

# Economic Losses Due To Illness And Premature Death In Parepare City : Health Advocacy With DALY Approach

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**Abstract: Background:** *The approach of economic losses due to illness and early death is an effective way to be used for advocacy and convincing all stakeholders that health is an investment.*

**Methods:** *This is an observational study in the field of health economics on the magnitude of economic losses due to illness and death with the aim of providing advocacy to all health stakeholders.*

**Results:** *The amount of direct costs, which consists of household expenses for transportation of IDR 749.3 million. Economic losses due to illness (YLD) IDR 26.7 billion, and YLL of IDR 243.2 billion, total economic loss due to both (DALY) is IDR 269.9 billion. Total economic losses of IDR 270.6 billion. This huge economic loss can be prevented by increasing the budget for promoting healthy behavior and expanding health insurance coverage for the community.*

**Conclusion:** *Approach to economic losses due to early illness and death (DALY) as an effective advocacy way to improve the understanding of health stakeholders that interventions to reduce economic losses through increasing the health budget are an investment.*

**Keywords:** *Health budget, Advocacy, DALY*

## 1. INTRODUCTION

World Health Organization and Harvard developed (1992) a Global Burden Diseases (GBD) metric that aims to assess the level of disease burden in a country. Approach to economic losses caused by illness and early death known as *Disability Adjustable Life* (DALY) which is the sum of the years lost due to illness or *Years Lived with Disability* (YLD) and the amount of years lost due to someone dying before reaching age Life expectancy or *Years of Life Lost due to mortality* (YLL) (1, 2).

Use of DALY is currently being used as an advocacy material for stakeholders, especially health, to negotiate health budgeting, especially at the district level (3). DALY's approach can be more convincing and provide evidence that health is an investment because it can be calculated using the value (Indonesian Rupiah=IDR) lost due to illness and death ***Disability Adjusted Life Years (DALY)***

Disability-Adjusted Life Year or DALY is widely used to measure disease burden, which is a summary measure of public health. Based on DALY's philosophy that every person born has the possibility to live with a number of years of life in optimal health, a person can lose years of healthy life caused by illness and / or death before reaching his life expectancy. DALY's metrics try to calculate the years of life in less optimal health. DALY = 10 years, for example, is associated with 10 years of life lost due to morbidity, mortality or both (4).

The size of DALY in the population is determined by the high and low impact on public health caused by an illness. In four DALY Global Burden of Disease (GBD) studies it has become the main benchmark, each of which presents a comprehensive assessment of the impact of diseases, injuries, and health risk factors worldwide (5, 6, 7).

DALY consists of years lived with disability (YLDs) and years of life lost due to mortality (YLLs), the component of morbidity from DALY, is calculated as follows:

$YLD = \text{Number of cases} \times \text{duration till remission or death} \times \text{disability Weight}$

Disability Weights (DWs) are components important from DALY calculations, because DW translates morbidity into years of lost (productive) healthy life, allowing a comparison of morbidity and mortality. DW has a scale value from zero (perfect health) to one (worst health), this can be interpreted as a proportional reduction in good health conditions with a state of poor health. In DALY philosophy is set equal to losing the proportion of years of healthy life during disability (illness).

YLL as a component of DALYs, calculated by the formula:

$YLL = \text{Number of deaths} \times \text{life expentancy at the of death}$

DALY can be expressed as an absolute number, so it gives an overview of the total population load, can be expressed relative to the population, for example, as the DALY number per 1,000 population. This allows direct comparison of the burden suffered by different populations. Finally, DALY can also be expressed relative to the number of cases. This allows a comparison of the impact of the disease on patients, not at the population level. All assumptions used in the DALY calculations must be explicitly mentioned, including domestic workers, tables and weights of social function life expectancy (8).

