-agricultural production, US\$ (n = 133)	-48.8 (-280.5, 0.0, 280.5)	-7.3 (-183.0, 176.8, 359.8) (n =126)	p = .006
Annual household quantity of agricultural products for consumption, kilogram (n = 164)	0.0 (-4.3, 0.0, 4.3)	0.0 (-20.0, 0.0, 20.0) (n = 151)	p = .840
Annual household quantity of non-agricultural products for consumption, kilogram (n = 117)	-3.0 (-10.0, 0.0, 10.0)	-1.0 (-5.0, 0.0, 5.0) (n = 92)	p = .051
Monthly household wage from outside work, US\$ (n = 47)	-24.4 (-68.3, 0.0, 68.3)	-14.6 (-61.0, 0.0, 61.0) (n = 35)	p = .891
Level of household maintenance activities			p = .859
Decrease	115 (61.8%)	117 (62.9%)	
No change	63 (33.9%)	63 (33.9%)	
Increase	8 (4.3%)	23 (3.2%)	

***Household satisfaction with food and noon-food consumption of TB cases and chronic disease cases***

Household satisfaction with food consumption of TB cases (20.4%) and chronic disease cases (12.9%) within a month treatment period was not significantly different (p=0.09), and household satisfaction with non-food consumption of TB cases (21%) and chronic disease cases (16.7 %) during the six month treatment period was also not significantly different (p=0.56) (Table 3).

**Table 3:** Household satisfaction with food and non-food consumption of TB cases (n=186) and chronic disease cases (n=186) during the treatment period

Items	TB cases n (%)	Chronic disease cases n (%)	TB cases/chronic disease cases comparison
Satisfaction with food consumption within one month treatment period			p = .094
Satisfied	38 (20.4%)	24 (12.9%)	
Neutral	120 (64.5%)	138 (74.2%)	
Dissatisfied	28 (15.1%)	24 (12.9%)	
Satisfaction with non-food consumption within six month treatment period			p = .561
Satisfied	39 (21.0%)	31 (16.7%)	
Neutral	115 (61.8%)	120 (64.5%)	
Dissatisfied	32 (17.2%)	35 (18.8%)	

***Household rice seeds and financial resources used for investment of TB cases and chronic disease cases***

Median annual household rice seeds and median annual household financial resources used for farming of TB cases and chronic disease cases were not changed between before and

after suffering from the disease. Reduction of median annual household financial resources used for investment in assets of TB cases (US\$-42.7) and chronic disease cases (US\$-73.2) was not significantly different ( $p=0.51$ ) and in child education of TB cases (US\$-68.30) and chronic disease cases (US\$-66) was also not significantly different ( $p=0.60$ ) (Table 4).

**Table 4:** Household rice seeds and financial resources used for investment of TB cases (n=186) and chronic disease cases (n=186) between before and after suffering from the disease

Items	Cases	Controls	Cases/controls comparison
	Median (Q1,Q3, IQR)	Median (Q1,Q3, IQR)	
Annual household rice seeds used for farming, kilogram	0.0 (0.0, 0.0, 0.0) (n = 167)	0.0 (0.0, 0.0, 0.0) (n = 144)	$p = .334$
Annual household financial resources used for farming, US\$	0.0 (-24.4, 0.0, 24.4) (n = 165)	0.0 (0.0, 15.2, 15.2) (n = 141)	$p = .317$
Annual household financial resources used for assets, US\$	-42.7 (-329.3, 0.0, 329.3) (n = 148)	-73.2 (-870.7, 0.0, 870.7) (n = 120)	$p = .507$
Annual household financial resources used for child education, US\$	-68.3 (-195.1, -26.8, 168.3) (n = 108)	-65.9 (-149.4, -22.6, 126.8) (n = 99)	$p = .605$

***Household participation in the community activities of TB cases and chronic disease cases***

The changed proportions from before to after suffering from the disease of TB cases (76.3% vs. 33.3%) and chronic disease cases (78% vs. 25.8%) who often participated in community activities were not significantly different ( $p=0.24$ ); and the changed proportions of TB cases (93% vs. 7%) and chronic disease cases (95.2% vs. 4.8%) who spend time for community participation were also not significantly different ( $p=0.38$ ) (Table 5).

**Table 5:** Household participation in community of TB cases (n=186) and chronic disease cases (n=186) before and after suffering from the disease

Items	TB cases n (%)	Chronic disease cases n (%)	TB cases/chronic disease cases comparison
Frequency of household participation before suffering from disease			$p = .731$
Sometimes	8 (4.3)	10 (5.4)	
Often	142 (76.3)	145 (78.0)	
Very often	36 (19.4)	31 (16.7)	
Frequency of household participation after suffering from disease			$p = .241$
Sometimes	121 (65.1)	133 (71.5)	
Often	62 (33.3)	48 (25.8)	
Very often	3 (1.6)	5 (2.7)	
Household spent most for community participation			$p = .379$
Before suffering from disease	173 (93.0)	177 (95.2)	
After suffering from disease	13 (7.0)	9 (4.8)	

## DISCUSSION

The results show annual household expenditure of TB cases was significantly less than chronic disease cases; annual household income earned from non-agricultural production of TB cases was significantly decreased more than chronic disease cases between before and after suffering from the disease, but annual household quantity of agricultural products for consumption of TB cases and chronic disease cases was not changed; reduction of monthly household wage from outside work of TB cases were much more even though not significantly different; as chronic disease cases, level of household maintenance activities of TB cases was decreased; household satisfaction with food and non-food consumption of TB cases and chronic disease cases during the treatment period was very low; reduction of household financial resources used for investment and of household participation in community activities of TB cases and chronic disease cases between before and after were not significantly different.

