

Budget-Impact Analysis of Adopting Expanded Hemodialysis (HDx) Via Theranova® in Korea

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Introduction

- In South Korea, there has been progressively increasing prevalence of chronic kidney disease (CKD) due to aging population and high rate of diabetes mellitus (DM) and hypertension. According to the KSN(Korean Society of Nephrology) registry data¹, the number of CKD patients are increasing by 8.7% annually and in 2020, there were total 145,006 end-stage renal stage (ESRD) patients in Korea. There are three modalities of renal replacement therapy for ESRD: hemodialysis (HD), peritoneal dialysis (PD), and kidney transplantation (KT). Among them, HD is the most predominant RRT modality in Korea, which is 81.0% among total RRT patients and 96% among dialysis patients.
- CKD places a considerable financial burden and the healthcare cost is increasing 7.8% annually. Treatment costs for CKD rose rapidly since 1960s, with availability of renal replacement therapy (RRT) making long-term administration of treatment for patients with end-stage renal disease (ESRD) possible. Especially, healthcare cost used by dialysis patients, which cover 0.14% of total population in Korea, account for more than 3% of the total healthcare cost in Korea. Among a single disease, medical expense for dialysis per patient is the highest disease².
- The accumulation of solutes in dialysis patient may be associated with complications resulting poor outcomes, including higher morbidity and mortality. Conventional dialysis such as high-flux HD is able to remove small molecules and smaller middle molecules adequately. However, Large middle molecules can be reduced by Expanded hemodialysis (HDx), which refers to a technique that combines diffusion and convection with Theranova® (Baxter Healthcare Corporation, Deerfield, IL USA) dialyzer. Theranova® is a medium cut-off dialyzer that allows for better clearance of large middle molecules than traditional high-flux HD dialyzers. Compared to high flux HD, HDx via Theranova® has been associated with reduced treatments for anemia and lower risk of all-cause and cardiovascular hospitalization.
- In randomized controlled trial³ from United States found that among dialysis patients, those who selected HDx improved clinical outcomes including fewer hospitalizations than patients who selected high-flux HD (see Table 1).

Table 1: Clinical outcomes between Theranova® and high-flux HD

Health resource utilization	Theranova® (n=86)	High-flux HD (n=85)
Hospitalization rate per patient-year (SE)	0.56 (0.13)	1.02 (0.12)
Hospital length of stay (mean days [SE])	4.11 (0.57)	4.63 (0.58)
ESA (mean dosage IU)	20,343	20,765
Iron (mean dosage mg)	413	508

Objective

- To estimate the budget impact in terms of reduced healthcare costs aligned with clinical factor, between Theranova® and conventional hemodialysis (HD) with a high-flux dialyzer in Korea.

Methods

- The budget impact model has been developed that compares the incremental costs of a 5-year maintenance period in scenarios where Theranova® is adopted (HDx) and Theranova® is not adopted (HD). The model has assumed a target population ratio of HDx and HD as 5.8% and 94.2% in year 2021 (baseline year) and 6.5% and 93.5% in year 2024. The population of baseline year (2021) of HDx and HD patient were assumed 5,187 and 84,241 respectively. It is calculated by multiplying assumed ratio to total HD population considering current total ESRD population CAGR based on 2019 KSN registry data.
- To estimate total healthcare cost, the model assumed the input data of baseline HD healthcare resources (Table 2) and individual cost (Table 3). Sensitivity analysis was conducted in terms of dialyzer usage, ESA costs and Iron costs.

Table 2: baseline HD healthcare resources input data

Healthcare resources	Input data	Data source	
Dialyzers	Dialyzers used (per month)	13	2019 KSN registry data ¹
Hospitalizations	Hospitalization rate (patient year)	0.617	Am J Nephrol. 2020;51(12):975-981 ⁴
	Mean episode length of stay (days)	16.60	Clin Ther. 2018 Jan;40(1):123-134 ⁵
	Frequency of ESA usage	95.4%	2019 KSN registry data ¹
Medications	ESA mean dose (Units per month)	1	2019 KSN registry data ¹
	Frequency of iron usage	32.0%	Scientific Reports (2020) 10:16062 ⁶
	Iron mean dose (mg per month)	1	Scientific Reports (2020) 10:16062 ⁶

