

COST-UTILITY ANALYSIS OF FLASH GLUCOSE MONITORING SYSTEMS IN PEOPLE WITH TYPE 2 DIABETES MELLITUS AND POOR GLYCAEMIC CONTROL ON BASAL INSULIN FROM THE SPANISH HEALTH SYSTEM PERSPECTIVE

Oyagüez, Itziar ¹; Bellido Castañeda, Virginia ²; Ampudia-Blasco, Francisco Javier ³; Carretero Gómez, Juana ⁴; Cebrián Cuenca, Ana ⁵; Gómez-Peralta, Fernando ⁶; Hernández Martínez, Antonio-Miguel ⁷; Mezquita-Raya, Pedro ⁸

¹Pharmacoeconomics & Outcomes Research Iberia (PORIB), Madrid; ²Servicio de Endocrinología y Nutrición, Hospital Universitario Virgen del Rocío, Sevilla; ³Servicio de Endocrinología y Nutrición, Hospital Clínico Universitario de Valencia, Valencia; ⁴Servicio de Medicina Interna, Hospital Universitario de Badajoz, Badajoz; ⁵Centro de Salud Cartagena Casco, Cartagena, Murcia; ⁶Servicio de Endocrinología y Nutrición, Hospital General de Segovia, Segovia; ⁷Servicio de Endocrinología y Nutrición, Hospital Clínico Universitario Virgen de la Arrixaca, Murcia; ⁸Servicio de Endocrinología y Nutrición, Hospital Universitario Torrecárdenas, Almería

INTRODUCTION

- Enhancing the levels of glycated HbA1c, limiting glycemic variability and avoiding hypoglycemic events are key issues to achieve therapeutic objectives and thus, improving well-being of patients with type 2 diabetes (T2DM)¹.
- Flash glucose monitoring devices, as FreeStyle Libre® Systems (FSL), have proven their efficacy and effectiveness in people with T2D receiving basal insulin², and thus, contributing to accomplish these therapeutic goals.

MATERIALS AND METHODS

- The validated DEDUCE microsimulation model³ was adapted to the Spanish setting to estimate lifetime total direct costs (€, 2024) and health outcomes in terms of quality-adjusted life years (QALYs), in a hypothetical cohort of 10,000 patients with T2DM receiving basal insulin and with poor glycemic control (HbA1c>8%). All model inputs were validated by a multidisciplinary advisory board comprising experts in Endocrinology, Internal Medicine, Primary Care and Health Economics.
- The baseline characteristics of the patients are summarized in Table 1.
- The annual probabilities of suffering the health events considered in patients receiving SMBG, their costs associated, and their health disutility values are presented in Table 2. Both costs and utility/disutility values were sourced from an economic evaluation published by a Spanish health technology assessment agency⁹. Per patient on SMBG, a daily consumption of 2.5 strips (€ 0.55/unit¹⁰, TAX included) and 2.5 lancets (€ 0.14/unit¹⁰, TAX included) was considered according to the Spanish recommendations for patients with T2DM poorly controlled¹¹.

Table 1. Summary of patients' baseline characteristics

Input	Mean (SD)	Input	Mean
Age [years] ⁴	62.9 (12.8)	Active smokers [%] ⁴	27.8 %
Women [%] ⁴	41.0 %	People with CVD [%] ⁷	35.6 %
Level of glycated HbA1c [%] ⁵	9.2 % (1.0%)	Treated with statins [%] ⁴	36.6 %
SBP [mmHg] ⁴	139.9 (28.4)	Treated with antihypertensives [%] ⁴	44.3 %
HDL cholesterol [mg/dL] ⁴	46.8 (9.6)	Treated with anticoagulants [%] ⁶	39.5 %
Total cholesterol [mg/dL] ⁴	201.8 (41.2)	Treated with oral antidiabetics [%] ⁸	84.4 %
Serum creatinine [mg/dL] ⁶	0.86 (0.2)	Baseline health utility value ⁹	0.784
UACR [mg/g] ⁷	99.2 (359.4)		

CVD: Cardiovascular Disease; HDL: High-Density Lipoprotein; SBP: Systolic Blood Pressure; SD: Standard Deviation; UACR: Urinary Albumin-Creatinine Ratio.

OBJECTIVE

To assess the cost-utility of FSL compared to Self-Monitoring Blood Glucose (SMBG) in patients with T2DM and poor glycemic control (HbA1c>8%) receiving basal insulin from the Spanish Health System perspective.

