Online Supplement for "Cost-effectiveness of Shared Telemedicine Appointments in Young Adults with T1D: CoYoT1 Trial"

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Supplementary eTable 1. Impact inventory for cost-effectiveness analysis (CEA)[a]

Sector	Type of Impact	Included in this reference case analysis		Notes on sources of evidence
		Health Care Sector	**Societal**	
Formal health care sector				The within-trial CEA used the observed trial data and the cost assumptions provided in eTables 4-5.

The lifetime CEA used the modified Sheffield T1D model (Thokala et al. 2013)[1] and its cost, health-utility, and other input parameters provided in eTables 6-8 |
health	**Health outcomes (effects)**			
	Utility	Yes	Yes	
	HbA1c	Yes	Yes	
	BMI	Yes	Yes	
	# of patients having severe hyper events	Yes	Yes	
	# of patients having severe hypo events	Yes	Yes	
	Medical costs			
	Direct trial personnel costs	Yes	Yes	
	Medical care costs including	Yes	Yes	
	healthcare services	Yes	Yes	
	test strip use	Yes	Yes	
	Insulin	No	No	
	Device Pump costs	Yes	Yes	
	Device CGM costs	Yes	Yes	
Informal health care sector				
health	self-management costs	No	No	
Non-health care sectors				
productivity	costs of unpaid lost productivity due to illness if employed	NA	Yes	
	costs of underperformance due to illness if employed	NA	Yes	
	costs of commute time for a usual care visit	NA	Yes	

[a] The impact inventory table was based on the recommendations of the Second Panel on Cost-Effectiveness in Health and Medicine.[2]

Supplementary eTable 2. Reporting checklist for cost-effectiveness analysis[a]

Element	Journal Article	Technical Appendix
INTRODUCTION		
Background and objectives	Yes	
RESEARCH DESIGN AND METHODS		
Study design	Yes	
Target populations and subgroups	Yes	
Setting and location	Yes	
Study perspective	Yes	
Comparator	Yes	
Time horizon	Yes	
Discount rate	Yes	
Type of analysis	Yes	
Choice of health outcomes	Yes	
Measurement of effectiveness	Yes	
Measurement and valuation of preference-based outcomes	Yes	Yes
Estimating resources and costs	Yes	Yes
Currency, price date, and conversion	Yes	Yes
Choice of model	Yes	
Assumptions		Yes
Analytic methods	Yes	
RESULTS		
Study parameters	Yes	Yes
Incremental costs and outcomes	Yes	Yes
Characterizing uncertainty	Yes	Yes
Characterizing heterogeneity	Yes	Yes
DISCUSSION		
Study findings, limitations, generalizability, and current knowledge	Yes	
OTHER		
Source of funding	Yes	
Conflicts of interest	Yes	

[a] The reporting checklist was based on the recommendations of the Consolidated Health Economic Reporting Standards (CHEERS) statement. [3]

Supplementary eTable 3. Within-trial cost assumptions

Within Trial Cost Assumptions		
Item	**Unit Cost (2015 USD) [a]**	**Source**
Direct Personnel Costs: *Time of investigators/coordinators devoted to patients*		
Primary care provider	$94.43/hour	Bureau of Labor Statistics 2016[4]
Advanced nurse practitioner	$47.21/hour	Bureau of Labor Statistics 2016
Registered nurse	$32.45/hour	Bureau of Labor Statistics 2016
Diabetes educator	$37.35/hour	Bureau of Labor Statistics 2016
Other provider	$35.92/hour	Bureau of Labor Statistics 2016
Direct Medical Care Costs		
Average daily insulin use over 6 months	$0.15/unit of insulin	Redbook 2016
Average daily fingerstick use over 6 months	$0.06/lancet $1.02/test strip	Redbook 2016
Event Complication Costs		
Outpatient diabetes care: primary care provider	$94.43/event	Bureau of Labor Statistics 2016
After-hours urgent care clinic visit	$180.23/event	Mehrotra et al 2005[5]
911 call	$0.86 surcharge/month	National Association of Emergency Numbers[6]
Outpatient care: emergency department	$476.06/event	Taubman et al 2014[7]
Ambulance use	$506.36/event	U.S. GAO Report to Congressional Committes, 2012[8]
Hospitalization (all causes)	$10,443.06/event	Healthcare Costs and Utilization Project [9]
Hospitalization due to hypoglycemic episode	$16,806.70/event	Ward et al 2014[10]
Hospitalization due to hyperglycemic episode	$15,657.00/event	St Charles et al 2009[11]
Hospitalization for other diabetic event	$10,107.70/event	Healthcare Costs and Utilization Project
Indirect Costs		
Days of work missed due to diabetes--patient	Age and sex specific median hourly wage	Bureau of Labor Statistics 2016
Days of underperformance at work with productivity <50%	Age and sex specific median hourly wage	Bureau of Labor Statistics 2016
Commute time for a clinic visit	Age and sex specific median hourly wage	Bureau of Labor Statistics 2016

