Supplementary Information – Online Resource 8

Evaluating cost-utility of continuous glucose monitoring in individuals with type 1 diabetes: a systematic review of methods and quality of studies using decision models and/or empirical data.

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Table 1. Economic evaluation methodology: model-based cost-utility studies.

Publication (author year, country)	Model used (version if available)	Model type	References for model structure (and validation) of the model	Rationale for model choice	Cycle length	Hypoglycemic events modelled?	Definition hypoglycemia
Wan 2018, US [1]	Sheffield diabetes model	Individual patient-level simulation model	Thokala 2014 [2]	Yes	One year	Yes	NSHEs were defined as the detection of a glucose value <3.0 mmol/L (<54 mg/dL) for at least 20 consecutive minutes, considered to be clinically significant biochemical hypoglycemia according to the International Hypoglycemia Study Group recommendations (21).
Bilir 2018, Sweden [3]	CORE diabetes model (v9.0)	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] McEwan 2014 [6]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	Severe hypoglycemic events may require third-party medical assistance (SHE2s) or third-party non-medical assistance (SHE1s). The model also considers non-severe hypoglycemic events (NSHEs). SHEs: < 40 mg/dl
Chaugule 2017, Canada [7]	CORE diabetes model (v9.0)	Individual patient-level Markov model	McEwan 2014 [6]	Yes	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	SHE1: severe hypoglycemic event requiring non-medical assistance SHE2: severe hypoglycemic events requiring medical assistance from a third party
Conget 2018, Spain [8]	CORE diabetes model	Individual patient-level Markov model	McEwan 2014 [6]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR
Gomez 2016 , Colombia [9]	CORE diabetes model (v8.5)	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5]	Yes	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR

Isitt 2022, Australia [10]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] McEwan 2014 [6]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR
Jendle 2017, Sweden [11]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] McEwan 2014 [6]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR
Jendle 2019, Sweden [12]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] McEwan 2014 [6]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR
Jendle 2021, Sweden [13]	CORE diabetes model (v9.0)	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] McEwan 2014 [6]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	Severe hypoglycemic events: requiring the assistance of a third party
Kamble 2012, US [14]	CORE diabetes model (v7.0)	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR
Lambadiari 2022, Greece [15]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] McEwan 2014 [6]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR
Nicolucci 2018, Italy [16]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] McEwan 2014 [6]	Yes	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	SHE was defined as hypoglycemic seizure or coma

Riemsma 2016, UK [17]	CORE diabetes model (v8.5)	Individual patient-level Markov model	McEwan 2014 [6]	Yes	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	Severe hypoglycemia: an episode that required assistance from a third party. glucose < 3.6 mmol/l was also mentioned.
Roze 2015, Sweden [18]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] Roze 2005 [19]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR
Roze 2016, France [20]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] McEwan 2014 [6]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR
Roze 2016, UK [21]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] McEwan 2014 [6]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR
Roze 2017, Denmark [22]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] McEwan 2014 [6]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR
Roze 2019, The Netherlands [23]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR
Roze 2019, Turkey [24]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5]	No.	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR

Roze 2020, UK [25]	CORE diabetes model	Individual patient-level Markov model	None	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	SHEs; defined as an event requiring medical assistance
Roze 2021, Canada [26]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] McEwan 2014 [6]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	SHEs; defined as an event requiring medical assistance
Roze 2021, UK [27]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] McEwan 2014 [6]	Yes	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR
Roze 2021, France [28]	CORE diabetes model (v9.0)	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	A series of ≥2 glucose sensor values <3.0 mmol/l [54 mg/dl] with a duration of at least 20 min.
Serné 2022, The Netherlands [29]	CORE diabetes model	Individual patient-level Markov model	Palmer 2004 [4] Palmer 2004 [5] McEwan 2014 [6]	No	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	NR
Zhao 2021, China [30]	CORE diabetes model (v9.5)	Individual patient-level Markov model	McEwan 2014 [6]	Yes	One year, except foot ulcer (1 month) and hypoglycemia (3 months).	Yes	Hypoglycemia was defined as three levels in CDM: (1) non-severe hypoglycemia event (NSHE); (2) severe hypoglycemia event grade 1 (SHE1), requiring non-medical assistance; and (3) severe hypoglycemia event grade 2 (SHE2), requiring medical assistance.
Garcia-Lorenzo 2018, Spain [31]	Study's own Markov Model Adjusted from McQueen et al. [26]	Cohort-based State Transition Markov Model	McQueen 2011 [32]	No	One year	No (since no effect was found in the	SHE: require the assistance of another person

