

COST-UTILITY ANALYSIS OF SENSOR AUGMENTED PUMP THERAPY WITH LOW GLUCOSE SUSPEND FUNCTION FOR PATIENTS WITH TYPE 1 DIABETES AND RECURRENT SEVERE HYPOGLYCEMIA IN SPAIN.

BACKGROUND

Sensor-augmented pump therapy with low glucose suspend (SAP-LGS) provides a useful adjunct relative to continuous subcutaneous insulin infusion (CSII) alone, since it allows automatic insulin suspension when blood glucose levels drop to a previously set value. This function has been shown to be especially useful in patients who are prone to hypoglycemia or have poor awareness of the onset of hypoglycemic events and/or those in whom early symptoms are subtle.

OBJECTIVE

To estimate the cost-effectiveness of SAP-LGS versus CSII alone for the treatment of patients with type 1 diabetes (T1D) and recurrent severe hypoglycemia in Spain.

METHODS

- The CORE Diabetes Model was used to project clinical and economic outcomes for the treatment of hypoglycemic-prone T1D patients over a lifetime horizon.
- A Spanish National Health System perspective was considered. The societal perspective was considered in an alternative scenario.
- The population baseline characteristics were based on the study performed by Ly et al¹. The mean age of the cohort was 18.6 years with duration of diabetes of 11 years . The proportion of male was 49.5% and mean HbA_{1c} level was 58 mmol/mol (7.5%).
- After 6 months using SAP-LGS no severe hypoglycemic events were reported versus 2.2 per 100 patients month in the CSII arm¹.
- A 3% annual discount rate was applied to both, costs and outcomes².
- An annual use of 43 sensors, lasting each for 6 days was validated by an expert panel as well as resource consumption.
- Utilities were obtained from various published sources^{3,4,5,6}.
- Unit costs were obtained from different Spanish sources and expressed in € 2016 (Table 1).
- Intervention costs included in the model were calculated based on the incremental costs between the SAP-LGS and CSII arms (including strips use)^{7,8}.

Table 1. Unit costs (€ 2016)

MANAGEMENT (€)			
Statins	436.25 ⁹	Stopping ACEs due to SE´s	54.4 ¹⁰
Aspirin	28.47 ⁹	Eye screening	78.93 ⁹
Angiotensin Converting Enzyme	142.34 ⁹	Foot screening program	14.23 ⁹
Screening for Microalbuminuria	14.17 ⁹	Non-standard ulcer treat	274.2 ¹⁰
Screening for gross proteinuria	14.17 ⁹	Anti-depression treatment	38.34 ¹¹
CARDIOVASCULAR DISEASE COMPLICATIONS (€)			
Myocardial infarction 1 st year	23,536 ⁹	Congestive Heart Failure 2 nd +years	1,054.42 Assumption
Myocardial infarction 2 nd +years	948 ⁹	Stroke 1 st year	6,120.32 ¹⁴
Angina 1 st year	2,517.97 ¹²	Stroke 2 nd +years	2,485.66 ¹⁴
Angina 2 nd +years	532.01 ¹²	Stroke death within 30 days	4,142.09 ⁹
Congestive Heart Failure 1 st year	5,557.66 ¹³	Peripheral vascular disease 1 st year	7,020.12 ¹⁵
RENAL COMPLICATIONS (€)			
Haemodialysis 1 st year	38,242.12 ¹⁶	Annual costs Peritoneal dialysis 2 nd +years	27,788.78 ¹⁶
Haemodialysis 2 nd +years	35,389.64 ¹⁶	Renal transplant costs 1 st year	41,224.79 ¹⁶
Peritoneal dialysis 1 st year	29,374.18 ¹⁶	Annual costs renal transplant 2 nd + years	6,760.51 ¹⁶
ACUTE EVENTS (€)			
Major hypoglycemia	3,628.63 ¹⁵	Edema onset (adv.ev.)	38.34 ¹¹
Ketoacidosis event	4,060.43 ¹⁷	Edema follow up (adv.ev.)	38.34 ¹¹
EYE DISEASE (€)			
Laser treatment	415.54 ¹¹	Blindness - year of onset	2,405.35 ¹⁸
Cataract operation	1,287.35 ¹¹	Blindness - following years	2,405.35 ¹⁸
Following cataract operation			
NEUROPATHY/FOOT ULCER/AMPUTATION (€)			
Neuropathy 1 st year	3,275.1 ¹⁹	Gangrene treatment	9,499.44 ¹⁷
Amputation (event based)	11,392.39 ¹⁷	Infected ulcer	2,440.78 ¹⁹
AmputationProsthesis (event based)	1,927.75 ¹¹	Standard uninfected ulcer	1,394.38 ¹⁹