## 2. METHOD

### a. Research design

This study is an observational research in the field of health economics that contributes directly to the magnitude of the economic lost of society and government due to

illness and death and both. As well as providing advocacy to the government to see the losses it causes.

b. Using data on morbidity and mortality from January to December 2017.

c. Research sites This research was carried out in Parepare Distric.

d. Methods of Collecting Data, Assumptions and Formula Economic Lost

1) Secondary Data is taken from Hospitals, Health Offices, BPS and Bappeda and other related institutions.

2) The assumptions and formulas used in calculating the number of economic Lost in this study are:

a. Productive Age Percentage = 70% (BPS Parepare Distric, 2017)

b. The number of visits by Primary Health Care (PHC) and Hospital patients for the 10 major diseases.

c. Using the Regional Minimum Salary IDR 31.2 million/ years

d. Life Expectancy for Parepare City = 70,64 years

e. The form used is:

1) Economic Loss due to YLD = (new + old case) x DD x% PA x DMS

2) Economic Loss due to YLL = d x (ex - Xd) x% PA x 365 days x DMS

3) Total Economic Loss = Economic Value DALY + HH. Exp

Information:

YLD = Years Lived with Disability (Number of years lost due to illness)

YLL = Years of Life Lost (Number of years lost due to premature death)

DALY = Disability Adjusted Life Years (Number of years lost due to premature illness and death)

HH-Exp = Household Expenditure (Household expenditure specifically for health)

DMS = District Minimum Salary (District / City Minimum Wage)

DD = Disability Days

% PA =% Productive Age (productive age)

$\sum d$  = Number of death (Number of deaths)

Xd = Age of death

ex = Life Expectancy at each age

### 3. RESULT

#### A. Direct Cost

The direct cost calculated in this study is Household expenditure for health (HH-Exp-H) which is the expenditure incurred by the household in obtaining health services. This fee consists of patient registration fees, medical care and services received by patients, plus transportation costs to PHC and hospital.

The amount of transportation costs incurred by the community to obtain health services for the ten major diseases in PHC was IDR 422.6 million, and IDR 326.7 million. This fee must still be incurred even though it has health insurance, because transportation is not included in health insurance fee claims.

Table 1. Household expenditure in obtaining health services for 10 major diseases at Primary Health Care (PHC) Parepare Distric 2017

No	ICD 10	The Type or Disease	Number of Visite	Transport to PHC (IDR)	Percent (%)
1	J06.9	Acute upper respiratory infection,			30.43

		unspecified	25,727	128,635,000	
2	I10	Essential (primary) hypertension	10,952	54,760,000	12.96
3	R50	Fever, unspecified	10,367	51,835,000	12.26
4	Z34.0	Supervision of normal first pregnancy	7,785	38,925,000	9.21
5	K29.0	Acute haemorrhagic gastritis	6,666	33,330,000	7.89
6	R51	Headache	5,223	26,115,000	6.18
7	R05	Cough	5,208	26,040,000	6.16
8	A09	Gastroenteritis and colitis of unspecified origin	4,564	22,820,000	5.40
9	K30	Functional dyspepsia	4,313	21,565,000	5.10
10	L30.9	Dermatitis, unspecified	3,728	18,640,000	4.41
		<b>Total</b>	<b>84,533</b>	<b>422,665,000</b>	<b>100</b>

In addition to spending on transportation to primary health care, the community incurred expenses to the hospital at the time of referral. The amount of costs incurred for transport to hospitals is explained in table 2.

