

# Economic Impact of Type 1 Diabetes Complications: A Nationwide Analysis

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## Background and objective

- Evidence regarding the cost impacts of type 1 diabetes (T1D)-related complications in the Asian population was scarce.
- We sought to quantify the economic burden of complications in Taiwanese T1D populations.

### Methods

Confirmed T1D populations by catastrophic illness card



#### during 2008-2016 in NHIRD

Identify complications of interest (follow-up until 2018)

- Macrovascular complications
- Microvascular complications
- Metabolic complications

Determine cost estimates associated with events of interest

- Calculate annual healthcare costs associated with events of interest (crude costs)
- Estimate the impacts (i.e., cost multiplier) of patients' characteristics such as comorbidities, medications, and complications (adjusted costs)

**Costs included** 

• Event-year cost: cost within the first year of the event occurred

Figure 1. Mean annual crude healthcare costs (per person) of complications of interested population compared with those of non-complications ("NC") from baseline year (before complication occurred; Year 0) up to 8 years of follow-up (Years 1–8)

Abbreviations: IHD, ischemic heart disease; MI, myocardial infarction; PVD, peripheral vascular disease.

#### Table 2. Cost multipliers of complications of interest and patients' characteristics

haracteristics	Multipliers	95%	6 Cls	Characteristics	Multipliers	95%	5 Cls
aseline annual health care	83 90	73 32	96 00	<b>Complication (state-year)</b>	(ref.: none)		
ost (2023, \$), mean (95% CI)	03.30	13.52	50.00	IHD/MI	1.12	0.89	1.40
emographics				Cerebrovascular disease	1.21	1.04	1.40
ge at index date (years)				Heart failure	1.48	1.18	1.85
ef.: < 14)				PVD	1.71	1.36	2.15
14-21	0.94	0.88	1.01	Diabetic foot	1.02	0.92	1.13
22–34	0.84	0.78	0.91	Nephropathy	1.21	1.11	1.31
≥ 35	0.88	0.81	0.96	Retinopathy	1.21	1.13	1.28
emale (ref.: male)	0.99	0.94	1.04	Neuropathy	1.02	0.92	1.13
iabetes duration (vears)				Complication (recurrent) (ref.: none)			
ref.: < 5)				IHD/MI	1.84	1.41	2.40

0.98

0.99

1.7

4.95

3.17

3.41

6.64

1.58

2.06

1.44

1.65

2.00

1.45

1.20

1.37

1.36

1.31

1.40

- State-year cost: average cost in the years following the event occurred
- Recurrent-year cost: cost for recurrent events
- Statistical analyses
  - Generalized estimating equation (GEE) was used to determine the impact (cost multiplier) of patients' characteristics (e.g., medication, complications) on annual healthcare costs.
  - Costs were presented as United States Dollars (USD) in year 2023.

Abbreviation: NHIRD, National Health Insurance Research Database.

### Results

Table 1. Patient characteristics of T1D population (n=10,137)

Mean (SD) or proportion		
46.0		
22.4 (10.9)		
3.7 (4.0)		
20.4		
7.5		
80.9		
91.3		
0.5		
7.5		
22.5		

5-9	0.95	0.91				
≥ 10	0.93	0.88				
Medication (ref.: none)						
Short-acting insulin	1.62	1.54				
Rapid-acting insulin	4.54	4.15				
Intermediate-acting insulin	2.94	2.73				
Long-acting insulin	3.17	2.95				
Premixed insulin	6.00	5.41				
OADs	1.50	1.42				
Complication (event-year) (ref.: none)						
IHD/MI	1.79	1.55				
Cerebrovascular disease	1.24	1.07				
Heart failure	1.41	1.20				
PVD	1.71	1.47				
Diabetic foot	1.33	1.23				
Nephropathy	1.13	1.08				
Retinopathy	1.31	1.25				
Neuropathy	1.27	1.19				
Hospitalized hyperglycemia	1.26	1.21				
Hospitalized hypoglycemia	1.36	1.32				

	Cerebrovascular disease	1.19	0.84	1.67		
	Heart failure	1.33	1.08	1.64		
	All-cause death (ref.: none	)				
	Fatal CVD	1.93	1.00	3.76		
	Other-cause death	1.64	1.13	2.39		
Abbreviations: CVD, cardiovascular disease; IHD, ischemic heart disease; MI, myocardial infarction; PVD, peripheral vascular disease. Note: Individual patient comorbidities were adjusted, but the data is not shown.						
	Illustration:					
	For a 23-years old T1D female receiving the					
	combination of rapid- and long-acting insulin to					
	develop a first event of heart failure, his annual					
	healthcare cost is estimated as below:					
	Calculation process:					
	USD 83.90* 0.84*0.99 *4.54*3.17*1.41					
	=USD 1,415.83					

✓ The event-year costs were generally high for macrovascular complications, while the annual healthcare costs of nephropathy and retinopathy increased gradually from the occurrence of the event during follow-up (Figure 1).

Abbreviation: SD, standard deviation.

✓ Baseline characteristics of 10,137 T1D populations were identified with a mean follow-up of 9.1 years (Table 1).

Recurring cardiovascular events also impose increased annual costs by 1.19 (cerebrovascular disease) to 1.84 (IHD/MI) times (Table 2).

## Conclusions

- ✓ The cost impacts of the incident and recurrent cardiovascular diseases in T1D populations were both compelling.
- The economic burden attributable to costly kidney transplants and insulin therapy for a life-long treatment of T1D cannot be ignored.
- ✓ These cost estimates highlight clinical and policy efforts needed for early and effective interventions to alleviate the cost burden in individuals with T1D and support the parameterization of economic simulation models in Taiwan or Asian settings to identify cost-effective strategies to improve the quality of care in this population.

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