Table 2. Probability and frequency, costs and utility/disutility values associated with the health events

Input	Annual Probability (Number of events per patient-year)	Cost per event [€, 2024]		Disutility (first and subsequent years)
		First year	Subsequent years	
Mild hypoglycemia	100 % (17.02) ¹²	€ 3.81 ^A		- 0.0016 ²⁴
SHE	8,9 % (2.5) ¹²	€ 1,003.59 ^B		- 0.0470 ²⁵
DKA	0.25 % (1.0) ¹³	€ 2,455.18 ^C		- 0.0470 ²⁵
MI	RECODe Motor ¹⁴	€ 30,168.50 ²¹	€ 1,214.44 ²¹	- 0.0550 ⁹
Heart failure	RECODe Motor ¹⁴	€ 6,327.90 ²²	€ 1,481.65 ²²	- 0.1080 ⁹
Stroke	RECODe Motor ¹⁴	€ 7,635.68 ²³	€ 3,101.09 ²³	- 0.1640 ⁹
Blindness	RECODe Motor ¹⁴	€ 2,863.20 ⁹	€ 2,863.20 ⁹	- 0.0740 ⁹
Renal failure	RECODe Motor ¹⁴	€ 3,946.55 ²¹	€ 41,592.79 ²¹	- 0.2040 ⁹
Fingerstick disutility	—	—	—	- 0.0300 ²⁶

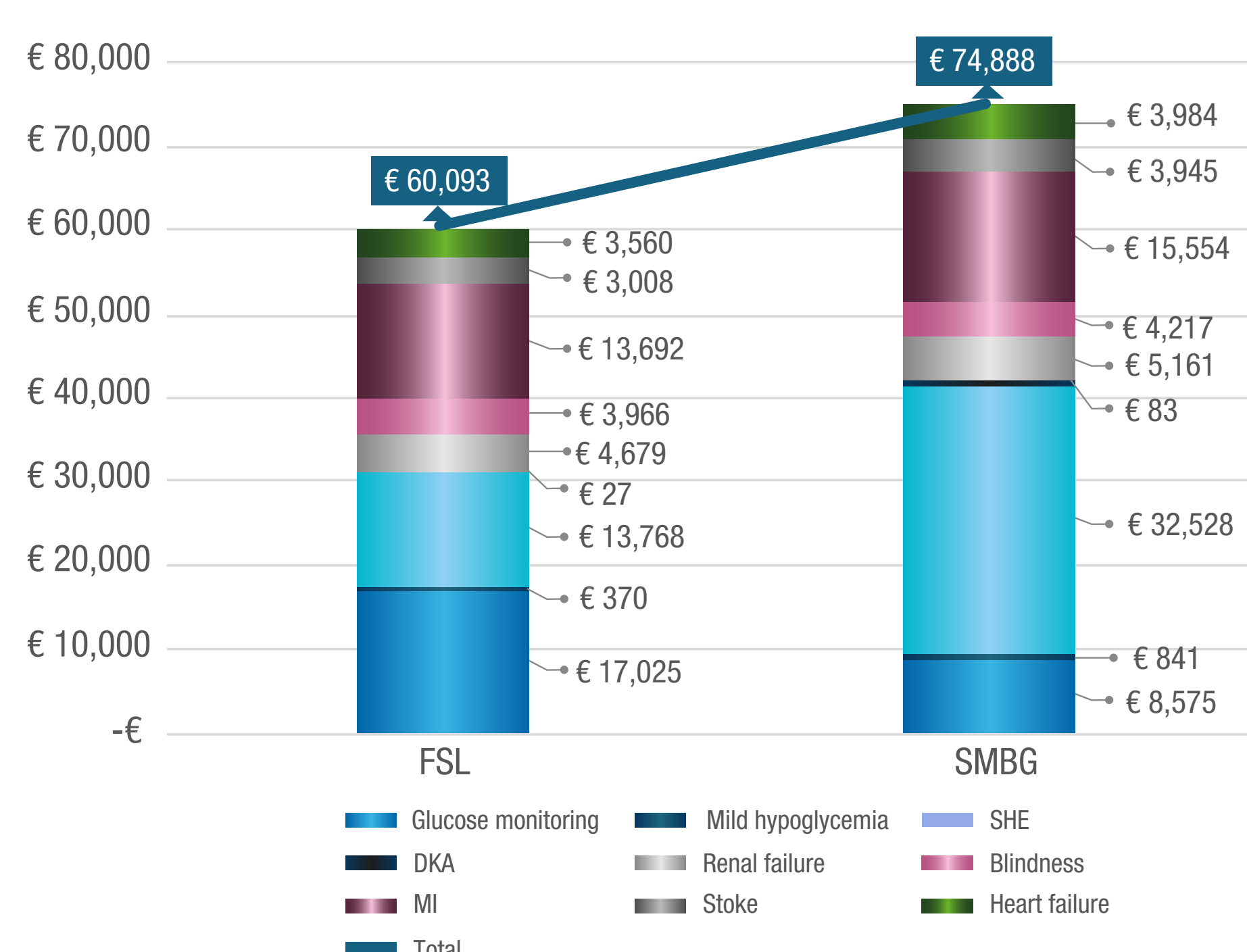
DKA: Diabetic Ketoacidosis; MI: Myocardial Infarct; SHE: Severe Hypoglycemia. ^A Cost estimated as a weighted average of specialist-managed event (21.9%¹⁵; € 17.40 ¹⁹) and patient-managed event (complementary data: 78.10%; € 0.00). ^B Cost estimated as a weighted average of SHE requiring hospital assistance (26.10%¹⁷; hospital assistance with admission [21.7%¹⁷; € 4,389.19 ¹⁹], and without admission [complementary data: 78.3%; € 2,071.09 ¹⁹]) and not requiring hospital assistance (complementary data: 73.9%; € 448.91 ²⁰). ^C Cost estimated as a weighted average of DKA requiring hospital assistance (87.1%¹³; € 2,818.81 ¹⁹) and not requiring hospital assistance (complementary data: 12.9%; € 0.00).