Table 2. Household expenditure in obtaining health services for 10 major diseases at Parepare Hospital in 2017

No	ICD 10	The Type or Disease	Number of Visite	Transport to Hospital (IDR)	Percent (%)
1	N25 - N29	Other disorders of kidney and ureter	5316	79,740,000	24.41
2	H60-H95	Diseases of the ear and mastoid process	2255	33,825,000	10.35
3	H49-H52	Disorders of ocular muscles, binocular movement, accommodation and refraction	2134	32,010,000	9.80
4	L99	Other disorders of skin and subcutaneous tissue in diseases classified elsewhere	2062	30,930,000	9.47
5	M54.5	Low back pain	1965	29,475,000	9.02
6	I63	Cerebral infarction	1738	26,070,000	7.98
7	A18	Tuberculosis of other organs	1612	24,180,000	7.40
8	K04	Diseases of pulp and periapical tissues	1610	24,150,000	7.39
9	C00-D48	Neoplasms	1591	23,865,000	7.30

10	L94	Other localized connective tissue disorders	1499	22,485,000	6.88
		<b>Total</b>		<b>326,730,000</b>	<b>100</b>

### B. Indirect Costs

Indirect costs in our study are costs lost due to a person suffering from an illness and resulting in being unable to work productively and the number of productive days lost due to someone dying before reaching life expectancy. This fee is calculated using the Disability Adjusted Life Year (DALY) approach (9, 10).

#### 1. Year of Lived with Disability (YLD)

*Years lived with disability (YLD)* is a number of unproductive years because someone falls ill so they cannot *disabled activities*. So, if someone cannot produce productively for 36 days due to illness, then that person's YLD is  $36/365 = 0.1$  years. The number of YLD can also be calculated for one particular population group for one year, that is, if it is known the prevalence of a disease and the unproductive days (*disability*) average for the disease (11).

The results of the study showed that the number of years lost was due to 544 years of illness, then the total number of lost losses was multiplied by the IDR 31.2 million / years Regional Minimum Wage, resulting in a total economic loss due to illness at PHC of IDR 17.05 billion. diseases Essential (primary) hypertension which is a non-communicable diseases (NCD) is the second cause of high YLD. It is seen that there is a shift in the pattern of diseases from infectious diseases to non-infectious diseases and the number will continue to increase if no preventive measures are taken.

Table 3. Years of Lived with Disability (YLD) for 10 major diseases at Parepare Primary Health Care in 2017

No	ICD-10	The Type of Disease	Productive Age Visits	YLD	Economic Loss (IDR)	Percent (%)
1	J06.9	Acute upper respiratory infection, unspecified	18,008	148.01	4,617,941,918	27.08
2	I10	Essential (primary) hypertension	7,666	84.01	2,621,141,918	15.37
3	R50	Fever, unspecified	7,526	61.86	1,929,955,068	11.32
4	Z34.0	Supervision of normal first pregnancy	5,449	44.79	1,397,332,603	8.20
5	K29.0	Acute haemorrhagic gastritis	4,666	51.13	1,595,388,493	9.36
6	R51	Headache	3,656		937,538,630	5.50

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7	R05	Cough	3,645	29.9 6	934,717,808	5.48
8	A09	Gastroenteritis and colitis of unspecified origin	3,194	35.0 0	1,092,085,479	6.41
9	K30	Functional dyspepsia	3,019	33.0 8	1,032,249,863	6.05
10	L30.9	Dermatitis, unspecified	2,609	28.5 9	892,063,562	5.23
		<b>Total</b>	<b>59,438</b>	<b>544.00</b>	<b>17,050,415,342</b>	<b>100</b>

The number of years lost due to illness at the hospital was 309.54 years with an economic loss of IDR 9.65 billion. Other disorders of kidney and ureter are ranked first in the number of years lost due to illness.

Table 4. Years of Lived with Disability (YLD) for 10 major diseases at Parepare Hospital 2017

