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Recommendation of Suitable Health Insurance Plans for Consumers

Abstract

In this independent study, we analyze and compare health insurance plans in Thailand. Insurance plans used in this study include plans from AIA, FWD, Allianz Ayudhya, and Muang Thai Life Assurance. The study applies the expected value concept and Multi-Criteria Decision Making (MCDM) approach to develop a Value Index (VI) for measuring cost-effectiveness. Results indicate that each insurance plan offers different VI according to its structure of premiun and coverage. the results also show that the VI can be used as a systematic and quantitative tool for ranking and comparing insurance plans.

Introduction

Health insurance plays an important role in reducing the financial burden of unexpected medical expenses. However, there are currently many health insurance plans offered by different companies with varying levels of coverage, making it difficult for consumers to choose the most suitable plan. Therefore, this study analyzes and compares the value of health insurance plans by applying the concepts of Expected Value and Multiple Criteria Decision Making (MCDM) to support a systematic decision-making process in selecting an appropriate health insurance plan.

Preliminaries

Expected Value

Expected Value (EV) is the expected future value of an asset, representing the average value of all possible outcomes. It is calculated by multiplying each outcome by its probability and summing the results

$$EV = \sum_{i=1}^{n} (P_i \cdot X_i)$$

Where EV : Expected Value
X_i : Value of the outcome or return in case i
P_i : Probability of outcome i

Future Value

Future Value (FV) is the total value of the principal (present value) and the returns accumulated over a given period of time, as shown in the following equation

$$FV = PV(1+r)^t$$

Where FV : Future Value
PV : Present Value
r : Annual return or interest rate
t : Time period

Multi-Criteria Decision Making (MCDM)

MCDM is a decision-making framework for problems involving multiple criteria, focusing on selecting or ranking the best alternatives under given conditions. It serves as an overarching concept that includes various analytical approaches.

Multiple Criteria Decision Analysis (MCDA)

MCDA is a method used to evaluate and compare alternatives based on multiple criteria. It assigns weights to each factor according to their importance and aggregates the scores to rank alternatives systematically. In this study, MCDA is applied to determine the coverage scores of health insurance plans.

