

Efficiency of telemedicine for optimal metabolic control on T1D patients. The Telemed-Study

O. Solà-Morales^{1,2}, M. Jansà³, D. Roca³, N. Pérez Ferre⁴, S. Martínez⁵, M.S. Ruiz de Adana⁶, F. Vázquez⁷ and E. Esmatjes³
on behalf of **Telemed Diabetes Group (Ciber-Dem)**

¹Health Institute Technology Transfer; ²IISPV- Institut Investigació Sanitaria Pere Virgili (Reus), ³Hospital Clinic i Universitari (Barcelona), ⁴Hospital Universitario San Carlos (Madrid); ⁵Hospital Clínico Universitario (Valencia); ⁶Hospital Universitario Carlos Haya (Málaga); ⁷Hospital de Cruces (Barakaldo)

XXXIII Jornadas AES, Santander 20 June 2013



- Diabetes is the next epidemic, related to many facts conditioned by both the individual and the environment.
- Uncontrolled T1D may be considered high risk patients, and therefore they are followed on a monthly basis to avoid long term complications
 - ... leading to high demands on the patient side
 - ... and also to a significant effort by healthcare professionals
- The application of otherwise common technologies was a logic ambition, but it had to be tested
 - Telemedicine has traditionally been poorly evaluated
 - Very few implementation case studies

the problem



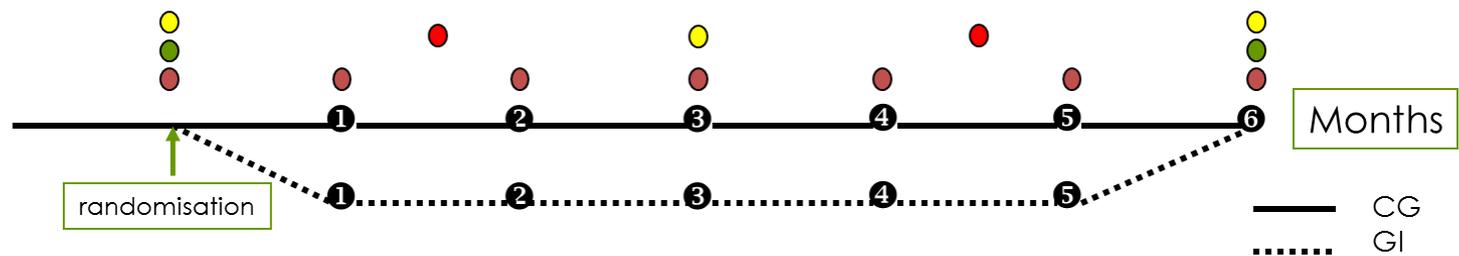
- To evaluate the of Telemedicine (TM) on clinical and organisational management of T1D within an optimisation programme
 - To prove the efficiency of such a technology (with robust method)

materials & methods

Materials and methods

- Multicentric, open trial (electronic randomisation)
- Duration 6 months (2011-12), prospective
- 2 arms:
 - Intervention group (IG)
 - Control Group (CG)

Protocol



- HbA1c
- Coste: paciente/profesional; reevaluación esquema terapéutico
- monitorización
- conocimientos: DKQ2; calidad de vida: DQoL, EUROQOL ; adherencia: SCI-R; hipoglucemias: Clarke

Materials and methods

- **Sample Size:** according to cost estimates ($\beta=0,02$, 10 % loss)
- **Inclusion criteria:**
 - T1D > 5 years
 - $18 < \text{Age} < 55$
 - HbA1c > 8%,
 - MDI.
 - BGM \geq 3-4 day
 - **Have internet access**



Materials and methods

- Medical Guard remote access



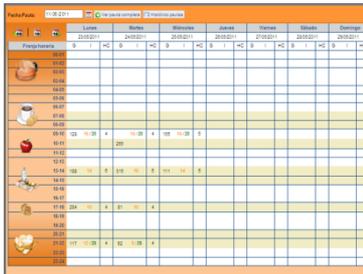
Fecha Pauta: 11/05/2011 [Ver pauta completa](#) [Historico pautas](#)

