

One Method of Breaking Down Medical Expenses by Illness: Estimating Marginal and Average Burden

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Background

- For effective population health management (PHM), establishing benchmarks for the prevalence of different diseases is useful. When the prevalence of a specific disease in a municipality exceeds its benchmark, interventions to reduce the disease prevalence are likely to be both appropriate and effective.
- A reduction in disease prevalence is expected to contribute to the reduction of healthcare expenditures; however, its impact manifests differently over time. In the short term, it is observed as a decrease in the marginal medical cost associated with the target disease, whereas in the medium to long term, it emerges as a reduction in the average excess cost.
- Quantitative evaluation of marginal medical cost requires an allocation of total healthcare expenditures to individual diseases, yet methods for such allocation have not been fully standardized.
- In this study, we present a disease-specific cost allocation method and apply it to estimate marginal medical costs for three common chronic diseases (hypertension, diabetes, and dyslipidemia), which are then compared with average excess costs.

Data source

- A health insurance claims database, “Wellness-Star☆”, owned by Nippon Life Insurance, was used.
- The database included health insurance claims data from multiple employment-based health insurance plans.

Target population

- Data from men aged 55-59 who had a definitive diagnosis of hypertension, diabetes, or dyslipidemia in 2021 were included in the analysis.

Methods

Disease-specific healthcare cost allocation method

- Nissay Information Technology Co, Ltd. (Nissay IT) has developed and patented this method.
- Healthcare costs recorded in medical claims, Diagnosis Procedure Combination (DPC) inpatient claims, and pharmacy claims are allocated into each disease using the following procedure:
 - Classify medical resources (such as procedures or medications) into those linked to specific diseases and those that are not.
 - When medical resources, such as procedures and medications, need to be checked for association with a diagnosis during claim review, they are classified as “those linked to specific diseases.”
 - Medical resources that do not require this check are mainly related to general care and hospital fees, such as initial or follow-up consultation fees and hospitalization fees. These are classified as “those not linked to specific diseases.”
 - Calculate the allocation rates for the claim
 - For medical resources linked to specific diseases, allocation rates are assigned to each disease (as ICD-10 code) recorded in the claim based on the Indication Master (proprietary to Nissay IT). The allocation rates in the master are designed to assign higher rates to diseases for which the corresponding procedures or prescriptions are most likely indicated based on previously observed associations between diagnoses and corresponding procedures or prescriptions in claims data.
 - Resources without applicable disease in the claim, including cases such as off-label prescriptions, are not assigned allocation rates.
 - The overall allocation rate for the claim is determined by the proportion of total costs assigned to each disease, calculated from resources with allocation rates.
 - Distribute the total cost by disease based on the calculated allocation rates
 - The allocation rates derived in step 2 are used to proportionally allocate the total cost of the claim to each disease. This includes medical resources that were classified as not linked to specific diseases in Step 1, as well as medical resources that were not assigned to any disease in Step 2.

Comparison of the costs

- Marginal cost for hypertension, diabetes, and dyslipidemia was developed for each disease from the disease-specific healthcare cost allocation method and was compared with the average excess cost for each disease.
- Average excess cost for each disease was estimated as the coefficient of a regression model in which the logarithm of healthcare costs was the explained variable and dummy variables for each disease were the explanatory variables.

Results

- For the analysis 46,293 individuals were identified. The average annual healthcare costs for the individuals were 355,060 JPY.
- The marginal cost and average excess cost for each disease are as below.

Disease	Marginal cost (JPY)	Average excess cost (JPY)
Hypertension (I10-I15)	31,630	60,200
Diabetes (E10-E14)	41,550	166,470
Dyslipidemia (E78)	17,120	27,830

Conclusions

- It is reasonable that the marginal cost was lower than average excess cost for all diseases analyzed in this study. The difference between the costs was the largest for diabetes; the marginal cost was approximately one quarter of the average excess cost.
- The marginal cost can be used as an indicator of the amount of medical cost reduction that should be achieved in the short term through PHM.

Example of Medical Cost Allocation (JPY 5,000) in a medical claim

- (1) Assign allocation rates to each disease included in the claim (ICD-10 codes E14, I10, and E78) for resources identified as linked to specific disease.
- (2) Example of disease-specific cost allocation after all costs in the claim have been distributed

Resources	Costs (JPY)	Allocation rate for each ICD-10 code		
		E14	I10	E78
Procedure A	1,000	100%		
Procedure B	300	80%		20%
Procedure C	2,200			
Drug D	1,000			
Drug E	500	40%	50%	10%

Resources identified as linked to specific diseases

Allocation rate from the Indication Master

No allocation rate is assigned to Procedure C and Drug D because no indication is available.

Resources	Costs (JPY)	Costs for each ICD-10 code (JPY)		
		E14	I10	E78
Procedure A	1,000	1,000		
Procedure B	300	240		60
Procedure C	2,200			
Drug D	1,000			
Drug E	500	200	250	50
Total costs (JPY)		1,440	250	110
Allocation rates		80.0%	13.9%	6.1%
Final disease-specific cost (JPY)		4,000	690	310

Calculate the overall allocation rate

Total cost in the claim (JPY 5,000) are allocated based on the allocation rates

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