The Economic Case For CGM

Tom Elliott, MBBS, FRCPC[1,2,3]
Arthur Weissinger, PhD[1]

[1]BCDiabetes
[2]Division of Endocrinology, University of British Columbia
[3]Corresponding Author

Continuous glucose monitors (CGM) have revolutionized the management of diabetes and have become the standard of care for the management of Type 1 in most tertiary care diabetes centres. The direct benefits of using CGM have been extensively documented and include reduced hypoglycemia, improved glycemic control, access to closed-loop pump systems, and improved quality of life (1-16).

The primary factor preventing widespread uptake of CGM is cost. Currently no Canadian province or territory covers CGM, although Quebec has full coverage, and Ontario restricted coverage for the Freestyle Libre®, a flash glucose monitor (FGM) that is less expensive but unlike CGM, requires data to be manually "pulled" from the device and lacks automated high and low glucose alarms. While most third-party insurers offer some coverage for CGM and FGM, more than 70% of BCDiabetes clients are forced to pay for CGM and FGM out of pocket.

In 2020-Mar the Minister of Health of British Columbia, a BCDiabetes client who lives with Type 1 diabetes, invited the author to "outline the economic case for CGM". The result was a spreadsheet (see http://bit.ly/2ZruLBL) that was shared with the Minister and has been kept up-do-date since. A detailed technical overview of CGM and FGM by the author can be found at http://bit.ly/2OYPE2p.

This paper describes and defines the assumptions embedded in that spreadsheet - to establish base costs of the various devices, and their comparator (finger-poke blood sugar testing) and to factor in potential cost-savings accruing from reductions in acute and chronic complications of diabetes.

The reader is referred to Table 1 which addresses the incremental cost savings of CGM and FGM versus conventional self monitoring of blood glucose (SMBG) using test strips, meter and lancets. For the purposes of this discussion FGM (Freestyle Libre®) is assumed to result in half the proportionate offset values assumed for CGM.

For the purpose of cost comparison of CGM vs standard care (SC), it is assumed that each glucose teststrip costs $0.75 and each one-time use lancet costs $0.06 (Freestyle Lite® & Microlet® respectively, Costco pricing 2020-Aug-28). For the purposes of this report it is assumed that under standard care the average individual living with Type 1 diabetes performs SMBG 4 times per day (this assumption matches BC Pharmacare's) for a cost of $3.24/day

Table 1, column B lists the per-day cost of the FGM and CGM systems, as well as the cost of SMBG. The Freestyle Libre®

flash glucometer system costs $6.49 per day (sensor @ $89.00 lasting 14 days, and reader @ $49.99 lasting one year; Costco pricing 2020-Aug-28). The two CGM device systems currently available on the Canadian market, the Dexcom G6®, and the Medtronic Guardian® Connect are priced identically (manufacturers' pricing), with annual subscriptions resulting in a cost of $9.83 per day.

In table 1, column C is shown the cost of the FGM or CGM systems with the additional cost of SMBG testing required daily for troubleshooting &/or calibration. Use of the Freestyle Libre® and Dexcom G6® assumes one SMBG per day, while the Medtronic Guardian® system assumes two SMBG tests per day. Also shown is the cost of Standard Care, including the cost of test strips and lancets.

Fewer episodes of severe hypoglycemia. Column D shows the savings achieved by a reduction in hospitalization for severe hypoglycemia. Based on the work of Charleer et al., a Belgian study which examined the economics of CGM, use of CGM is predicted to result in a reduction of hospitalization for severe hypoglycemia of 0.26 days per patient per year [(3)]. Hospitalization to treat severe hypoglycemia is estimated to cost approximately $4,425.00/day. Reducing the frequency and severity of hypoglycemia is expected to result in savings of approximately $3.15/person/day.

