Use of a cost-tool to support decisions on resource allocation in the type 2 diabetes population using glucose monitoring devices





Clay B^{1*}, Repetto E², Gyldmark M³

¹Roche Diabetes Care, Global Market Access, Indianapolis, USA, ²Roche Diabetes Care, Medical Affairs, Indianapolis, USA, ³Roche Diabetes Care, Basel, Switzerland

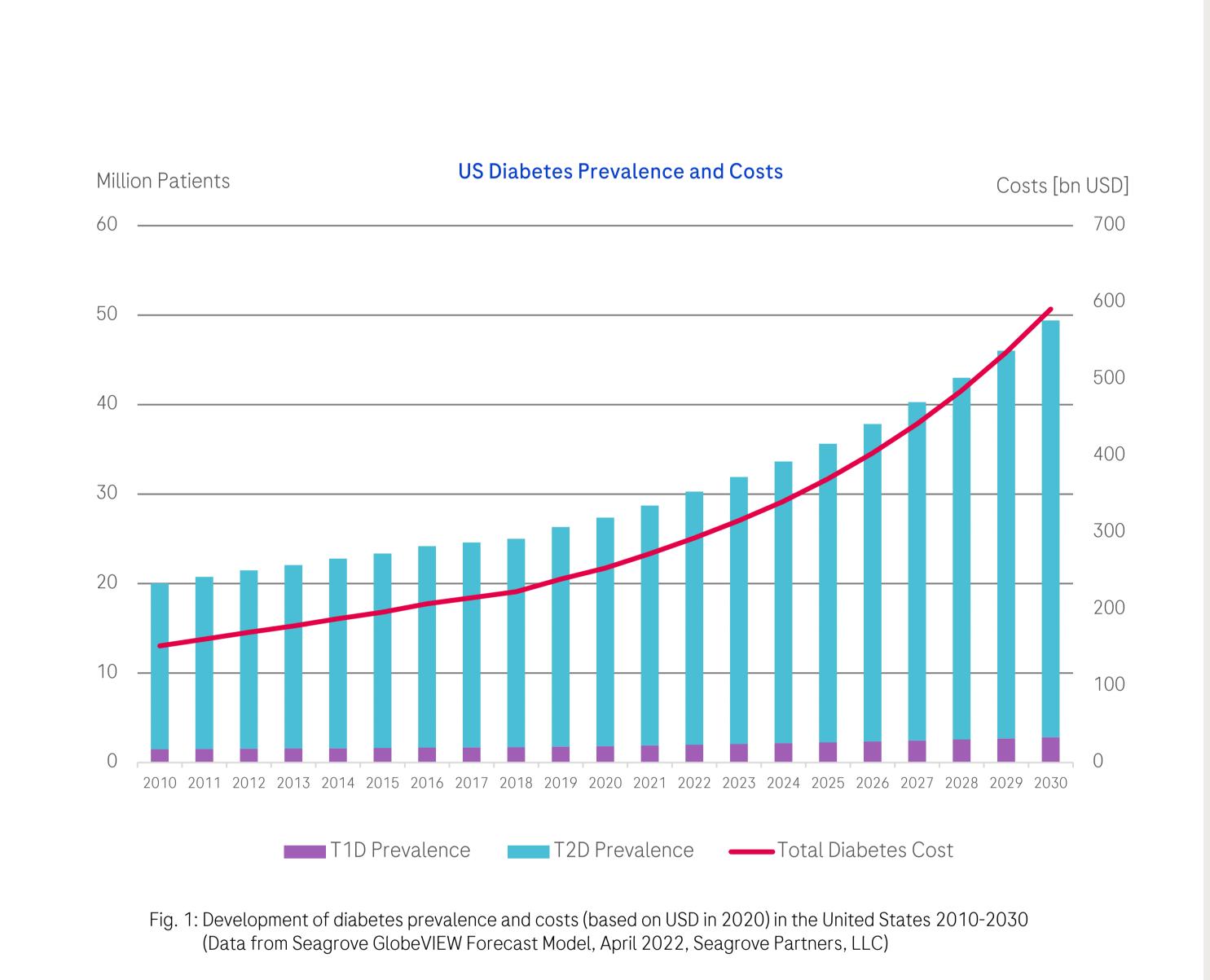
Introduction & Objective

Diabetes is an epidemic and costly disease that poses a significant economic burden to society. As there are restricted financial means to treat diabetes, cost-conscious decisions need to be made. More than 30 million people are currently diagnosed with diabetes in the US, of which over 90 % are persons with type 2 diabetes mellitus (T2DM) [1,2]. Glucose monitoring is an essential component of the management of T2DM [3-5]. More than 70% of the T2DM population consists of non-intensively treated patients that do not use multiple dose insulin therapy (non-MDI) [2,6]. Within the past decade, several studies have demonstrated the clinical benefit of structured self-monitoring of blood glucose (SMBG) in this population [7-11]. Therefore, medical and scientific societies recommend individualized SMBG as a useful tool for the management of these patients [3].

Conversely, for approximately 8% of T2DM patients that use intensive insulin therapy, including multiple doses of insulin (MDI), technologies such as continuous glucose monitoring (CGM) have become an alternative option [6,12,13].

For non-intensively treated people with T2DM use of CGM is not recommended and may just represent additional costs. Due to the high and growing number of people living with diabetes, cost conscious decisions are instrumental to mitigate the burden of disease management (see Fig. 1).

In this research, we want to estimate population and person level costs of two types of devices for glucose monitoring in non-intensively managed T2DM patients in the US.

