

A Method to Estimate Causally Related Cost Savings of A Preventive Intervention : An Analysis Using the "Wellness-Star☆" Database

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OBJECTIVES

- When estimating the cost-saving effects of preventive interventions, only the portion of the cost difference between the health status groups is causally related.
- However, extracting causality from data has been challenging.
- Using disease-specific cost decomposition logic patented by Nissay Information Technology, the difference for each disease could justify the causality.

METHODS

- We focused on weight loss for individuals with obesity and improvement of sleep quality for individuals with poor sleep.
- "Wellness-Star☆" database provided by Nippon Life Insurance Company, including claims and checkups data of about 200 health insurers, was used.
- We compared total and disease-specific costs Per Member Per Year (PMPY) between the obese group (BMI > 30) and the normal-weight group (18.5 < BMI < 25) for obesity, and between the well-slept group and the poor-slept group, based on surveys, for sleep quality.
- Diseases were classified using the first three digits of the ICD-10 codes.
- We used the disease-specific healthcare cost allocation method in this study. This method was developed and patented by Nissay Information Technology Co., Ltd.. Healthcare costs recorded in medical claims, Diagnosis Procedure Combination (DPC) inpatient claims, and pharmacy claims were allocated to each disease.¹

RESULTS

- PMPY for the normal-weight group (N=652,553) and obese group (N=64,132) was €708.01 and €1,289.83.
- The 3 diseases having the largest differences between the two groups were type 2 diabetes (€9.56), hypertension (€7.94), and unspecified diabetes (€6.74), all of which have obesity as a risk factor.
- PMPY for the well-slept group (N=577,318) and poor-slept group (N=319,975) were €793.15 and €915.32.
- The 3 diseases having the largest differences between the two groups were chronic kidney disease (€0.67), sleep disorders (€0.66), and type 2 diabetes (€0.64), all of which may cause poor sleep.

ICD-10	Description	PMPY		
		the obese group	the normal-weight group	Δ
E11	type 2 diabetes	€11.02	€1.46	€9.56
I10	hypertension	€10.85	€2.90	€7.94
E14	unspecified diabetes	€8.17	€1.43	€6.74
G47	Sleep disorders	€6.03	€1.14	€4.88
E78	Lipoprotein Metabolism Disorders and Other Lipidemias	€5.19	€2.14	€3.05
N18	Chronic kidney disease	€3.21	€1.55	€1.65
M17	Knee osteoarthritis	€2.01	€0.47	€1.54
I48	Atrial fibrillation and flutter	€2.39	€1.06	€1.33
I50	heart failure	€1.71	€0.64	€1.06
F32	Depressive episodes	€2.29	€1.25	€1.05

Table 1: The 10 diseases having the largest positive differences of PMPY for the obese group and the normal-weight group

ICD-10	Description	PMPY		
		the well-slept group	the poor-slept group	Δ
E11	Sphingolipid metabolism disorders and other lipid storage disorders	€0.17	€0.00	€0.17
I10	Bronchial and pulmonary malignant neoplasms (tumors)	€1.00	€0.91	€0.09
E14	Schizophrenia	€0.40	€0.31	€0.09
G47	Amyloidosis	€0.09	€0.01	€0.08
E78	Breast malignant neoplasms (tumors)	€1.46	€1.38	€0.08
N18	Pancreatic malignant neoplasms (tumors)	€0.31	€0.23	€0.07
M17	Glycosaminoglycan metabolism disorders	€0.07	€0.00	€0.07
I48	Myeloid leukemia	€0.64	€0.57	€0.07
I50	Subarachnoid hemorrhage	€0.17	€0.11	€0.06
F32	Lymphocytic leukemia	€0.12	€0.06	€0.06

Table 3: The 10 diseases having the largest positive differences of PMPY for the well-slept group and the poor-slept group

ICD-10	Description	PMPY		
		the obese group	the normal-weight group	Δ
D66	Hereditary factor VIII deficiency	€ 0.00	€ 0.64	-€ 0.64
K50	Crohn's disease (regional enteritis)	€ 0.31	€ 0.76	-€ 0.45
K51	Ulcerative colitis	€ 0.73	€ 0.93	-€ 0.19
E75	Disorders of sphingolipid metabolism and other lipid storage disorders	€ 0.00	€ 0.19	-€ 0.18
C25	Malignant pancreatic neoplasms	€ 0.10	€ 0.27	-€ 0.17
C15	Malignant esophageal neoplasms	€ 0.02	€ 0.13	-€ 0.11
K40	Inguinal hernias	€ 0.07	€ 0.18	-€ 0.11
L85	Other acanthosis	€ 0.39	€ 0.50	-€ 0.10
H52	Disorders of refraction and accommodation	€ 0.53	€ 0.62	-€ 0.09
K64	Hemorrhoids and perianal venous thrombosis	€ 0.15	€ 0.23	-€ 0.08

Table 2: The 10 diseases having the largest negative differences of PMPY for the obese group and the normal-weight group

ICD-10	Description	PMPY		
		the well-slept group	the poor-slept group	Δ
N18	Chronic kidney disease	€ 1.48	€ 2.15	-€ 0.67
G47	Sleep disorders	€ 1.54	€ 2.20	-€ 0.66
E11	Type 2 (non-insulin-dependent) diabetes mellitus (NIDDM)	€ 2.63	€ 3.27	-€ 0.64
F32	Depressive episode	€ 1.13	€ 1.73	-€ 0.60
E14	Diabetes mellitus, unspecified	€ 2.36	€ 2.84	-€ 0.48
D59	Acquired hemolytic anemia	€ 0.06	€ 0.49	-€ 0.43
K21	Gastroesophageal reflux disease	€ 1.10	€ 1.51	-€ 0.41
J45	Asthma	€ 1.22	€ 1.61	-€ 0.39
I10	Essential (primary) hypertension	€ 4.24	€ 4.63	-€ 0.39
K50	Crohn's disease (regional enteritis)	€ 0.46	€ 0.75	-€ 0.29

Table 4: The 10 diseases having the largest negative differences of PMPY for the well-slept group and the poor-slept group

CONCLUSIONS

- When estimating the cost-saving effects of preventive interventions, a method was proposed that decomposes correlations by disease and determines causality for each condition individually.
- However, this approach is not necessarily applicable to all types of preventive interventions.
- Preventive interventions such as maintaining a normal weight and improving sleep quality can result in substantial cost savings for patients with several comorbidities.

Reference

1. Kakinuma, A., Kinugawa, M., Miyamori, Y., Sato, K., Yamamoto, S., Tanno, K., Nakamura, K., & Iwasaki, K. (2025, September). One method of breaking down medical expenses by illness: Estimating marginal and average burden [Poster presentation]. ISPOR Real-World Evidence Summit 2025, Tokyo, Japan.

Conflicts of Interest

- A.Kakinuma, Y.Miyamori, M.Kinugawa, T.Yabuki, M.Takamoto, K.Sato, T.Kakoi and S.Yamamoto are employees of Nippon Life Insurance Company.
- K.Iwasaki, T.Takeshima and A.Chida are employees of Milliman, which serves as a consultant to Nippon Life.
- A.Igarashi is a professor at the University of Tokyo and an advisor to Nippon Life.
- N.Ikegami is an advisor to Milliman Inc.