						meta-analysis)	
Health Quality Ontario 2018, Canada [33]	A transition-state model structure developed by McQueen et al [26]	Cohort-based State Transition Markov Model	McQueen 2011 [32]	Yes	One year	Yes	NR
Huang 2010, US [34]	Study's own Markov Model (Monte-Carlo based)	Cohort-based State Transition Markov Model	DCCT. 1996 [35]	NR	One year	No	NA
McQueen 2011, US [32]**]**	Study's own Markov Model with input from CDC Cost-Effectiveness Group model	Cohort-based State Transition Markov Model	NA	Yes	One year	No	NA
Pease 2020, Australia [36]**]**	Study's own Markov Model	Cohort-based State Transition Markov Model	NA	Yes	One year	Yes	NR
Pease 2022, Australia [37]	Study's own patient-level Markov Model	Individual patient-level Markov model	NA	Yes	One year	Yes	NR
Rotondi 2022, Canada [38]	A Markov cost-effectiveness model adapted from the Ontario Health (OH) [27] report and previous work by Garcia-Lorenzo et al. [31] and McQueen et al. [26].	Cohort-based State Transition Markov Model	Health Quality Ontario 2018 [33] Garcia-Lorenzo 2018 [31] McQueen 2011 [32]	No	One year	Yes	NR

Abbreviations: DCCT, diabetes control and complications trial; NA, not applicable; NR, not reported; SHE, severe hypoglycemic event.

References

1. Wan W, Skandari MR, Minc A, Nathan AG, Winn A, Zarei P, et al. Cost-effectiveness of Continuous Glucose Monitoring for Adults With Type 1 Diabetes Compared With Self-Monitoring of Blood Glucose: The DIAMOND Randomized Trial. Diabetes Care. 2018;41:1227–34.
2. Thokala P, Kruger J, Brennan A, Basarir H, Duenas A, Pandor A, et al. Assessing the cost-effectiveness of type 1 diabetes interventions: the Sheffield type 1 diabetes policy model. Diabet Med. 2014;31:477–86.
3. Bilir SP, Hellmund R, Wehler B, Li H, Munakata J, Lamotte M. Cost-effectiveness Analysis of a Flash Glucose Monitoring System for Patients with Type 1 Diabetes Receiving Intensive Insulin Treatment in Sweden. Eur Endocrinol. 2018;14:73–9.
4. Palmer AJ, Roze S, Valentine WJ, Minshall ME, Foos V, Lurati FM, et al. The CORE Diabetes Model: Projecting long-term clinical outcomes, costs and cost-effectiveness of interventions in diabetes mellitus (types 1 and 2) to support clinical and reimbursement decision-making. Curr Med Res Opin. 2004;20 Suppl 1.
5. Palmer AJ, Roze S, Valentine WJ, Minshall ME, Foos V, Lurati FM, et al. Validation of the CORE Diabetes Model against epidemiological and clinical studies. Curr Med Res Opin. 2004;20 Suppl 1.
6. McEwan P, Foos V, Palmer JL, Lamotte M, Lloyd A, Grant D. Validation of the IMS CORE Diabetes Model. Value Health. 2014;17:714–24.
7. Chaugule S, Graham C. Cost-effectiveness of G5 Mobile continuous glucose monitoring device compared to self-monitoring of blood glucose alone for people with type 1 diabetes from the Canadian societal perspective. J Med Econ. 2017;20:1128–35.
8. Conget I, Martín-Vaquero P, Roze S, Elías I, Pineda C, Álvarez M, et al. Cost-effectiveness analysis of sensor-augmented pump therapy with low glucose-suspend in patients with type 1 diabetes mellitus and high risk of hypoglycemia in Spain. Endocrinol Diabetes Nutr. 2018;65:380–6.
9. Gomez AM, Alfonso-Cristancho R, Orozco JJ, Lynch PM, Prieto D, Saunders R, et al. Clinical and economic benefits of integrated pump/CGM technology therapy in patients with type 1 diabetes in Colombia. Endocrinol Nutr. 2016;63:466–74.
10. Isitt JJ, Roze S, Tilden D, Arora N, Palmer AJ, Jones T, Rentoul D, Lynch P. Long-term cost-effectiveness of Dexcom G6 real-time continuous glucose monitoring system in people with type 1 diabetes in Australia. Diabet Med. 2022 Jul;39(7):e14831.
11. Jendle J, Smith-Palmer J, Delbaere A, de Portu S, Papo N, Valentine W, et al. Cost-Effectiveness Analysis of Sensor-Augmented Insulin Pump Therapy with Automated Insulin Suspension Versus Standard Insulin Pump Therapy in Patients with Type 1 Diabetes in Sweden. Diabetes Ther. 2017;8:1015–30.
12. Jendle J, Pöhlmann J, De Portu S, Smith-Palmer J, Roze S. Cost-Effectiveness Analysis of the MiniMed 670G Hybrid Closed-Loop System Versus Continuous Subcutaneous Insulin Infusion for Treatment of Type 1 Diabetes. Diabetes Technol Ther. 2019;21:110–8.
13. Jendle J, Buompensiere MI, Holm AL, de Portu S, Malkin SJP, Cohen O. The Cost-Effectiveness of an Advanced Hybrid Closed-Loop System in People with Type 1 Diabetes: a Health Economic Analysis in Sweden. Diabetes Ther. 2021;12:2977–91.
14. Kamble S, Schulman KA, Reed SD. Cost-effectiveness of sensor-augmented pump therapy in adults with type 1 diabetes in the United States. Value Health. 2012;15:632–8.
15. Lambadiari V, Ozdemir Saltik AZ, De Portu S, Buompensiere MI, Kountouri A, Korakas E, et al. Cost-Effectiveness Analysis of an Advanced Hybrid Closed-Loop Insulin Delivery System in People with Type 1 Diabetes in Greece. Diabetes Technol Ther. 2022;24:316–23.
16. Nicolucci A, Rossi MC, D'Ostilio D, Delbaere A, de Portu S, Roze S. Cost-effectiveness of sensor-augmented pump therapy in two different patient populations with type 1 diabetes in Italy. Nutr Metab Cardiovasc Dis. 2018;28:707–15.