Table 3. Healthcare cost input data

Healthcare resources	Input data	Data source
HD dialyzer cost per session	33,900 (KRW)	Reimbursement fee for HD medical device in Korea
Hospitalization day cost	317,183.99 (KRW)	Clin Ther. 2018 Jan;40(1):123-134 ⁵
ESA cost (per Int unit)	106,949.14 (KRW)	2019 KSN registry data ¹ Expert consultation
Iron cost (per unit)	16,209 (KRW)	Scientific Reports (2020) 10:16062 ⁶ Expert consultation

Results

- The budget Impact Analysis showed that a gradual adoption of Theranova® led to incremental cost of 60,085,283,951 KRW (around 48,068,227 USD) savings over 5-years of time horizon. Lower costs were attributed reduced cost of hospitalization by 58,795,897,510 KRW (around 47,036,718 USD). Costs of ESA and iron were also reduced by 878,448,507 KRW (around 702,759 USD) and 410,937,934 KRW (around 328,750 USD), respectively (Figure 1, 2). The exchange rate per USD was calculated as 1200 KRW and applied discount rate was 4.5%.

Figure 1: Aggregated incremental budget impact analysis

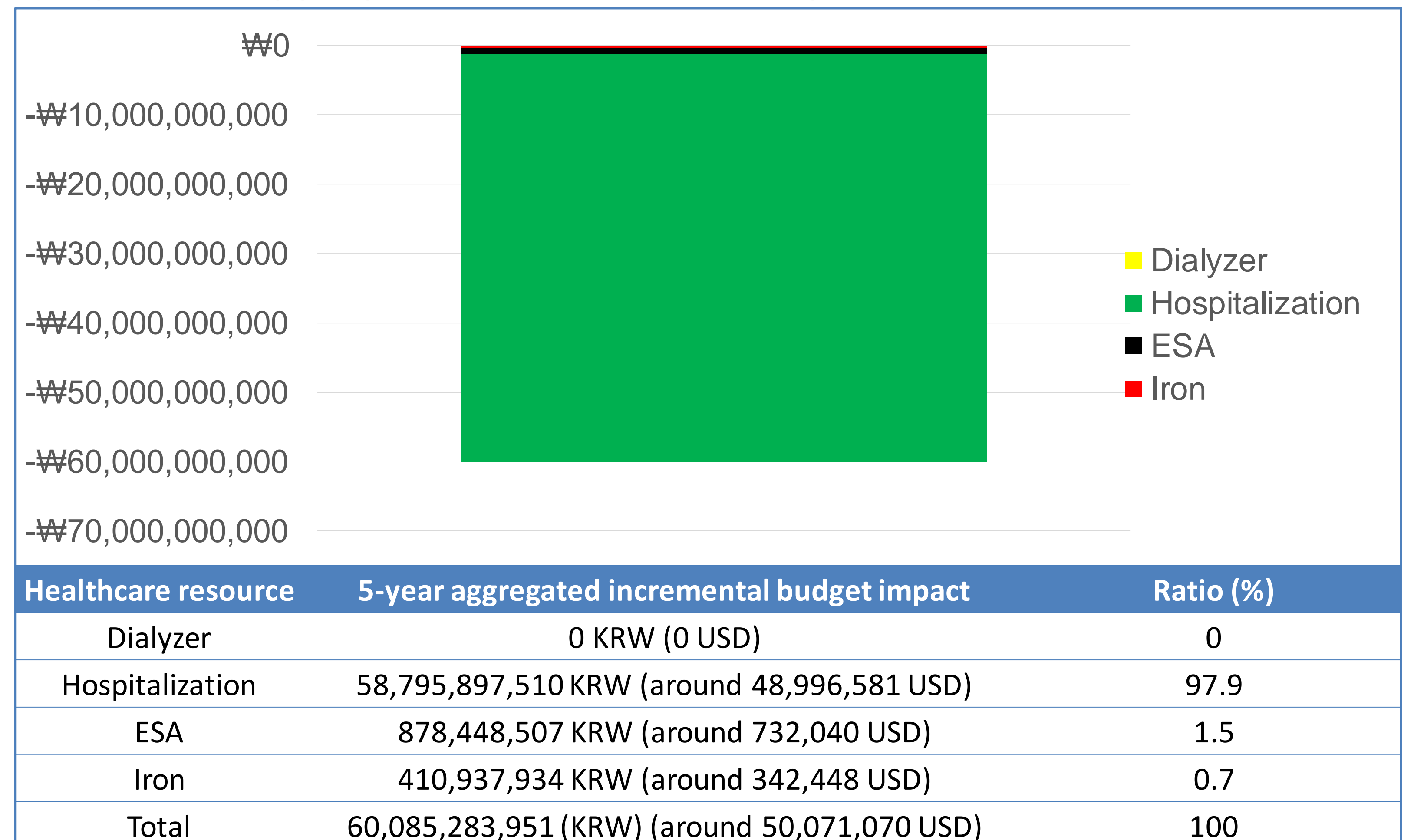
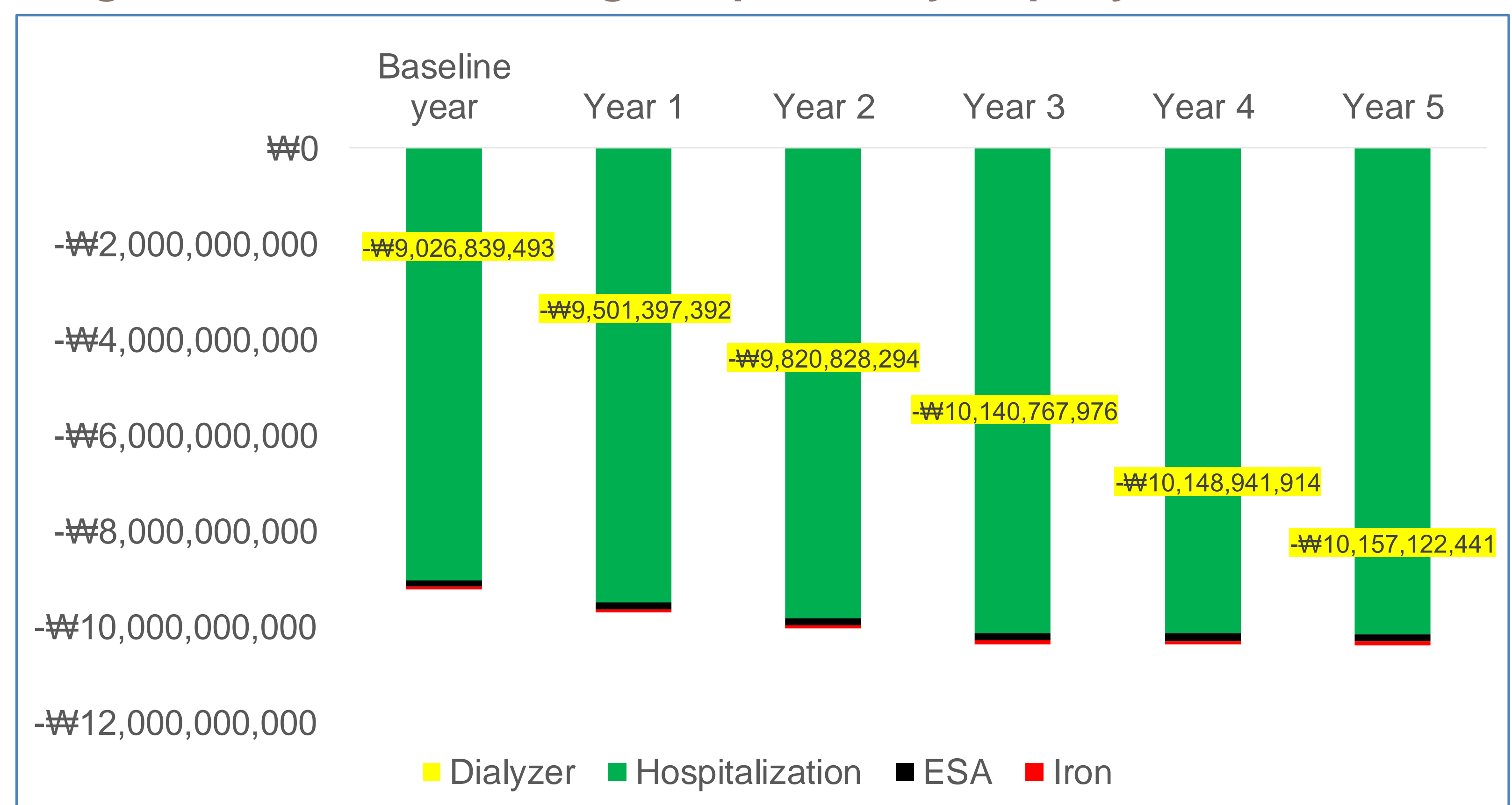


Figure 2. Incremental budget impact analysis per year



Limitation

- External validity is a main limitation since clinical effects were obtained from a single RCT in which clinical endpoints and patient selection favored younger healthier patients.

Conclusions

- Theranova® leads to reduction of hospitalization and medications. Its increased adoption provides economic benefit by reduction of healthcare cost.

References

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