The provision of TB service was provided free of charge while the service for most other chronic diseases were not in Cambodia. This might be a reason why annual household expenditure of TB cases was significantly less than chronic disease cases.

The formative study documented that stigma arising from pulmonary TB negatively impacted on household income earned from selling food and supplies. The effects of infectious disease made individuals become marginalized socially affecting their business and ways of earning a livelihood.<sup>28</sup> This might explain our study findings that annual household income earned from non-agricultural production of TB cases was significantly worse than chronic disease cases after suffering from

the disease. The formative study documented that the husband of pulmonary TB patient was absent from outside work because he had to take care of and accompany his wife to health facilities and that a female patient affected with other chronic illness to stop paid work due to her illness. These stories could reasonably explain our study findings that both TB cases and chronic disease cases had decreased their monthly household wage and outside work. A previous study in India reported that tuberculosis in women affected washing and cooking<sup>22</sup> and the formative study found that household of pulmonary TB patients and also of other chronic illness patients had reduced frequency of washing clothes and cooking food and also volume of water and firewood collection. Findings of those studies were in line with our results showed the level of household maintenance activities of TB cases and chronic disease cases was reduced such as income generating activities, wage and outside work, and household maintenance activities<sup>9</sup>. This could imply that pulmonary TB morbidity caused negative impact on household production of our TB cases, especially with more significant decrease of household income earned from non-agricultural production comparing to chronic disease cases.

The formative study documented that households of pulmonary TB and of other chronic illness did not fully meet their food and non-food consumption because they could neither go fishing nor buy food the same amount as before, had no expensive or delicious food to eat and faced with a negative change in child education service. Another study revealed that TB patients and their households could not afford to buy food although they needed.<sup>27</sup> Findings from those studies were compatible with this present study showed very low proportion of TB cases and chronic disease cases

satisfied with food and non-food consumption. Consumption did play a critical role in maintaining the vigour and health of human resource.<sup>9</sup> Thus, the dissatisfaction with food and non-food consumption of TB cases might affect their members 'vigour and health that in turn might have a negative impact on the household production and investment activities that ultimately lead to undesirable outputs of the production and investment.

The formative study showed that pulmonary TB households as well as other chronic illness affected households reduced financial resource for their investment activities because the resource was shared with care and treatment expenditure. Findings of the previous study revealed that households of majority of TB patients had no capital to start up or run a small business.<sup>27</sup> These findings support our study results revealed that TB cases and chronic disease cases reduced their financial resources for investment activities. Financial resources were allocated to the investment activities only after fulfilled current household requirement and to return resources to the household for future use<sup>9</sup>, this indicates that pulmonary TB morbidity affected not only the current household requirement but also future use of resources.

The formative study documented that households of pulmonary TB and of other chronic illness reduced financial and also labour contribution to community activities because they had difficulty to earn as well as to physically involve after getting the disease. These findings were compatible with this present study results and shows that, after suffering from the disease, household participation in community activities of TB cases and chronic disease cases was decreased both in the frequency of participation and in the amount of expenses they contributed to the community activities. This could reflect that pulmonary TB morbidity caused less

household resource allocation to the community participation and this diminishes household duties to share the resource for maintaining and strengthening the social network, specifically their community.

As a strength of this study, our methodology for selecting study samples was very specific and based on medical records of the patient in affected households. In addition, the researcher has medical knowledge and experience travelling from one village to another for months to verify all eligible TB cases and chronic disease cases by herself through a predetermined verification procedure, so this prevented misclassification of TB cases and chronic disease cases. This study was constrained by household head's self-report and recall for previous information. The estimation of annual household income earned from production and annual financial resources used for investment before suffering from the disease might be difficult for them to recall or estimate. Nevertheless, this study concerned on this and allowed them for time to recall and estimate accordingly in order to overcome recall bias. Another weakness of this study would be the comparable group for selection of all chronic diseases because some chronic diseases may need more expenditure than TB while other may be less.

## RECOMMENDATIONS

There are two recommendations from this study. First, finding in this study found that pulmonary TB morbidity caused greater loss of household production, income earned from non-agricultural production, than other chronic diseases. Therefore free health care for TB should be provided continually to help reducing annual household expenditure of TB cases. Second, future studies are needed to determine the best way to help households

affected with pulmonary TB during the treatment in a sustainable manner for maintaining and strengthening their production, satisfaction with food and non-food consumption, financial resources used for investment, and participation in the community.

## CONCLUSION

This study reveals that household satisfaction with food and non-food consumption during the treatment period of both TB cases and chronic disease cases was very low; as control, household resources used for investment and household participation in community of TB cases were reduced. However, household production, in particular, the annual household income earned from non-agricultural production was significantly lower than chronic disease cases. The average annual household expenditure of TB cases was significantly less than chronic disease cases.

## AUTHOR CONTRIBUTIONS:

NN designed the study and formulated the content of the intervention tools and knowledge with guidance from SK and SJ. NN conducted the study and carried out reliability testing under the supervision of SK and SJ. All authors read and approved the manuscript prior to submission for publication.

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## CONFLICTS OF INTEREST:

All financial contributors of this study had no influence on designing the study, conducting the study and analysing the data. Conflicts of interest are not declared.

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