Min-Max Normalization

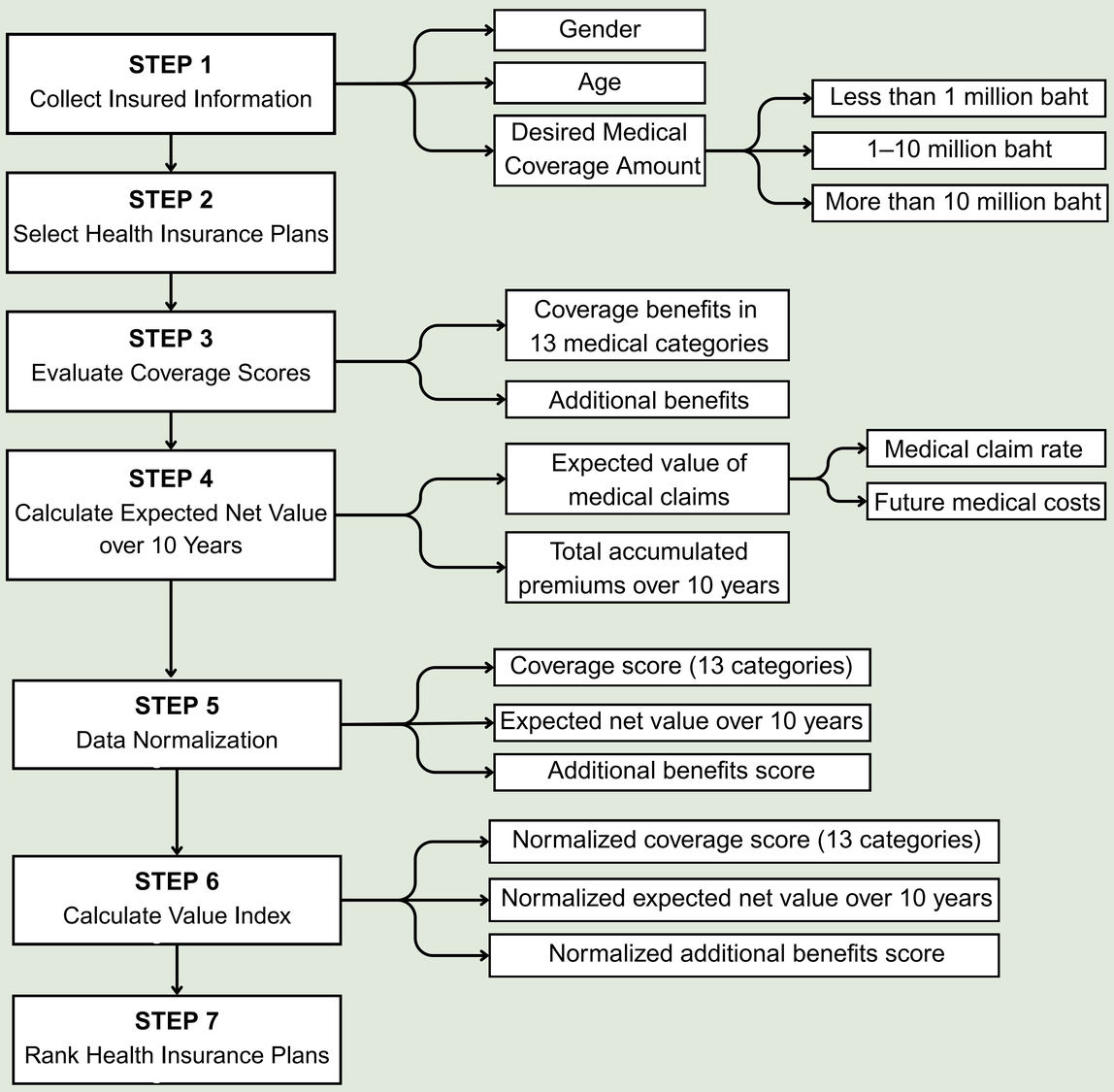
Used to rescale data with different ranges into a common range of [0,1], allowing the data to be compared and analyzed more appropriately. Its formulation is as shown in the following equation:

$$X_{norm} = \frac{X - X_{min}}{X_{max} - X_{min}}$$

Where X_{norm} : Normalized value of variable X
X_i : Actual value
X_{max} : Maximum value of variable X
X_{min} : Minimum value of variable X

Summary

The analysis applies the MCDM framework to compare multiple insurance plans based on several criteria, including coverage limit, premium, disease coverage, and policy conditions. The process consists of 7 steps.



Methodology

An evaluation of 10 health insurance plans from AIA, FWD, Allianz, and MTL referred to Plan 1 to Plan 10 using a 7 step MCDM framework to identify optimal 10-year value.

STEP 1 Collect Insured Information

- Age
- Gender : Male, Female
- Coverage level of medical expense
  - Less than 1 million baht
  - 1-10 million bath
  - More than 10 million baht

STEP 2 Select Health Insurance Plans

STEP 3 Calculate Expected Net Value (10 Years)

Evaluates coverage scores based on two components: 13 medical expense categories and additional benefits. Scoring follows MCDA and WHO frameworks, categorized into 3 levels

Score	Level	Description
2	Hight	Comprehensive
1	Medium	Limited
0	Low	No coverage

STEP 4 Calculate Expected Net Value over 10 Years

Calculated by comparing inflation-adjusted medical expenses and claim rates against total premiums paid over the same period. The process is as follows:

1 Expected Medical Claims

$$E_t = P_t \times C_t$$

Where E_t : Expected medical claim value in year t
P_t : Medical claim rate in year
C_t : Medical Expenses

Medical Expenses

$$C_t = C_0(1+r_m)^{t-1}$$

Where C_t : Medical expenses in year t
C_0 : Current medical expenses (set at 150,000)
t : Year, where $t = 1, 2, \ldots, 10$
r_m : Medical inflation rate

2 Net Expected Value

$$V = \sum_{t=1}^{10} E_t - P_T$$

Where V : Net expected value over 10 years
P_T : Total Premium (10 years)

Decision
if $V < 0$: Not cost-effective
if $V = 0$: Break-even
if $V > 0$: Cost-effective

Note : Only insurance plans with $V \geq 0$ are selected.