[a] The annual inflation rate for a given year is the percent change from the previous year. Inflation rates were obtained from the Personal Consumption Expenditures: Chain-type Price Index (PCEPI), downloaded through the link: https://fred.stlouisfed.org/series/PCEPI. As an example, to convert a price expressed in 2010 dollars to 2015 dollars, one would use the following equation ((PCEPI(2015)/PCEPI(2010) x Price (2010)= Price (2015)).

Supplementary eTable 4. Itemized continuous subcutaneous insulin infusion (CSII) annual cost assumptions in 2015 USD

Component	Warranty/duration	unit cost[a]	Annual total costs
Insulin pump	4 years	$7,736.39	$1,934.10
pump infusion set	2-3 days	$13.73	$2,003.93
Pump cartridge/syringe	2-3 days	$4.681	$683.46
Total			$4,621.49[b]

[a] The unit costs of CSII components were obtained in the recently published cost-effectiveness study based on the Diabetes Control and Complications Trial (DCCT)[12], which was based on the products manufactured by Medtronic and Animas.

[b] The daily price of $12.66 was calculated by the total annual price divided by 365.

Supplementary eTable 5. Itemized blood glucose monitoring annual cost assumptions[e] used in 2015 USD.

Component	Warranty/duration	unit cost[a]	Annual total costs
CGM sensor	7 days	$77.98	$4,066.00
CGM receiver	1 year	$476.63	$476.63
CGM transmitter	6 months	$502.48	$1,004.96
Total			$5,547.59[b]

[a] The prices of CGM components were the estimated average allowable prices in the U.S. marketplace and were provided by the Dexcom Pricing Department.

[b] The daily price of $15.20 was calculated by the total annual price divided by 365.

Supplementary eTable 6. Baseline characteristics of the study populations

	Intervention (n=42)	Control (n=39)	P-value
Demographic characteristics			
Gender - Female (%)	19 (45)	19 (49)	0.83
Race (%)			0.44
White	35 (83)	35 (90)	
Black	1 (2)	2 (5)	
Other	6 (14)	2 (5)	
Age			0.10
mean ± SD	19.8 ± 1.7	20.5 ± 1.9	
range	18 - 24	18 - 25	
Insurance (%)			0.90
Private	36 (86)	33 (85)	
Public (Medicaid)	4 (10)	5 (13)	
Military (Tricare)	2 (5)	1 (3)	
Healthcare utilization at baseline for last 3 months			
# of clinic visits in last one year			0.28
mean ± SD	2.6 ± 1.1	2.3 ± 1.0	
range	1 - 5	1 - 5	
Daily strip test			0.69
mean ± SD	3.0 ± 2.1	3.5 ± 2.7	
range	0.2 - 9	0.3 - 11	
Pump use - Yes (%)	19 (45)	20 (51)	0.66
CGM use - Yes (%)	4 (10)	11 (30)	**0.04**
Clinical characteristics at baseline			
HbA1c			0.62
mean ± SD	8.7 ± 1.7	8.7 ± 1.8	
range	6.5 - 13.4	6.7 - 13.1	
BMI			0.59
mean ± SD	25.2 ± 5.4	25.2 ± 3.7	
range	17.9 - 42.3	19.4 - 33.6	
SBP			0.72
mean ± SD	114.1 ± 9.7	114.7 ± 11.3	
range	84 - 130	96 - 148	
DBP			0.43
mean ± SD	73.1 ± 7.5	75.7 ± 7.6	
range	50 - 89	65 - 97	
# of patients having severe hypoglycemia in last 3 months			
n (%)	0	1 (3)	1.00
# of patients having severe hyperglycemia in last 3 months			
n (%)	0	1 (3)	1.00
T1D Duration (year)			**<0.01**
mean ± SD	8.2 ± 4.7	11.7 ± 5.5	
range	0.2 - 17.1	1.0 - 21.1	
Smoke - Yes (%)	3 (7)	0 (0)	0.24
Albuminutia - Yes (%)	3 (7)	0 (0)	0.24
Quality of life at baseline			
Utility			0.99
mean ± SD	0.91 ± 0.11	0.90 ± 0.12	
range	0.63 - 1.0	0.58 - 1.0	
Diabetes distress			0.87
mean ± SD	1.97 ± 0.88	1.86 ± 0.69	
range	1.00 - 4.47	1.12 - 3.82	