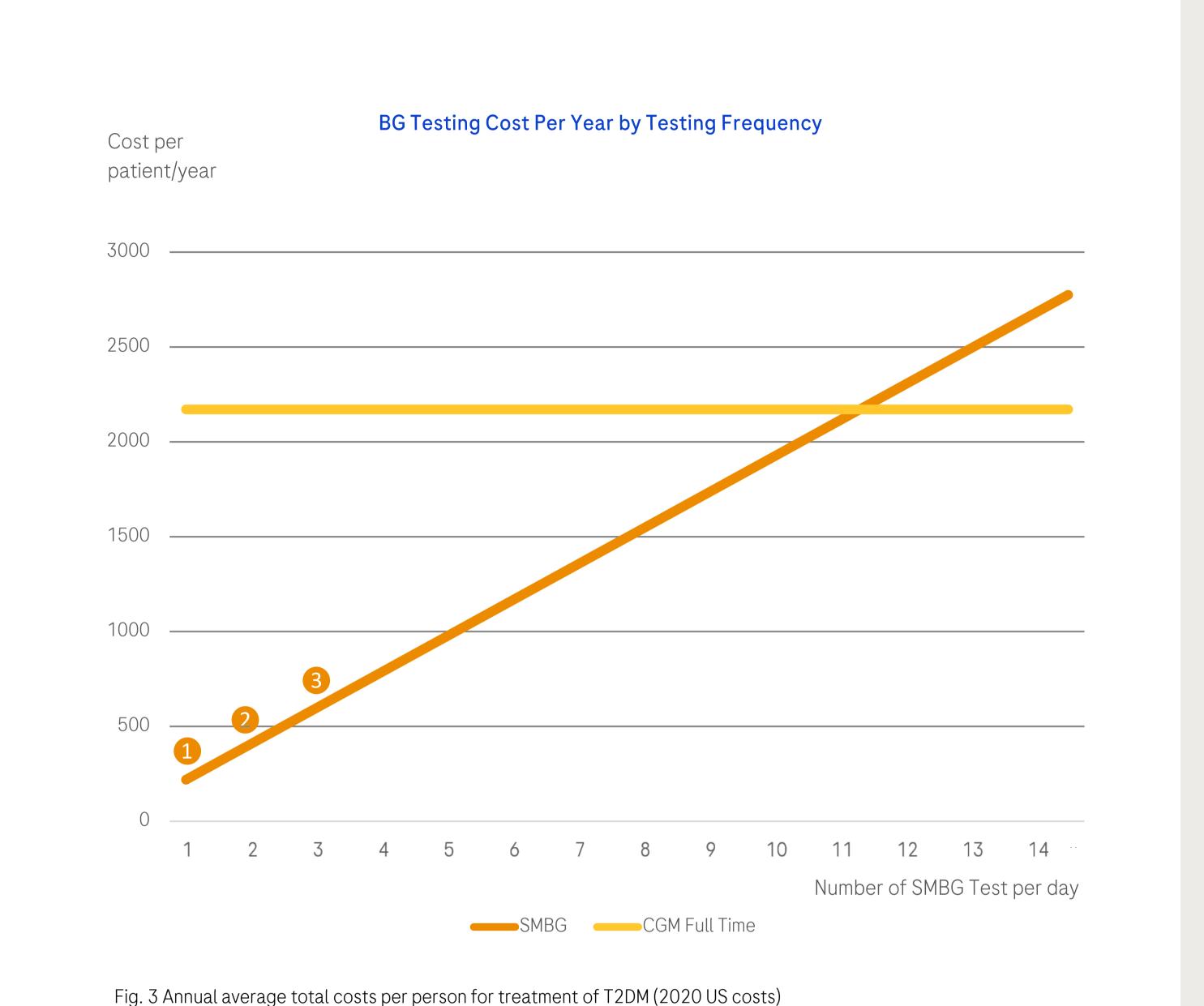


Results

Based on blood glucose testing frequency derived from the analysis of MarketScan data and average wholesale prices, the cost of glucose monitoring devices was estimated to be USD 238 for SMBG users and USD 2,171 for CGM users. This data was used in the cost tool to model hypothetical costs under different assumptions around daily use of test strips. Costs at 1.0, 2.0 and 3.0 SMBG tests per day were as follows: USD 219 ¹, USD 409 ² and USD 598 ³ per person per year. Further analysis using the tool demonstrates that the cost breakeven point occurs at an average of 11 tests per day for the SMBG cohort. It is unlikely that non-intensively treated T2DM patients would use such a high amount of tests per day.

At current cost levels, using SMBG is a less expensive strategy to manage non-intensely treated T2DM. If these costs are examined at a population level, and assume a use of 1 test per person per day, then it could mean for a typical cohort of 1,000 patients that USD 1.9 M USD is saved on an annual basis (see Table 2).