	Lunes			Martes			Miércoles			Jueves			Viernes			Sábado			Domingo			
	23/05/2011			24/05/2011			25/05/2011			26/05/2011			27/05/2011			28/05/2011			29/05/2011			
Franja horaria	G	I	HC	G	I	HC	G	I	HC	G	I	HC	G	I	HC	G	I	HC	G	I	HC	
00-01																						
01-02																						
02-03																						
03-04																						
04-05																						
05-06																						
06-07																						
07-08																						
08-09																						
09-10	128	16/20	4		16/20	4	155	14/20	6													
10-11				285																		
11-12																						
12-13																						
13-14	188	14	6	315	16	6	111	14	6													
14-15																						
15-16																						
16-17																						
17-18	284	10	4	81	10	4																
18-19																						
19-20																						
20-21																						
21-22	117	12/28	4	62	8/28	4																
22-23																						
23-24																						

Materials and methods

costs
questionnaires

Insulin dose modification
CH dose
events



Fecha	11/02/2011	12/02/2011	13/02/2011	14/02/2011	15/02/2011	16/02/2011	17/02/2011	18/02/2011	19/02/2011	20/02/2011	21/02/2011	22/02/2011	23/02/2011	24/02/2011	25/02/2011	26/02/2011	27/02/2011	28/02/2011	29/02/2011	30/02/2011	
Presión arterial	9	HC	9	1	HC	9															
Glucemia	124	10	128	4	10	128	4	10	128	4	10	128	4	10	128	4	10	128	4	10	128
HbA1c	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Insulina	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
CH	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10



- Filiation data
- Clinical Management
 - HbA1c
 - Doses of insulin
 - Insulin/kg
 - BMI
- Diabetes perception
 - Clarke questionnaire (Diabetes knowledge)
 - DKQ2 (QoL)
 - EQ-5D VAS
 - SCI-R (Adherence)

Materials & methods

costs

	IG	CG	Prof.
Transportation (€)	Yes	Yes	Yes
Duration Visit (min)	Yes	Yes	Yes
Total Time for visit	Yes	Yes	No
Duration internet connection (min)	Yes	No	Yes
Extra visits (number)	Yes	Yes	Yes
Extra Calls (min)	Yes	Yes	Yes