No	ICD Code	The Type of Disease	Product Age Visits	YLD	Economic Loss (IDR)	Percent (%)
1	N25 - N29	Other disorders of kidney and ureter	2604	85.61	2,671,061,918	27.66
2	H60-H95	Diseases of the ear and mastoid process	1104	27.22	849,323,836	8.79
3	H49-H52	Disorders of ocular muscles, binocular movement, accommodation and refraction	1045	22.90	714,608,219	7.40
4	L99	Other disorders of skin and subcutaneous tissue in diseases classified elsewhere	1010	27.67	863,342,466	8.94
5	M54.5	Low back pain	962	31.63	986,774,795	10.22
6	I63	Cerebral infarction	851	25.65	800,173,151	8.29
7	A18	Tuberculosis of other organs	789	25.94	809,319,452	8.38
8	K04	Diseases of pulp and periapical tissues	788	21.59	673,578,082	6.97
9	C00-D48	Neoplasms	779	19.21	599,296,438	6.21
10	L94	Other localized connective tissue disorders	734	22.12	690,161,096	7.15

	<b>Total</b>	<b>10666</b>	<b>309.54</b>	<b>9,657,639,452</b>	<b>100</b>
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### 2. Years Life of Lost (YLL)

*Years of Life Lost (YLL)* is the number of years lost because the population died before reaching the age of average life or *Life Expectancy (LE)*. So if LE is 63 years old and one dies at the age of 23 years, then YLL for that person is 40 years. For a number of residents, the number of YLL can be calculated in one year, which is, among others, using the technique of "*life table*" (12).

Table 4. Years of Life Lost (YLL) due to premature death before reaching life expectancy in Parepare District in 2017

Age of Dead	Amount	YLL	Economic Loss (IDR)	Percent (%)
12 - 16	20	1,240	38,688,000,000	15.91
17 - 25	19	1,083	33,789,600,000	13.89
26 - 35	27	1,296	40,435,200,000	16.63
36 - 45	41	1,558	48,609,600,000	19.99
46 - 55	56	1,568	48,921,600,000	20.12
56 - 65	49	882	27,518,400,000	11.31
65 - 70	12	108	3,369,600,000	1.39
70 - 76	15	60	1,872,000,000	0.77
<b>Total</b>	<b>239</b>	<b>7,795.00</b>	<b>243,204,000,000</b>	<b>100,00</b>

Table 4 shows the magnitude of the year lost due to an early death of 7.795 years with economic losses reaching IDR 243.2 billion, where at the age of 36 - 55 years the YLL causes the biggest compared to other age groups.

### 3. Total Economic Loss

Total economic loss is the sum of all direct and indirect costs due to illness and premature death. This fee consists of the economic value of YLD and YLL plus the transportation costs incurred by the people of Parepare City to obtain health services in PHC and hospitals.

Table 5 Total Economic Lost in Parepare City 2017

No	Expense Type	Description	Amount	Percent (%)
A	<i>Direct Cost</i>			
	<i>a. House Hold Expenditure</i>			
1	Transport	Transport to Primary Health Service	422,665,000	0.16

2	Transport	Transport to Hospital	326,730,000	0.12
	<b>Total A (Direct Cost)</b>		<b>749,395,000</b>	0.28
B	<i>Indirect Cost</i>			
1	<i>Years Lived with Disability (YLD)</i>	Economic value of YLD	26,708,054,795	9.87
2	<i>Years of Life Lost (YLL)</i>	Economic value of YLL	243,204,000,000	89.86
	<b>Total B (Indirect Cost)</b>		<b>269,912,054,795</b>	99.72
	<b>Total Economic Lost (Total A+B)</b>		<b>270,661,449,795</b>	<b>100</b>

Table 5 shows the magnitude of the total economic loss of the people of Parepare City due to diseases and premature death of IDR 27,661 billion, the biggest loss from the economic value of IDR 243,204 billion (89.86%), economic value of IDR 26.708 billion while economic losses from transportation costs to PHC hospital amounting to IDR 749,395 million (0.28%).