17. Riemsma R, Ramos IC, Birnie R, Büyükkaramikli N, Armstrong N, Ryder S, et al. Integrated sensor-augmented pump therapy systems [the MiniMed® Paradigm™ Veo system and the Vibe™ and G4® PLATINUM CGM (continuous glucose monitoring) system] for managing blood glucose levels in type 1 diabetes: a systematic review and economic evaluation. Health Technol Assess. 2016;20:1–252.
18. Roze S, Saunders R, Brandt AS, de Portu S, Papo NL, Jendle J. Health-economic analysis of real-time continuous glucose monitoring in people with Type 1 diabetes. Diabet Med. 2015;32:618–26.
19. Roze S, Valentine WJ, Zakrzewska KE, Palmer AJ. Health-economic comparison of continuous subcutaneous insulin infusion with multiple daily injection for the treatment of Type 1 diabetes in the UK. Diabet Med. 2005;22:1239–45.
20. Roze S, Smith-Palmer J, Valentine W, Payet V, De Portu S, Papo N, et al. Cost-Effectiveness of Sensor-Augmented Pump Therapy with Low Glucose Suspend Versus Standard Insulin Pump Therapy in Two Different Patient Populations with Type 1 Diabetes in France. Diabetes Technol Ther. 2016;18:75–84.
21. Roze S, Smith-Palmer J, Valentine WJ, Cook M, Jethwa M, De Portu S, et al. Long-term health economic benefits of sensor-augmented pump therapy vs continuous subcutaneous insulin infusion alone in type 1 diabetes: a U.K. perspective. J Med Econ. 2016;19:236–42.
22. Roze S, de Portu S, Smith-Palmer J, Delbaere A, Valentine W, Ridderstråle M. Cost-effectiveness of sensor-augmented pump therapy versus standard insulin pump therapy in patients with type 1 diabetes in Denmark. Diabetes Res Clin Pract. 2017;128:6–14.
23. Roze S, Smith-Palmer J, De Portu S, Delbaere A, De Brouwer B, De Valk HW. Cost-effectiveness of sensor-augmented insulin pump therapy vs continuous subcutaneous insulin infusion in patients with type 1 diabetes in the Netherlands. Clinicoecon Outcomes Res. 2019;11:73–82.
24. Roze S, Smith-Palmer J, De Portu S, Özdemir Saltik AZ, Akgül T, Deyneli O. Cost-Effectiveness of Sensor-Augmented Insulin Pump Therapy Versus Continuous Insulin Infusion in Patients with Type 1 Diabetes in Turkey. Diabetes Technol Ther. 2019;21:727–35.
25. Roze S, Isitt J, Smith-Palmer J, Javanbakht M, Lynch P. Long-term Cost-Effectiveness of Dexcom G6 Real-time Continuous Glucose Monitoring Versus Self-Monitoring of Blood Glucose in Patients With Type 1 Diabetes in the U.K. Diabetes Care. 2020;43:2411–7.
26. Roze S, Isitt JJ, Smith-Palmer J, Lynch P. Evaluation of the Long-Term Cost-Effectiveness of the Dexcom G6 Continuous Glucose Monitor versus Self-Monitoring of Blood Glucose in People with Type 1 Diabetes in Canada. Clinicoecon Outcomes Res. 2021;13:717–25.
27. Roze S, Buompensiere MI, Ozdemir Z, de Portu S, Cohen O. Cost-effectiveness of a novel hybrid closed-loop system compared with continuous subcutaneous insulin infusion in people with type 1 diabetes in the UK. J Med Econ. 2021;24:883–90.
28. Roze S, Isitt JJ, Smith-Palmer J, Lynch P, Klinkenbijl B, Zammit G, et al. Long-Term Cost-Effectiveness the Dexcom G6 Real-Time Continuous Glucose Monitoring System Compared with Self-Monitoring of Blood Glucose in People with Type 1 Diabetes in France. Diabetes Ther. 2021;12:235–46.
29. Serné EH, Roze S, Buompensiere MI, Valentine WJ, De Portu S, de Valk HW. Cost-Effectiveness of Hybrid Closed Loop Insulin Pumps Versus Multiple Daily Injections Plus Intermittently Scanned Glucose Monitoring in People With Type 1 Diabetes in The Netherlands. Adv Ther. 2022;39:1844–56.
30. Zhao X, Ming J, Qu S, Li HJ, Wu J, Ji L, et al. Cost-Effectiveness of Flash Glucose Monitoring for the Management of Patients with Type 1 and Patients with Type 2 Diabetes in China. Diabetes Ther. 2021;12:3079–92.
31. García-Lorenzo B, Rivero-Santana A, Vallejo-Torres L, Castilla-Rodríguez I, García-Pérez S, García-Pérez L, et al. Cost-effectiveness analysis of real-time continuous monitoring glucose compared to self-monitoring of blood glucose for diabetes mellitus in Spain. J Eval Clin Pract. 2018;24:772–81.
32. McQueen RB, Ellis SL, Campbell JD, Nair K V., Sullivan PW. Cost-effectiveness of continuous glucose monitoring and intensive insulin therapy for type 1 diabetes. Cost Eff Resour Alloc. 2011;9.