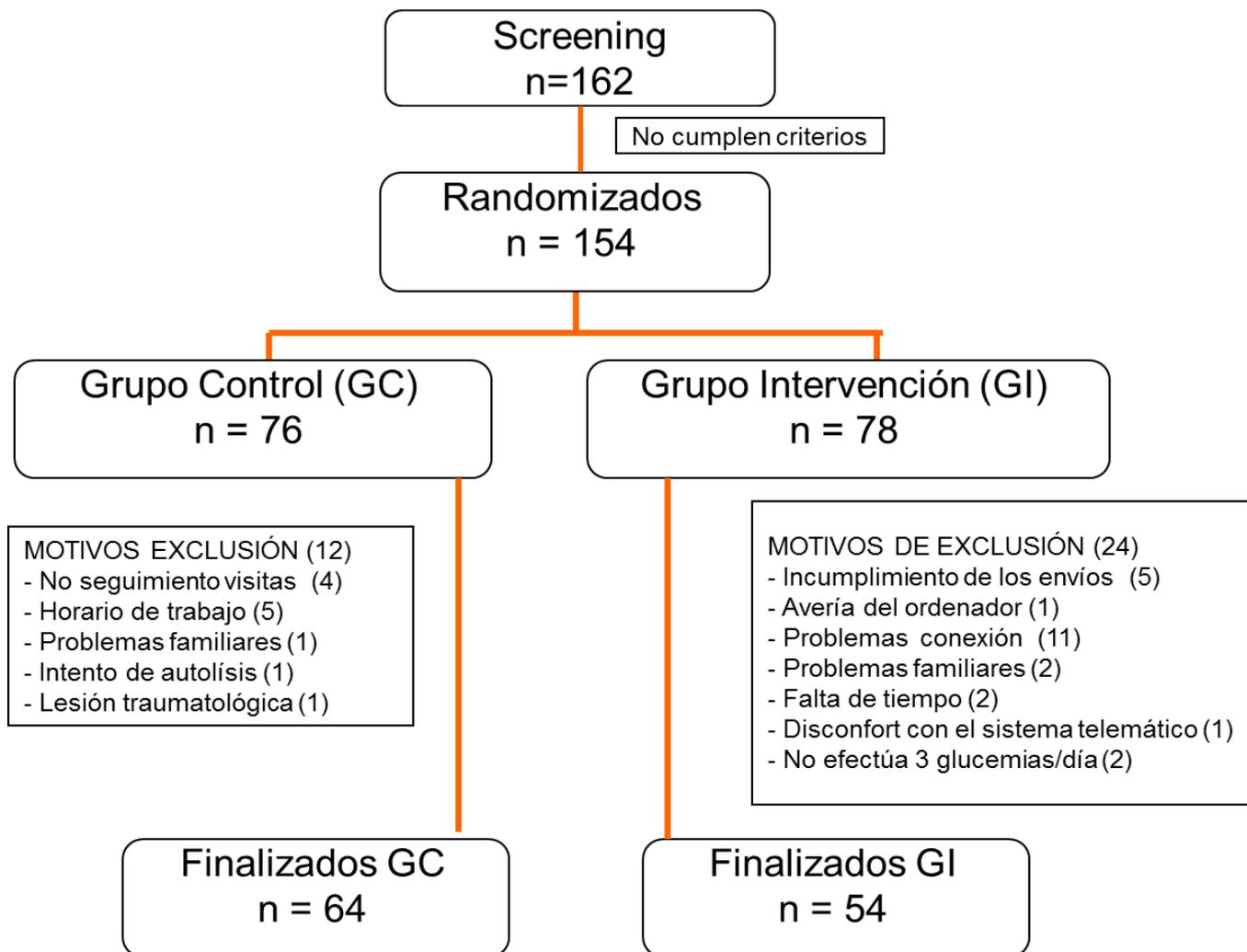
Materials & methods

salaries

	anual salary	€/min
Other	12.572,97	0,02392118
B-Level (Diplomado)	29.104,17	0,05537323
Student	12.572,97	0,02392118
'Blue colar' worker (FP)	23.676,49	0,04504659
C Level	35.833,80	0,06817694
Services to public	14.629,55	0,027834
Average Mean Salary	22.790,20	0,04336035

- Source INE 2012

results



Basal characteristics (Included vs Exluded)

	EXCLOS	Media	Desviación típ.	Sig.
Age	1	32,15	9,642	,871
	2	30,89	9,546	
Sex	1	,55	,500	,920
	2	,56	,504	
DKQ2	1	24,75	4,373	,966
	2	24,82	4,386	
Years since onset	1	16,99	8,968	,967
	2	17,89	8,245	
BMI	1	25,5187	4,46387	,015
	2	24,5758	3,17244	
HbA1c	1	9,185	1,2124	,089
	2	9,644	1,3689	
Severe Hypoglicemia	1	,35	,911	,001
	2	1,45	5,578	
Mild Hypoglicemia	1	4,06	3,680	,929
	2	3,94	3,835	
CBG Test / wk	1	26,197	7,6240	,135
	2	25,172	12,0823	
Euroqol VAS	1	65,71	17,913	,480
	2	61,56	19,990	
Clarke	1	1,95	1,785	,590
	2	2,06	1,825	
ADSCIR	1	62,67	11,295	,262
	2	60,53	12,064	
Insulin (UI /kg^day)	1	60,15	24,560	,147
	2	55,78	18,332	
Utility Telematyc devices	1	8,55	1,891	,088
	2	9,00	1,301	