- The effectiveness of FSL was captured by the reduction on HbA1c levels (1.1%)⁵, and the reduction of the frequency of both hypoglycemia (58.0%) and DKA events (68.0%)². A reduction of 83% in the usage of strips and lancets was observed in real-world evidence studies², and thus, was considered for this analysis in the cohort receiving FSL.
- In addition to the mortality for all causes, the probabilities of death associated with both severe hypoglycemic event (SHE) (0,32%)¹⁹ and diabetic ketoacidosis (DKA) (0,40%)¹³ were also considered.
- In addition to the base-case, a probabilistic sensitivity analysis (PSA) was conducted to test the robustness of the model.

RESULTS

- During the lifetime horizon (50 years), the total cost per patient receiving SMBG and FSL were estimated in € 74,888 and € 60,093, respectively (Figure 1).
- In addition to the cost-savings of almost € 14,796 associated to FSL compared to SMBG, the device also yielded 0.80 additional QALYs, resulting in a dominant strategy (Table 3).
- In the PSA, FSL remained dominant compared to SMBG in 100% of the 1,000 iterations (Figure 2).

Figure 1. Disaggregated and total costs per patient estimated by the model during a lifetime horizon



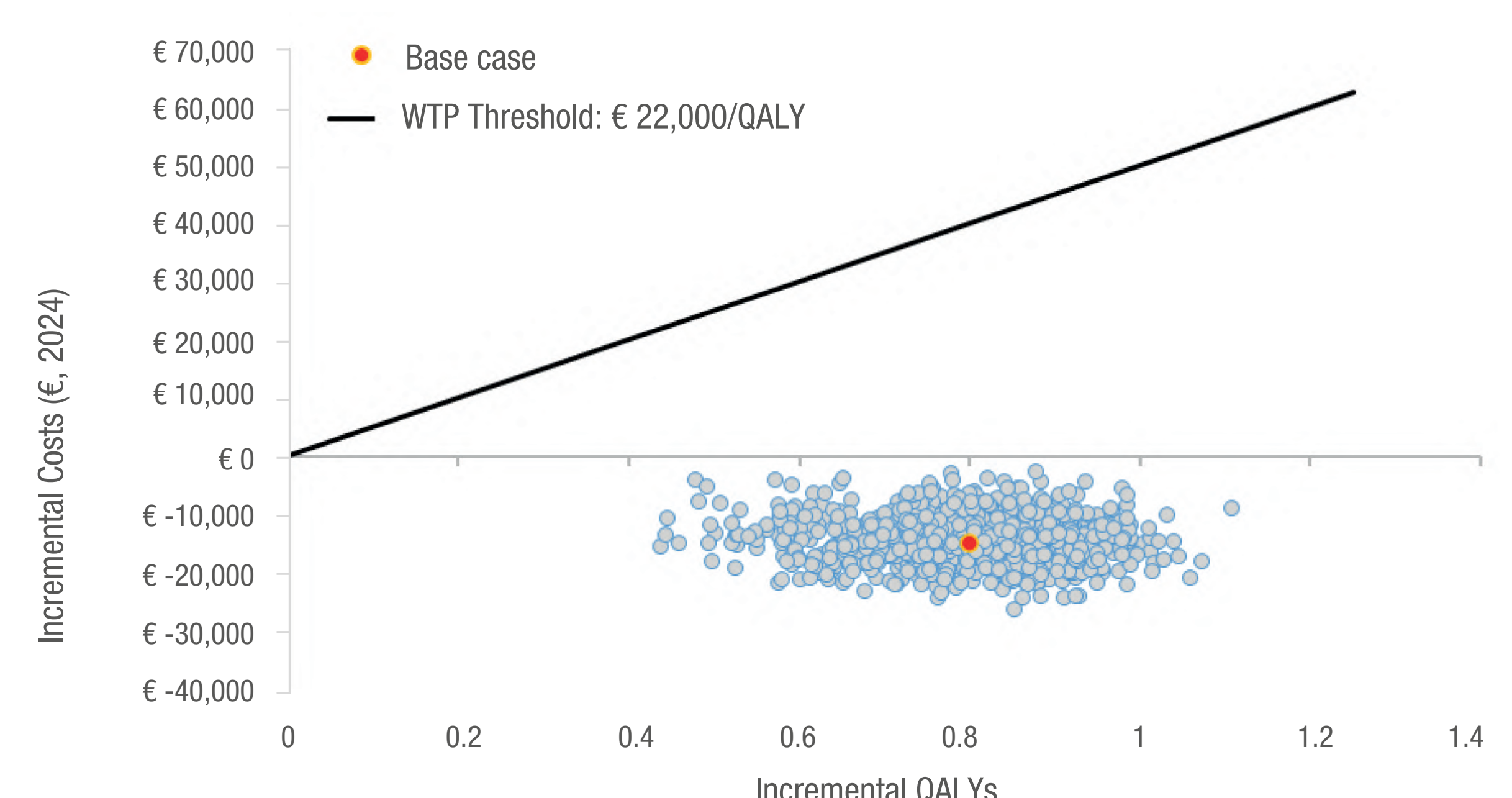
DKA: Diabetic Ketoacidosis; FSL: FreeStyle Libre®; SHE: Severe Hypoglycemic Event; SMBG: Self-Monitoring Blood Glucose.