Our approach has some limitations related to the use of claims data to estimate frequency of use of monitoring devices. The observed frequency of use reflects the number of strips that were delivered and may not reflect what was used by the patient. However as this was the case for both cohorts we consider this to have a negligent impact on order to study the relative cost efficiency of using SMBG versus CGM in non-intensively treated persons with T2DM.



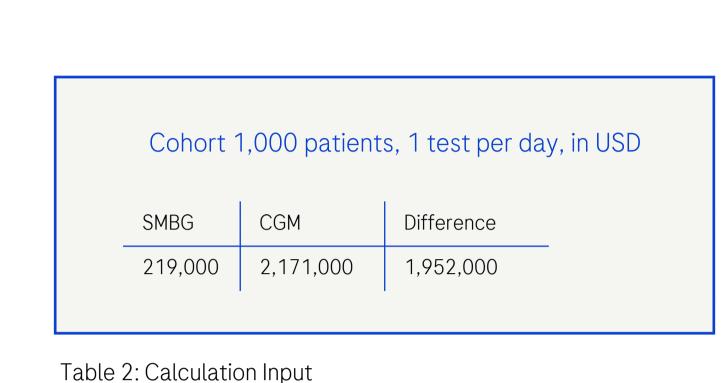


Table 2: Calculation Input

Conclusions

Results of the present analysis indicate that SMBG is associated with lower device costs than using a CGM across a broad range of testing frequencies. Furthermore, there is little clinical evidence to support the use of CGM in non-intensively treated T2DM patients that use oral drugs only or in combination with injectable antidiabetic such as GLP-1 analogs and/or basal insulin. In light of the high costs related to diabetes management, the use of SMBG offers adequate glucose monitoring while having a significant cost-saving advantage compared to CGM in patients with T2DM non-intensively treated.