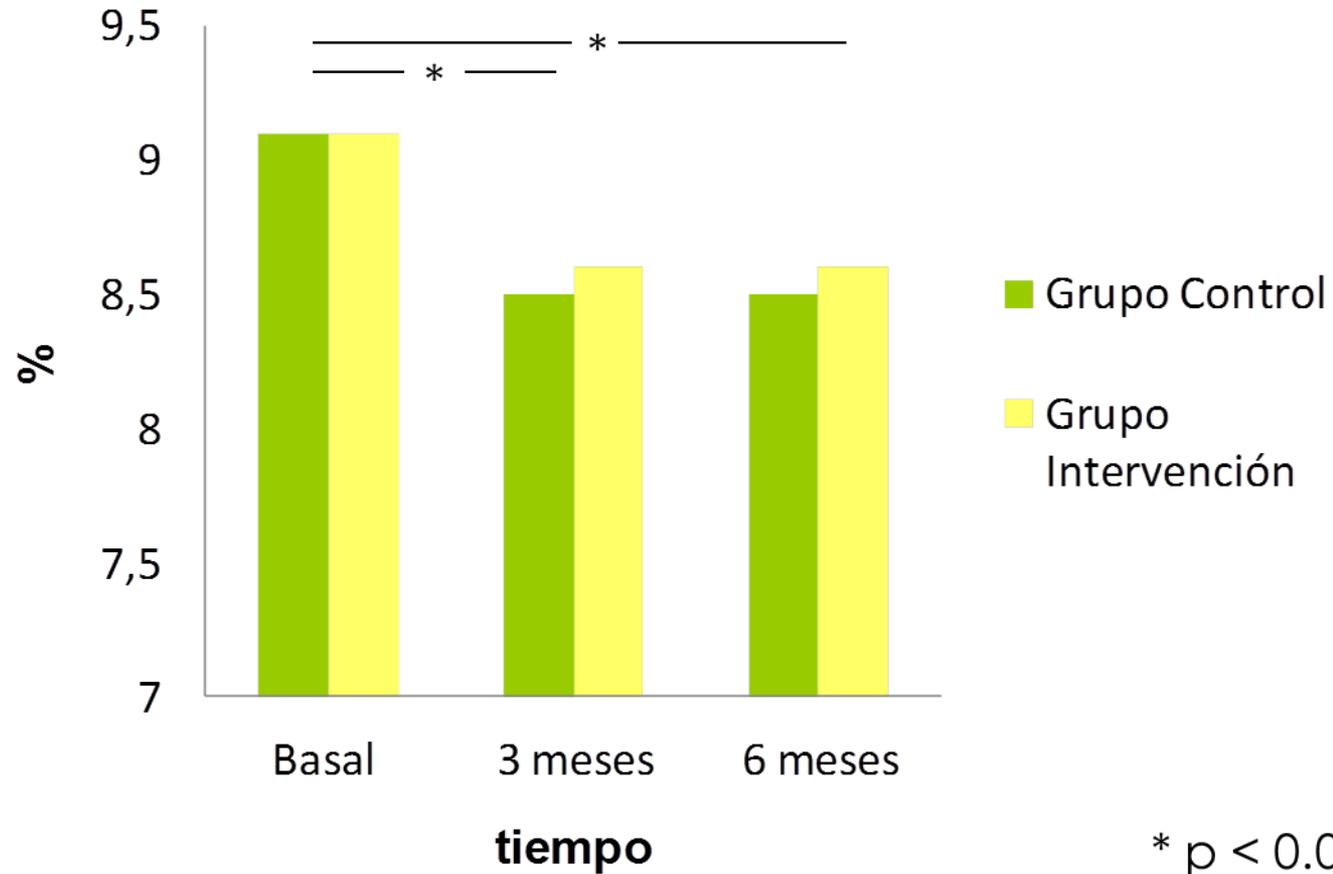
basal characteristics

	GRUP	N	Media	Desviación típ.	Sig.
Sex (woman)	I	53	0,55	,503	,887
	C	65	0,55	,501	
Age	I	53	33,13	10,141	,371
	C	65	31,35	9,217	
Clarke Questionnaire	I	52	1,54	1,709	,240
	C	65	2,28	1,790	
ADSCI Adherence	I	53	61,25	11,950	,420
	C	65	63,83	10,684	
DKQ2	I	53	24,72	4,495	,901
	C	65	24,78	4,307	
Weight	I	53	75,48	17,5576	,059
	C	65	71,51	14,1761	
Years since Dx	I	53	17,58	9,241	,924
	C	65	16,51	8,781	
BMI	I	53	26,06	4,42565	,647
	C	65	25,08	4,48019	
HbA1c	I	53	9,16	1,4943	,215
	C	65	9,20	,9338	
Severe Hypoglycemia	I	46	0,15	,556	,001
	C	58	0,50	1,096	
Mild Hypoglycemia	I	49	4,04	3,570	,905
	C	60	4,08	3,797	
CBG tests /wk	I	53	26,19	7,6863	,916
	C	64	26,20	7,6328	
Euroqol VAS	I	52	64,73	17,650	,966
	C	65	66,49	18,218	
Insulin UI / Kg^day	I	53	0,89	,309201581	,008
	C	65	0,75	,228492423	
Impression on Telemedic monitoring	I	49	8,96	1,369	,059
	C	65	8,25	2,165	

duration of visits(min)