Supplementary eTable 7. Comparison of within-trial mean costs by the bootstrap method. The significant differences in bold.

	Mean DID (intervention - control)		95% CI of DID	
	by original dataset	by bootstrap	Lower	Upper
Per-Patient Costs ($)				
Total direct costs	-2955	-2969	-15195	3357
Trial-treatment medical care	128	130	**91**	**170**
Other medical care	-3855	-3854	-10276	348
Strip test use	108	110	-93	355
Pump use	1140	1138	**554**	**1819**
CGM use	911	908	**310**	**1633**
Total indirect costs	-365	-366	-1304	-54
Missed work	-159	-159	-464	49
Poor performance	-214	-214	-918	16
Total commute time for in-person visits	3	3	-4	11
Total costs	-3010	-2965	-12199	2777

Supplementary eTable 8. Adjusted baseline costs for prior 9 months[a] in 2015 USD

	Intervention (n=42)		Control (n=39)		P-value
Per-Patient Costs ($)	**mean (SD)**	**median (IQR)**	**mean (SD)**	**median (IQR)**	
Total direct costs	3,502 (5036)	1892 (860, 4345)	4,222 (3528)	3956 (944, 5469)	0.13
Trial staff for intervention/control	152 (65)	175 (117, 175)	136 (60)	117 (58, 175)	0.28
Other medical care	1029 (5189)	0 (0, 399)	583 (2054)	0 (0, 373)	0.99
Strip test use	821 (567)	735 (435, 1034)	959 (735)	708 (435, 1293)	0.69
Pump use	1,443 (1607)	0 (0, 3190)	1724 (1612)	0 (0, 3190)	0.44
CGM use	365 (1138)	0 (0, 0)	1,139 (1775)	0 (0, 3830)	**0.02**
Total indirect costs	2276 (428)	55 (28, 417)	315 (532)	45 (15, 309)	0.75
missed work	111 (266)	0 (0, 0)	134 (276)	0 (0, 242)	0.49
poor performance	134 (342)	0 (0, 121)	149 (371)	0 (0, 0)	0.64
commute time for an in-person visit	31 (20)	25 (15, 45)	33 (30)	23 (11, 45)	0.53
Total costs	3,705 (5000)	2851 (875, 4729)	4,504 (3606)	4190 (944, 6163)	0.11

[a] The adjustment was by multiplying the costs data for 3 months with three to make the baseline costs for 9 months.