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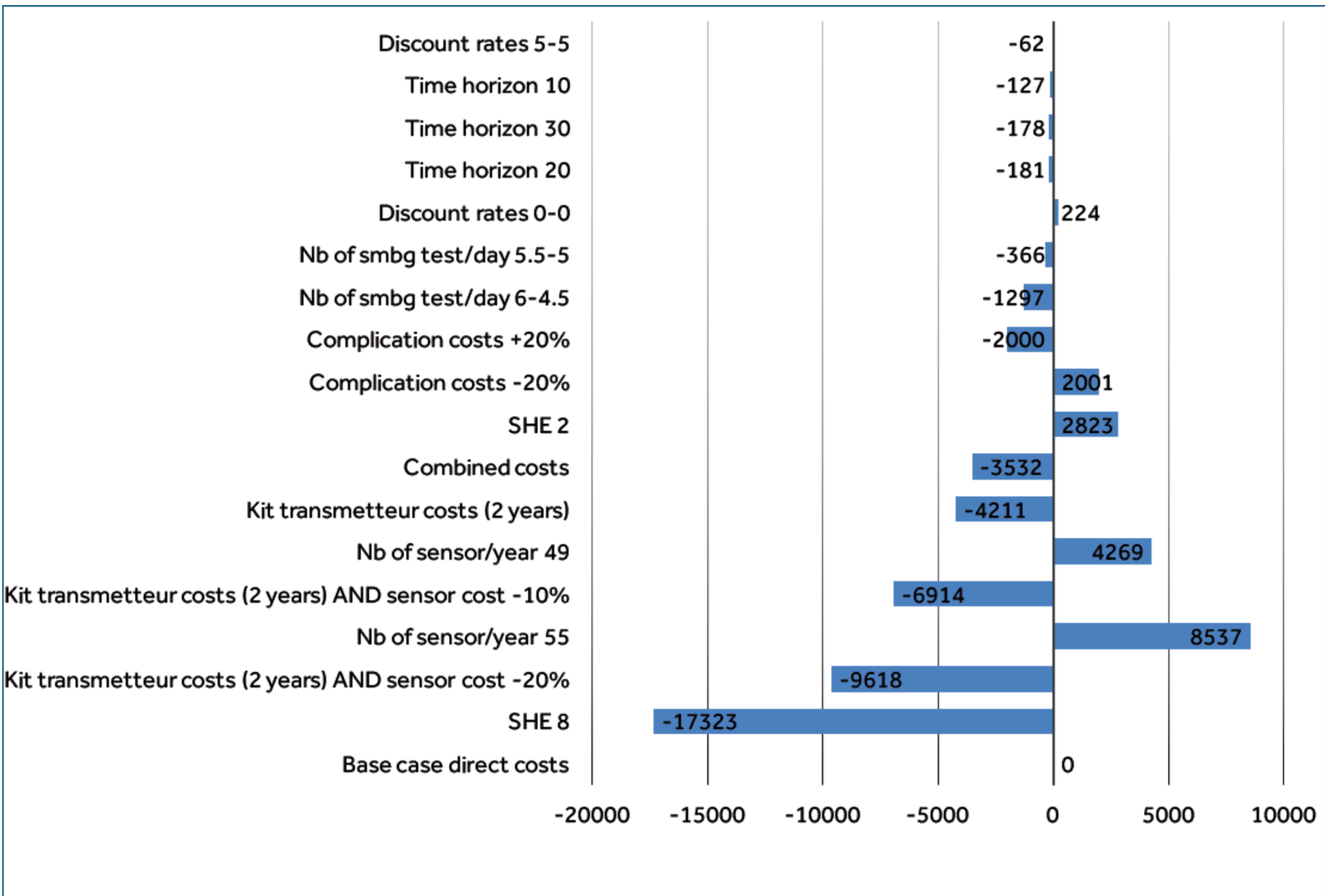
RESULTS

- SAP-LGS was associated with improvements in quality-adjusted life years (QALY) by 1.877 (13.110 versus 11.233).
- SAP-LGS mean total direct costs were €47,664 higher (€112,444 versus €64,780)
- Incremental cost-utility ratio (ICUR) was €25,394/QALY.
- According to the deterministic sensitivity analysis (SA), the model was most sensitive to the frequency of severe hypoglycemic events.
- The probabilistic SA showed 97.5% of the 1,000 Montecarlo simulations performed were below €30,000/QALY²⁰.
- Estimated ICUR when the societal perspective was considered was €21,862/QALY.

Table 2. Base case results

INTERVENTION COST	SAP	CSII	DIFFERENCE
Treatment (€)	74,445	8,002	66,443
Management (€)	8,824	8,745	79
Cardiovascular disease (€)	5,268	5,179	89
Renal complications (€)	6,351	6,177	174
Neuropathy/Foot Ulcer/Amputation (€)	5,145	5,084	61
Eye disease (€)	12,297	12,092	205
Hypoglycaemia (€)	0	17,681	-17,681
Keto/ Lactic Acidosis (€)	0	1,707	-1,707
Anti-Depression Treatment (€)	114	113	1
Total costs (€)	112,44	64,780	47,664
QALY	13.110	11.233	1.877
ICUR (€/QALY)	25,394		

Figure 1. Deterministic sensitivity analysis results



NB: number; SMBG: self-monitoring blood glucose; SHE: severe hypoglycaemia event.

CONCLUSION

From the National Health System and the societal perspective, SAP-LGS represents a cost-effective alternative compared with CSII for the treatment of hypoglycemic-prone T1D patients in Spain when considering a willingness-to-pay threshold of €30,000/QALY.