	GRUPO	N	Media	Desviación típ.	Sig.
V1 Patient Time	I	53	154,642	89,7951	,671
	C	65	143,077	104,2896	
V1 Prof Time	I	53	67,26	28,615	,026
	C	63	54,16	18,770	
V2 Patient Time	I	53	32,264	38,8113	,000
	C	65	125,538	86,5083	
V2 Prof Time	I	53	23,94	11,126	,031
	C	65	34,66	17,834	
V3 Patient Time	I	53	29,811	29,0219	,000
	C	65	121,846	100,9934	
V3 Prof Time	I	50	23,36	7,637	,002
	C	64	35,95	16,535	
V4 Patient Time	I	53	29,434	35,1461	,000
	C	65	131,846	112,2273	
V4 Prof Time	I	52	23,25	7,375	,000
	C	64	35,34	13,899	
V5 Patient Time	I	53	33,774	45,6777	,000
	C	65	128,692	97,2403	
V5 Prof Time	I	51	22,20	7,995	,000
	C	64	34,45	15,994	
V6 Patient Time	I	53	20,415	27,7990	,000
	C	65	132,154	108,9150	
V6 Prof Time	I	46	21,78	8,874	,004
	C	64	33,88	15,547	
V7 Patient Time	I	53	130,094	67,1643	,034
	C	65	138,615	102,4753	
V7 Prof Time	I	53	67,21	19,496	,367
	C	62	68,00	14,542	

T1D control



* $p < 0.001$

Clinical results

Final visit compared to first visit

GRUPO		Media	Desviación típ.	Sig. (bilateral)		GRUPO	Media	Desviación típ.	Sig. (bilateral)
C	HbA1c	0,59	1,0915	,000	I		0,47	,8570	,000
	Severe Hypoglucemia	0,49	1,103	,002		- 0,07	1,289	,733	
	Mild Hypoglucemia	- 11,14	9,212	,000		- 9,58	10,283	,000	
	Insulin (UI / Kg*day)	- 0,71	,591424766	,000		- 0,40	,675778333	,000	
	CBG Tests / wk	- 2,51	6,9080	,006		- 1,87	11,1833	,244	
	Weight	- 1,28	3,1902	,002		- 0,30	2,8718	,453	
	BMI	- 0,58	1,23539	,000		- 0,09	1,06387	,539	
	Euroqol VAS	0,21	16,672	,922		- 0,38	22,171	,904	
	DKQ2	- 2,03	3,048	,000		- 1,58	4,059	,006	
	ADSCIR Adherence	- 5,71	10,730	,000		- 4,87	11,192	,003	

costs of programme

	GRUP	N	Mean	SD	Sig.
All Patient time (V1-V7)	C	65	921,77	636,90	,000
	I	53	430,43	209,29	
All Prof. Time (V1-V7)	C	65	318,23	76,40	,002
	I	53	284,70	43,50	
All Connection time (V2-V6)	C	65	-	-	N/A
	I	53	170,00	162,31	
All Inactive Connection time (V2-V6)	C	65	-	-	N/A
	I	53	145,70	129,47	