#### 4. DISCUSSION

Household expenditure on health (HH-Exp-H) of IDR 749.3 million was spent as transportation costs to PHC and hospitals. In Parepare City there are 1 PHC for each sub-district, but some villages that are far from community PHC still need transportation facilities to reach them, especially if patients have to get referral health services in hospitals located outside the city. The use of transportation by patients in utilizing health services is because they are not strong enough to walk (13). Transportation facilities used in the form of cars, motorbikes or *becak* (traditional transportation facilities in the city of Parepare)

The distance between PHCs is one of the reasons why people do not use health care facilities and have more to do self-medication or traditional medicine. Research in several places shows that the low number of visits to PHC is where people live far away, so that even though they have health care coverage, but they do not have transportation costs (not covered by insurance) they do not use health care facilities. Research by Trinh Manh Hung, et.al (2018) that in Vietnam to get and reach health service facilities, most people have to use transportation facilities (14).

Based on data from 10 major diseases in the City of Parepare, some of them are degenerative diseases caused by unhealthy behaviors and lifestyles. This study shows that in PHC and cardiovascular diseases (CVD) hospitals have become the cause of high YLD. If prevention efforts are not carried out by advocating to stakeholders to increase the health promotion budget for healthy living eating the DALY number of these diseases will continue to increase (15). According to UNDP this is caused by lifestyle changes and the shifting of diseases caused by the environment and infectious diseases to degenerative diseases (16). Gregg, Edward W (2018) shows that interventions for adopting healthy lifestyles for overweight or obese people with type 2 diabetes can reduce long-term disability, and have an impact on reducing YLD (17).

This research provides evidence that excellent public health is a big investment for all of us who are sometimes overlooked because of the lack of advocacy for all health stakeholders in the region (18). By making prevention efforts against economic losses of IDR 270,661 billion, it is certain that the economy in Parepare City will develop with tanks, which are characterized by populations that are free of illness and can work well. This proves

economically if the intervention can reduce losses, then the cost of the intervention is investment (19).

Total Economic Losses IDR 270,661 billion far greater than the Regional Original Revenue Budget in 2017. This study shows that by advocating using economic losses with DALY approach more understood by stakeholders (20), especially the legislature compared to using incident rates, prevalence, maternal mortality rates and other indicators that are not understood by them.

## 5. CONCLUSIONS

Prevention of economic losses due to illness (YLD) must be handled, based on the data that there are most diseases with high YLD are degenerative diseases. Essential (primary) hypertension is the second largest contributor of YLD, as well as other Non-Communicable Diseases (NCD), due to unhealthy lifestyles of the community such as smoking, lack of physical activity and not consuming vegetables and fruits.

Provision of quality health services from Primary Health Care to referral hospitals for all communities fairly and affordably. Guaranteed access to health services both in terms of transportation and in terms of financing, so it is necessary to strive to improve road and transportation facilities to existing health services. Also, it is necessary to increase the number of people in the national health insurance to guarantee the cost of care, by increasing the health insurance budget each year following population growth and mobilization.

Some of the causes of premature death that result in high YLL can be prevented by the application of healthy living behaviors thereby reducing the risk of disease, especially NCD disease. The high number of YLD especially at a productive age must be prevented by increasing adolescent health services by conducting regular health checks at schools.

Conduct advocacy to all stakeholders both executive and legislative with an economic loss approach due to illness and premature death (DALY) that can be more accepted by them, to increase awareness of the importance of increasing the health budget to improve services and increase access to public health financing through health insurance in the National Health Insurance.

### 1. *Conflict of Interest*

The authors have no conflict of interest, they have agreed to be published in this journal

### 2. *Funding*

The study is self-funded

### 3. *Ethical Clearance*

The study has passed through The Health Ethics Commission of Public Health Faculty of Hasanuddin University, No.7556/UN4.14.8/ TP.02.02/2019