The present cost-tool on glucose monitoring can help to inform payers and the healthcare system on optimizing device resources allocation in the management of a T2DM population.

References

- 1] Ali SN, Dang-Tan T, Valentine WJ, Hansen BB. Evaluation of the Clinical and Economic Burden of Poor Glycemic Control Associated with Therapeutic Inertia in Patients with Type 2 Diabetes in the United States. Adv Ther. 2020;37(2):869-882. doi:10.1007/s12325-019-01199-8
- [2] Centers for Disease Control and Prevention. National Diabetes Statistics Report, 2020.

 Atlanta, GA: Centers for Disease Control and Prevention, U.S. Dept of Health and Human Services; 2020. https://www.cdc.gov/diabetes/data/statistics-report/diagnosed-diabetes.html Accessed 12 Oct 2021.
- [3] American Diabetes Association. 7. Diabetes Technology: Standards of Medical Care in Diabetes-2021. Diabetes Care. 2021 Jan;44(Suppl 1):S85-S99.
- [4] IDF Global Guideline for Type 2 Diabetes, Chapter 8, 2012
- [5] Davies MJ, D'Alessio DA, Fradkin J, Kernan WN, Mathieu C, Mingrone G, Rossing P, Tsapas A, Wexler DJ, Buse JB. Management of hyperglycaemia in type 2 diabetes, 2018. A consensus report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). Diabetologia. 2018 Dec;61(12):2461-2498. doi: 10.1007/s00125-018-4729-5. Erratum in: Diabetologia. 2019 May;62(5):873. PMID: 3028857
- [6] Roche data on file 2021. Distribution of treatment type in type 2 diabetes patients between 2018 and 2020: Analysis of the Truven Health MarketScan data.
- [7] Polonsky WH, Fisher L, Schikman CH, Hinnen DA, Parkin CG, Jelsovsky Z, Axel-Schweitzer M, Petersen B, Wagner RS. A structured self-monitoring of blood glucose approach in type 2 diabetes encourages more frequent, intensive, and effective physician interventions: results from the STeP study. Diabetes Technol Ther. 2011 Aug;13(8):797-802. doi: 10.1089/dia.2011.0073. Epub 2011 May 13. PMID: 21568751.
- [8] Bosi E, Scavini M, Ceriello A, Cucinotta D, Tiengo A, Marino R, Bonizzoni E, Giorgino F; PRISMA Study Group. Intensive structured self-monitoring of blood glucose and glycemic control in noninsulin-treated type 2 diabetes: the PRISMA randomized trial. Diabetes Care. 2013 Oct;36(10):2887-94. doi: 10.2337/dc13-0092. Epub 2013 Jun 4. PMID: 23735724; PMCID: PMC3781531.
- [9] Chircop J, Sheffield D, Kotera Y. Systematic Review of Self-Monitoring of Blood Glucose in Patients with Type 2 Diabetes. Nurs Res. 2021 Jul 20. doi: 10.1097/NNR.000000000000542. Epub ahead of print. PMID: 34292228.
- [10] Mannucci E, Antenore A, Giorgino F, Scavini M. Effects of Structured Versus Unstructured Self-Monitoring of Blood Glucose on Glucose Control in Patients With Non-insulin-treated Type 2 Diabetes: A Meta-Analysis of Randomized Controlled Trials. J Diabetes Sci Technol. 2018;12(1):183-189.
- [11] Machry RV, Rados DV, Gregorio GR, Rodrigues TC. Self-monitoring blood glucose improves glycemic control in type 2 diabetes without intensive treatment: A systematic review and meta-analysis. Diabetes Res Clin Pract. 2018;142:173-187
- [12] Lin R, Brown F, James S, Jones J, Ekinci E. Continuous glucose monitoring: A review of the evidence in type 1 and 2 diabetes mellitus. Diabet Med. 2021 Jan 26:e14528.
- [13] Haak T, Hanaire H, Ajjan R, Hermanns N, Riveline JP, Rayman G. Flash glucose-sensing technology as a replacement for blood glucose monitoring for the management of insulintreated type 2 diabetes: a multicentre, open-label randomized controlled trial. Diabetes Ther. 2017;8:55-73.
- [14] Klompas M, Eggleston E, McVetta J, Lazarus R, Li L, Platt R. Automated detection and classification of type 1 versus type 2 diabetes using electronic health record data. Diabetes Care. 2013 Apr;36(4):914-21. doi: 10.2337/dc12-0964. Epub 2012 Nov 27. PMID: 23193215; PMCID: PMC3609529.