33. Health Quality Ontario. Continuous Monitoring of Glucose for Type 1 Diabetes: A Health Technology Assessment. Ont Health Technol Assess Ser. 2018 Feb 21;18(2):1-160.
34. Huang ES, O'Grady M, Basu A, Winn A, John P, Lee J, et al. The cost-effectiveness of continuous glucose monitoring in type 1 diabetes. Diabetes Care. 2010;33:1269–74.
35. The Diabetes Control and Complications Trial Research Group. Lifetime Benefits and Costs of Intensive Therapy as Practiced in the Diabetes Control and Complications Trial. JAMA. 1996;276:1409–15.
36. Pease A, Zomer E, Liew D, Earnest A, Soldatos G, Ademi Z, et al. Cost-Effectiveness Analysis of a Hybrid Closed-Loop System Versus Multiple Daily Injections and Capillary Glucose Testing for Adults with Type 1 Diabetes. Diabetes Technol Ther. 2020;22:812–21.
37. Pease A, Callander E, Zomer E, Abraham MB, Davis EA, Jones TW, et al. The Cost of Control: Cost-effectiveness Analysis of Hybrid Closed-Loop Therapy in Youth. Diabetes Care. 2022;45:1971–80.
38. Rotondi MA, Wong O, Riddell M, Perkins B. Population-Level Impact and Cost-effectiveness of Continuous Glucose Monitoring and Intermittently Scanned Continuous Glucose Monitoring Technologies for Adults With Type 1 Diabetes in Canada: A Modeling Study. Diabetes Care. 2022;45:2012–9.