## 6. REFERENCES

- [1] B. Devleeschauwer *et al.*, "Calculating disability-adjusted life years to quantify burden of disease," *Int. J. Public Health*, vol. 59, no. 3, pp. 565–569, 2014.
- [2] World Health Organization (WHO), "WHO guide to cost-effectiveness analysis," *Mak. Choices Heal. WHO Guid. to Cost-effectiveness Anal.*, pp. 289–312, 2003.
- [3] V. L. Feigin *et al.*, "Global and regional burden of stroke during 1990-2010: Findings from the Global Burden of Disease Study 2010," *Lancet*, vol. 383, no. 9913, pp. 245–255, 2014.
- [4] S. A. Kristina, D. Endarti, N. Sendjaya, and O. Pramestuty, "Estimating the burden of cancers attributable to smoking using disability adjusted life years in Indonesia," *Asian*

- Pacific J. Cancer Prev.*, vol. 17, no. 3, pp. 1577–1581, 2016.
- [5] T. J. Aragón, D. Y. Lichtensztajn, B. S. Katcher, R. Reiter, and M. H. Katz, “Calculating expected years of life lost for assessing local ethnic disparities in causes of premature death,” vol. 12, pp. 1–12, 2008.
- [6] L. A. Murray CJL, “The Global Burden of Disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020.” Harvard University Press, Cambridge, 1996.
- [7] M. C. Lopez AD, Mathers CD, Ezzati M, Jamison DT, “Global burden of disease and risk factors.” Oxford University Press, New York, 2006.
- [8] B. Devleeschauwer, A. H. Havelaar, and C. Maertens, “DALY calculation in practice : a stepwise approach,” pp. 571–574, 2014.
- [9] B. A. Larson, “Calculating disability-adjusted-life-years lost (DALYs) in discrete-time,” *Cost Eff. Resour. Alloc.*, vol. 11, no. 1, p. 18, 2013.
- [10] A. Chen, K. H. Jacobsen, A. A. Deshmukh, and S. B. Cantor, “The evolution of the disability-adjusted life year (DALY),” *Socioecon. Plann. Sci.*, vol. 49, pp. 10–15, 2015.
- [11] J. A. Salomon *et al.*, “Disability weights for the Global Burden of Disease 2013 study,” *Lancet Glob. Heal.*, vol. 3, no. 11, pp. e712–e723, 2015.
- [12] E. A. Struijk *et al.*, “Development of Methodology for Disability-Adjusted Life Years (DALYs) Calculation Based on Real-Life Data,” *PLoS One*, vol. 8, no. 9, 2013.
- [13] R. Sinha, K. Chatterjee, N. Nair, and P. Tripathy, “Determinants of Out-of-Pocket and Catastrophic Health Expenditure: A Cross-sectional Study,” *Br. J. Med. Med. Res.*, vol. 11, no. 8, pp. 1–11, 2015.
- [14] T. M. Hung *et al.*, “The Estimates of the Health and Economic Burden of Dengue in Vietnam,” *Trends Parasitol.*, vol. 34, no. 10, pp. 904–918, 2018.
- [15] D. Ding *et al.*, “The economic burden of physical inactivity: a global analysis of major non-communicable diseases,” *Lancet*, vol. 388, no. 10051, pp. 1311–1324, 2016.
- [16] WHO, *The Republic of Indonesia Health System Review*, vol. 7, no. 1. 2017.
- [17] E. H. Ip *et al.*, “Impact of Intensive Lifestyle Intervention on Disability-Free Life Expectancy: The Look AHEAD Study,” *Diabetes Care*, no. 2, p. dc172110, 2018.
- [18] H. Li, S. L. Parish, M. Mitra, and J. Nicholson, “Health of US parents with and without disabilities,” *Disabil. Health J.*, vol. 10, no. 2, pp. 303–307, 2017.
- [19] S. M. David McDaid, Franco Sassi, *Health, Preventing Disease*, First. New York: Open University Press, 2015.
- [20] A. Rubinstein *et al.*, “Estimation of the burden of cardiovascular disease attributable to modifiable risk factors and cost-effectiveness analysis of preventative interventions to reduce this burden in Argentina,” *BMC Public Health*, vol. 10, no. 1, p. 627, 2010.