Supplementary eTable 9. Within-trial results in healthcare utilization

Outcomes in utilization	Intervention (N=42)			Control (N=39)			p-value[a]
	Mean	SD	Median (range)	Mean	SD	Median (range)	
Diabetes self-care costs during the trial							
mean N of daily strip tests over visits	3.8	3.52	2.5 (0.1, 16.9)	3.58	1.94	3 (0.4, 7.2)	0.38
CGM use at 9 months - Yes (%)	14 (47)			4 (36)			0.73
Pump use at 9 months - Yes (%)	11 (37)			3 (30)			**1.00**
Clinical trial staff for intervention/control during the trial							
N of Clinical visits	3.38	1.1	4 (1, 4)	0.53	0.61	0 (0, 2)	**<0.01**
Healthcare utilization due to T1D during the trial							
911 calls	0.14	0.78	0 (0, 5)	0.23	1.08	0 (0, 6)	0.54
ER visits	0.09	0.52	0 (0, 3)	0.14	0.59	0 (0, 3)	0.55
Urgent care visits	0.00	0.00	0 (0, 0)	0.00	0.00	0 (0, 0)	1.00
Hospitalizations	0.00	0.00	0 (0, 0)	0.23	1.08	0 (0, 6)	0.15
Non-study outpatient visits	1.27	2.38	0 (0, 9)	3.00	3.12	3 (0, 11)	**0.01**
Patients work costs if they were employed during the trial							
N of missed workdays	1.32	3.20	0 (0, 15)	3.05	7.97	0 (0, 42)	0.56
N of workdays with < 50% productivity	1.95	4.49	0 (0, 24)	8.58	31.69	0 (0, 180)	0.29
Commute hours for in-person clinic visit	1.13	1.00	1.00 (0, 4)	0.99	1.40	0.15 (0, 6.67)	0.16

[a] Wilcoxon rank-sum test was used to compare the two groups.

Supplementary eTable 10. Comparison of within-trial key outcomes through imputed datasets

Outcomes	Mean DID (Intervention - control)	95% CI of DID	
		lower	upper
QALYs	0.016	-0.007	0.038
Utility[a]	0.038	-0.017	0.093
Total direct costs	-1554	-6531	3424
Trial-treatment medical care	130	**94**	**166**
Other medical care	-3256	-8283	1771
Strip test use	172	-175	520
Pump use	737	-141	1615
CGM use	658	-150	1465
Total indirect costs	-305	-1242	631
missed work	-116	-420	187
poor performance	-190	-980	600
commute time for in-person visits	3	-7	12
Total costs	-1866	-6893	3161

a The p-value for the treatment effect by LMM using the imputed datasets was 0.0575.

Supplementary eTable 11. Clinical input parameters for the long-term cost-effectiveness model

Cohort baseline characteristics	Mean (SD)
Gender-female (%)	47%
Race-white (%)	86%
Smokes (%)	4%
Age	20.16 (1.83)
T1D duration (year)	9.86 (5.34)
HbA1c	8.70 (1.71)
Systolic blood pressure	114.92 (9.04)
High-density lipoprotein	57.08 (19.22)
Total cholesterol	170.02 (47.63)

Supplementary eTable 12. Cost assumptions of the long-term cost-effectiveness analysis

Definition	Base-Case Value (2015 USD)	References
Blood glucose monitoring[a] related costs		
Daily blood glucose monitoring (CGM)		See Table 3
Daily blood glucose monitoring (control)		See Table 3
Kidney related costs		
Microalbuminuria	21.75	St Charles et al, 2009
Macroalbuminuria	32.01	St Charles et al, 2009
End-stage renal disease	109,315.22	Beckwith et al, 2012[13]
Neuropathy related costs		
Neuropathy	1,443.79	Beckwith et al, 2012
Amputation, year of event	55,688.88	Beckwith et al, 2012
Amputation, year 2+ after event	1,959.42	Beckwith et al, 2012
Eye related costs		
Background diabetes retinopathy	9,551.63	Li et al, 2013[14]
Proliferative diabetes retinopathy	13,802.06	Li et al, 2013
Macular edema	8,640.82	Li et al, 2013
Blindness	4,716.18	St Charles et al, 2009
Cataract	3,275.50	Palmer et al, 2004[15]
Cardiovascular complication costs		
Myocardial infarction, year of event	43,711.23	St Charles et al, 2009
Myocardial infarction, year 2+ after event	2,416.25	St Charles et al, 2009
Fatal Myocardial infarction	3,329.18	Clarke et al, 2003 (UKPDS 65)[16]
Stroke, year of event	57,885.35	St Charles et al, 2009
Stroke, year 2+ after event	19,318.56	St. Charles et al, 2009
Fatal stroke	9,007.58	UKPDS 65
Heart failure, year of event	17,693.98	McQueen et al, 2011[17]
Heart failure, year 2+ after event	1,858.42	McQueen et al, 2011
Fatal heart failure	13,349.89	UKPDS 65
Angina, year of event	8,671.93	St Charles et al, 2009
Angina, year 2+ after event	3,754.94	St Charles et al, 2009
Glycemic control relate costs		
Severe hypoglycemia	1,391.14	St Charles et al, 2009
Non-severe hypoglycemia	20.32	Foos et al, 2015[18]
Hyperglycemia	15,657.10	St Charles et al, 2009

[a] Blood glucose monitoring costs include costs of test strips and CGM sensor, transmitter, and receiver initial purchase and replacements. The cost of insulin was excluded since CGM did not modify insulin intake.