Table 3. Disaggregated and total costs per patient estimated by the model during a lifetime horizon

	FSL	SMBG	Incremental (FSL vs. SMBG)
LYG	13.85	13.26	+ 0.59
QALY	9.97	9.17	+ 0.80
Total costs	€ 60,093	€ 74,888	- € 14,796
ICER (€/QALY)	FSL Dominant		

ICER: Incremental Cost-Effectiveness Ratio; ICUR: Incremental Cost-Utility Ratio; FSL: FreeStyle Libre®; LYG: Life Years Gained; QALY: Quality-Adjusted Life Year; SMBG: Self-Monitoring Blood Glucose.

Figure 2. PSA results: Scatterplot of the 1,000 Monte Carlo simulations.



QALY: Quality-Adjusted Life Year; WTP: Willingness-To-Pay.

REFERENCES

- Karter AJ, et al. Diabetes Care. 2006;29:1757-63
- Guerci B. Diabetes Technol Ther. 2023;25(1):20-30
- Szafarski K et al. Value Health. 2024;S1098-3015(24)00039-1
- Navarro-Pérez J, et al. BMC Cardiovasc Disord. 2018;18:180
- Carlson AL, et al. BMJ Open Diabetes Res Care. 2022;10:e002590
- D'Alessio D, et al. Diabetes Obes Metab. 2015;17:170-8
- Action to Control Cardiovascular Risk in Diabetes Study Group, et al. N Engl J Med. 2009;358:2545-59
- Mauricio D, et al. Diabetes Obes Metab. 2017;19:1155-64
- Perestelo-Pérez L, et al. Servicio de Evaluación del Servicio Canario de la Salud; 2020
- González Pacheco H. 2021: https://sescs.es/wp-content/uploads/2022/07/SESCS_Informe-final-EM_FLASH_DEF_NIPO.pdf?x55084;
- Menéndez Torre E. Av En Diabetol. 2012;28:3-9
- Mhanti K, et al. Diabetes Obes Metab. 2016;18:907-15
- Barranco RJ, et al. Diabet Med. 2017;34:966-72
- Basu S, et al. Lancet Diabetes Endocrinol. 2017;5:788-98
- Orozco-Beltrán D, et al. Diabetes Ther. 2014;5:155-68
- Parekh W, et al. Diabetes Ther. 2017;8:899-913
- Ampudia-Blasco FJ, et al. Endocrinología, Diabetes y Nutrición. 2021;68:557-66
- Crespo C, et al. Av Diabetol. 2013;29:182-9
- Barranco RJ, et al. Diabet Med. 2015;32:1520-6
- Hammer M, et al. J Med Econ. 2009;12:281-90
- Ray JA, et al. Curr Med Res Opin. 2005;21:1617-29
- Delgado JF, et al. Rev Esp Cardiol. 2014;67:643-50
- Lopez-Bastida J, et al. BMC Health Serv Res. 2012;12:315;
- Bilir SP, et al. Eur Endocrinol. 2018;14:73-9
- Escobar C, et al. BMC Health Serv Res. 2022;22:217
- Matza LS, et al. Value Health. 2017;20:507-11

CONCLUSIONS

FSL is an efficient alternative, which provides cost-savings for the Spanish Healthcare System and improves quality of life for T2DM population on basal insulin and poorly controlled (HbA1c>8%).

Acknowledgement

This study is sponsored by Abbott