Fewer episodes of diabetic ketoacidosis. Column E similarly shows the savings achieved by a reduction in the frequency of diabetic ketoacidosis (DKA). CGM is predicted to result in a reduction of hospitalization for DKA of 0.096 days per patient per year [(3)]. Reduction of DKA could result in a saving to the system of approximately $1.16 /patient/day.

Reduction in long-term hyperglycemic complications. Column F shows further savings achieved by a reduction in long-term hyperglycemic complications. It has been estimated that with a reduction in A1c of 1.0%, a reduction in microvascular events (nephropathy, retinopathy and neuropathic complications) and macrovascular events (heart disease, stroke and peripheral vascular complications), would be expected to result in average cost savings of approximately US$817 per patient per year (average of $685 and $950, see P. 186 of Wagner et al.) [(17,18)]. Significant cost savings were apparent within one year of achieving a lower A1c level. Assuming 46% inflation since 2001 and US exchange of 0.76, US$817 in 2001 translates into CAD$1566 per patient per year or CAD$4.29 per patient per day on 2020-Aug-26 per 1% reduction in A1c [(19)]. The Diamond study showed an average reduction in A1c at 24 weeks of 0.5% [(7)]. On this basis, predicted cost savings with CGM = $4.29/2 = $2.14 per patient per day.

Reduced work absenteeism. Column G shows the cost offset achieved by a reduction in work absenteeism. Based on Charleer (2018) CGM is predicted to result in a reduction of absenteeism from work of 2.607 days per patient per year [(3)]. At an estimated cost of $192.00/day, this reduction in work absenteeism is estimated to save the system $1.43 per day [(20)].

Costs not estimated. Presenteeism, reduced work productivity while at work due to asymptomatic hypoglycemia, diabetic neuropathy and mood disorders is well recognized [(21)].

While we are unable to estimate the cost per person per day, presenteeism is known to contribute to lost productivity of approximately $26.9 billion per year in the United States [22].

We have not attempted to put a dollar value (savings) on improved quality of life such as reduction in anxiety and fear associated with hypoglycemia in general and overnight hypoglycemia in particular (broken nights' sleep for those living with diabetes and their caregivers) or to the freedom experienced with the use of closed-loop pump systems made possible by CGM. Nor, conversely, have we addressed the potential economic cost of CGM-associated hypervigilance, an increasingly recognized phenomenon [22].

Discussion. The reader is directed to Table 1, column H which shows cost-savings predicted with the economic model discussed which considered published, readily quantifiable economic benefits attributable to CGM. Column I shows net device cost after subtraction of estimated savings (column H) from base price plus SMBG (column C). Column J shows the net savings of FGM and CGM compared to standard care. Compared to standard care (SMBG x4 daily) savings range from $0.43 (Dexcom G6®) to -$0.38 (Medtronic devices) per patient per day, not including potential economic benefits associated with improved quality of life.

The direct economic benefits of CGM are expected to accrue over the course of months to years. The direct quality of life benefits of CGM are experienced immediately.

Conclusions. Considering the published evidence, CGM usage is cost neutral compared to standard care. This conclusion ignores potential CGM-related economic benefits associated with improved quality of life.

A	B	C	D	E	F	G	H	I	J
Brand Name	Price/Day	Price/Day including SMBG	Savings from fewer hypos	Savings from fewer DKAs	Savings from fewer late complications	Savings from reduced absenteeism	Total Savings with Device	Net Device Cost per day	Savings vs Standard Care
Freestyle Libre® + Reader	$6.49	$7.30	$1.57	$0.58	$0.69	$1.07	$3.91	$3.39	-$0.15
Dexcom G6® Annual Subscription	$9.83	$10.64	$3.15	$1.16	$1.37	$2.14	$7.83	$2.81	$0.43
Medtronic Guardian® Annual Subscription	$9.83	$11.45	$3.15	$1.16	$1.37	$2.14	$7.83	$3.62	-$0.38
Standard Care SMBG + lancets	$3.24	$3.24						$3.24	$0.00

TABLE 1: CGM and FGM cost offsets

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