Supplementary eTable 13. Health-utility assumptions of the long-term cost-effectiveness analysis

Event/state	Utility/disutility [a,b]	References
Diabetes no complication (CGM, control)	0.916	Trial data
Kidney related events/states		
End-stage renal disease	0.552	Joyce et al, 2011[19]
Neuropathy related events/states		
Neuropathy	0.703	Begg et al, 2007[20]
Amputation, year of event[2]	-0.109	Palmer et al, 2004
Amputation, year 2+ after event	0.766	Clarke et al, 2002[21]
Eye related costs		
Proliferative diabetes retinopathy	0.894	Begg et al, 2007
Macular edema	0.89	Begg et al, 2007
Blindness	0.826	Clarke et al, 2002
Cardiovascular complication events/states		
Myocardial infarction, year of event	-0.129	Clarke et al, 2002
Myocardial infarction, year 2+ after event	0.82	Clarke et al, 2002
Stroke, year of event	-0.181	Clarke et al, 2002
Stroke, year 2+ after event	0.614	Clarke et al, 2002
Heart failure, year of event	-0.129	Clarke et al, 2002
Heart failure, year 2+ after event	0.829	Clarke et al, 2002
Angina	0.768	Clarke et al, 2002
Glycemic control related events		
Severe hypoglycemia event	-0.0052	N.I.C.E., 2002[22]
Non-severe hypoglycemia event[c]	-0.00045	N.I.C.E., 2002 and Harris et al, 2014[23]
Hyperglycemia event	-0.001	Walters, 2006[24]

[a] Negative values indicate *per episode disutilities* of events, and positive values indicate *annual utilities of health-states*. For events that may happen more than once per year (e.g., glycemic control related events), the disutilites were multiplied by the event count.

[b] Literature based utilities were adjusted to reflect health-utilities observed in the trial.

[c] Harris et al, 2014[23] report disutilities of -.0056 and -0.003 for day-time and nocturnal non-severe hypoglycemia, and -0.0592 and -.0277 for day-time and nocturnal severe hypoglycemia, respectively. We calculated the disutility of an episode of non-severe hypoglycemia by multiplying the severe hypoglycemia disutility in N.I.C.E., 2002[22] by the ratio of severe and non-severe hypoglycemia disutilities reported in Harris et al, 2014[23] (approximately 10%).

Supplementary eTable 14. Lifetime cost-effectiveness analysis results

	Intervention	Control
BASE-CASE CEA		
Life-time probability of		
Background diabetic retinopathy	38%	
Proliferative diabetic retinopathy	31%	
Macular edema	17%	
Blindness	2%	
Macroalbuminuria	66%	
End stage renal disease	61%	
Neuropathy	44%	
Amputation	14%	
Myocardial infarction	30%	
Stroke	5%	
Angina	15%	
Heart failure	8%	
Expected life years (mean and [95% CI])	40.66 [40.55 - 40.76]	
Difference in expected life years	-	
Discounted QALYs (means)	16.99	17.94
Difference in QALYs (mean and [95% CI])	0.95 [.91 - .99]	
Discounted total costs (means)	361,513 [358,969 - 363,834]	
Difference in costs (mean)	-	
SENSITIVITY CEA: duration of intervention effectiveness (year):		
1 year: Diff in QALYs (mean and [95% CI])	0.10 [0.02, 0.21]	
5 years: Diff in QALYs (mean and [95% CI])	0.24 [0.20, 0.28]	
10 years: Diff in QALYs (mean and [95% CI])	0.43 [0.39, 0.47]	
SUBGROUP CEAs		
Subgroup with high baseline HbA1c		
Difference in QALYs (mean and [95% CI])	1.19 [1.15, 1.23]	
Subgroup with low baseline HbA1c		
Difference in QALYs (mean and [95% CI])	-	

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