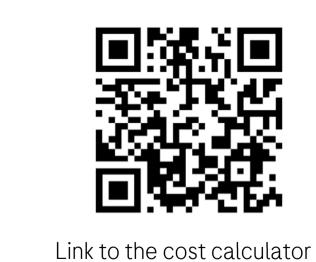
Methods

An observational retrospective analysis was conducted using the IBM® MarketScan® Commercial and Medicare Supplemental databases. The target population consisted of patients with >=1 pharmacy claim for either a self-monitoring blood glucose (SMBG) strip or a continuous glucose monitoring (CGM) sensor between January 1, 2018 and March 31, 2019. The date of the first claim of an SMBG strip or CGM sensor was designated as the index date.

To be included, patients were required to have at least 2 primary or secondary diagnoses of type 2 diabetes (T2D) International Classification of Diseases, Tenth Revision Clinical Modification (ICD-10-CM: E11) or 1 primary or secondary diagnosis of T2D and 1 antidiabetic medication within 12 months. Patients were also required to be at least 18 years of age at the index date, to be continuously enrolled in the health plan for 12 months prior and following the index date and to have no claims for rapid-acting insulin or glucagon medication before and after the index date. Patients with evidence of CGM use during the pre-index period, or pregnancy or gestational or secondary diabetes at any time during the study period were excluded. Patients with claims for both type 1 and type 2 diabetes were reclassified using a modified version of the Klompas algorithm [14].

Patient demographic and clinical characteristics were measured during the pre-index period and included age at index, gender, geographic region, health plan coverage, comorbidities & diabetes complications, the Charlson comorbidity index (CCI), and types of antidiabetic medications. A total of 6,996 eligible patients were included in the matched overall analysis (3,498 patients each in the SMBG and CGM cohort). A propensity score-matched SMBG and CGM cohorts was well balanced (a standardized difference of 10%) with respect to the key characteristics. The mean patient age was 52.8 in both cohorts. Both cohorts had a slightly higher proportion of males 51.8% and 52.2% in the CGM and SMBG cohort respectively.

After using a propensity score matching, 3,498 individuals were identified in each cohort and frequency of testing was estimated and used as default values in a cost simulation. The database analyses identified a median of 1.1 test per day for SMBG and 0.8 blood glucose tests per day for CGM users. These data were used as inputs for a cost tool developed to estimate the relative total costs of managing people with T2DM using SMBG versus CGM given various assumptions regarding daily test strip use. Scenario analyses were performed using median SMBG testing frequency of 1.0, 2.0 and 3.0 tests per day, and prices were based on 2020 average wholesale prices in the US. The result of the model is a comparison of the total SMBG and CGM costs for an average patient or a population over any specified number of years.