STEP 5 Data Normalization

To standardize variables with different units (Coverage, Extra, and Value Scores), Min-Max Normalization is applied to rescale all values into a uniform range of [0, 1].

STEP 6 Calculate Value Index

The normalized Coverage, Extra, and Value scores are integrated using the MCDA approach to compute the final Value Index for each plan, based on assigned criteria weights.

$$VI = 0.3C_{S_{norm}} + 0.5V_{norm} + 0.2E_{S_{norm}}$$

Where VI : Value Index
$C_{S_{norm}}$: Normalized coverage score (13 categories)
V_{norm} : Normalized net expected value (10 years)
$E_{S_{norm}}$: Normalized extra benefits score

STEP 7 Rank Health Insurance Plans

Plans are ranked by their Value Index (VI) from highest to lowest. The highest VI indicates the most recommended and valuable plan based on the evaluation criteria.

Example

Case Study : A 16 year old male and female requiring medical coverage less than 1 million baht

Results (Example)

Plan	Coverage Limit	Total Premium	Value Index
Plan1_BSC_350K	350,000	163,745	0.7343386
Plan1_HSV_200K	200,000	80,000	0.6357143
Plan1_BSC_550K	550,000	213,485	0.6107061
Plan1_HSV_300K	300,000	101,500	0.573012

Recommended Plan:
Plan1_BSC_350K has the highest Value Index (VI) and is therefore considered the most suitable plan for both male and female aged 16 requiring medical coverage less than 1 million baht.

Example

Case Study : A 23 year old male and female requiring medical coverage more than 10 million baht.

Results (Example) : Male

Plan	Coverage Limit	Total Premium	Value Index
Plan3_HPH_25M	25,000,000	328,600	0.7718658
Plan3_PPT_12M	12,000,000	370,732	0.7646445
Plan3_PPT_40M	40,000,000	615,341	0.7466034
Plan3_ELH_20M	20,000,000	298,346	0.6814128

Recommended Plan:
Plan3_HPH_25M has the highest Value Index (VI) and is therefore considered the most suitable plan for a 23 year-old male with a coverage level of more than 10 million baht.

Results (Example) : Female

Plan	Coverage Limit	Total Premium	Value Index
Plan3_PPT_12M	12,000,000	370,732	0.7904634
Plan3_HPH_25M	25,000,000	350,500	0.784309
Plan3_PPT_40M	40,000,000	615,341	0.7630679
Plan3_EHP_100M	100,000,000	1,028,978	0.71

Recommended Plan:
Plan3_PPT_12M has the highest Value Index (VI) and is therefore considered the most suitable plan for a 23 year-old female with a coverage level of more than 10 million baht.

Results

Based on the calculation of the Value Index, which was developed to compare health insurance plans, the results indicate that the most suitable plans vary according to age group and level of medical coverage. The use of the Multi-Criteria Decision Making (MCDM) approach allows multiple factors to be considered simultaneously, enabling a systematic comparison and ranking of insurance plans.

Example results

Age Group	Target Coverage	Plan Limit	Optimal Plan
6 - 10	1-10M	3M	Plan2_PPT_3M
11 - 20	< 1M	500K	Plan1_BSC_500K
	1-10M	3M	Plan2_PPT_3M
	> 10M	25M	Plan3_HPH_25M

These results show that the Value Index can help compare and identify suitable health insurance plans for consumers based on their age and desired level of coverage.

Conclusion

The study shows that the Value Index, developed using Expected Value and the MCDM approach, can effectively evaluate and compare the value of different health insurance plans. The results also indicate that the most suitable plan varies depending on age group and coverage level. Therefore, this approach can serve as a useful tool to support consumers in selecting appropriate health insurance plans.

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