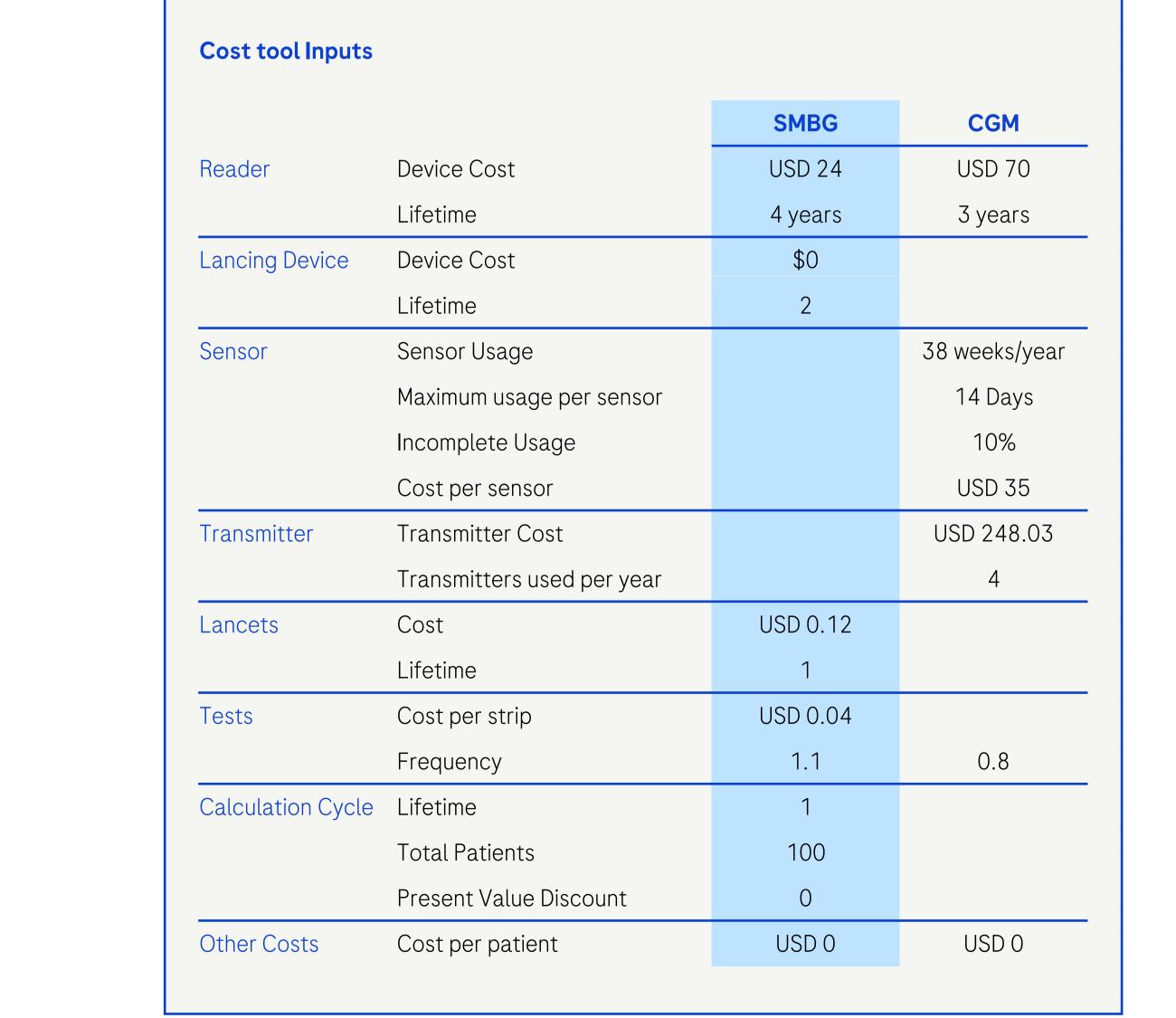


Table 1: Input data for cost tool (2020 prices)