costs of programme

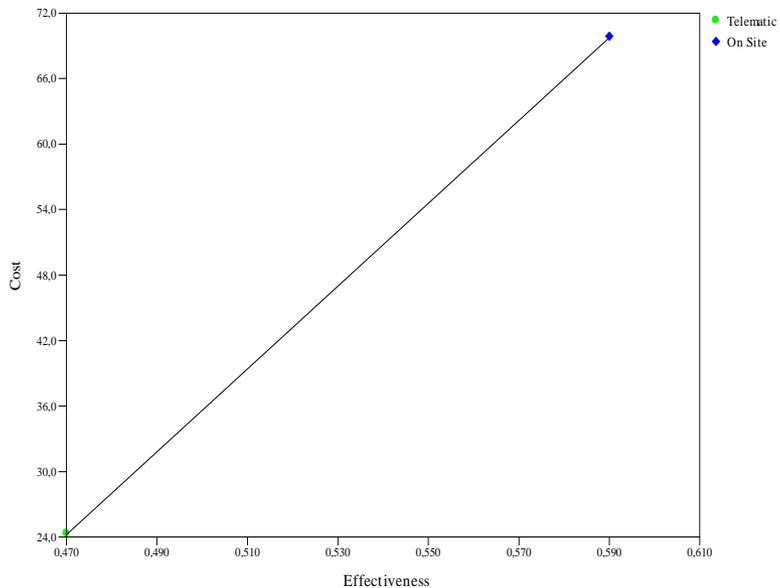
	GRUPO	N	Mean	SD	Sig.
All Patient Cost (V1-V7)	C	65	69,90	49,13	,000
	I	53	24,36	13,31	
All Prof Cost (V1-V7)	C	65	17,27	4,56	,004
	I	53	14,83	2,76	
All Transportation Time (V1-V7)	C	65	35,79	30,32	,000
	I	53	7,33	5,30	
All Labor Costs (V1-V7)	C	65	35,34	25,34	,000
	I	53	16,88	8,43	

costs of programme

	GRUPO	N	Media	Desviación tip.	Sig.
All Patient time (V1-V7)	C	65	921,77	636,90	,000
	I	53	430,43	209,29	
All Prof. Time (V1-V7)	C	65	318,23	76,40	,002
	I	53	284,70	43,50	
All Connection time (V2-V6)	C	65	-	-	,000
	I	53	170,00	162,31	
All Inactive Connection time (V2-V6)	C	65	-	-	,000
	I	53	145,70	129,47	
All Patient Cost (V1-V7)	C	65	69,90	49,13	,000
	I	53	24,36	13,31	
All Prof Cost (V1-V7)	C	65	17,27	4,56	,004
	I	53	14,83	2,76	
All Transportation Time (V1-V7)	C	65	35,79	30,32	,000
	I	53	7,33	5,30	
All Labor Costs (V1-V7)	C	65	35,34	25,34	,000
	I	53	16,88	8,43	

All Times	C	1.240,00
	I	1.030,83
All Costs	C	87,18
	I	39,19

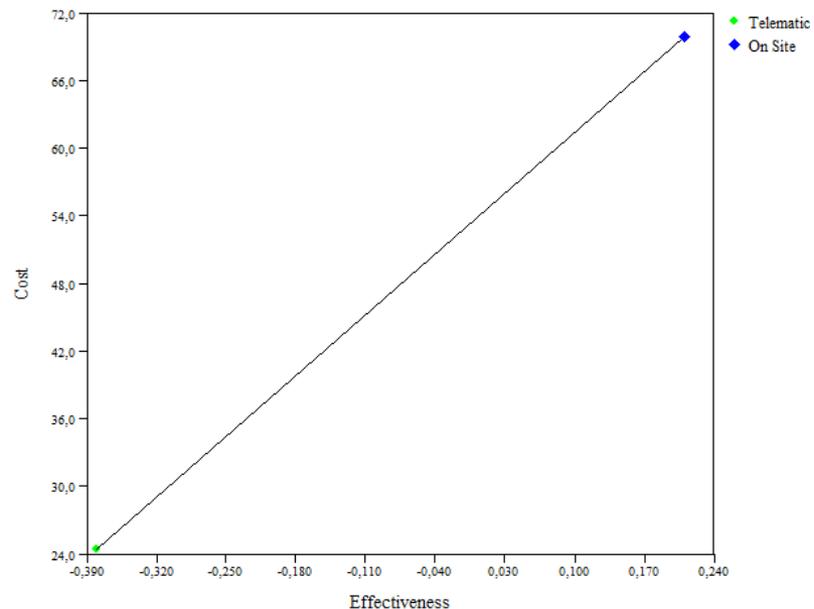
Cost-Effectiveness Analysis
At T1D



HbA1c

- RICE= 379,50

Cost-Effectiveness Analysis
At T1D



QALY

- RICE= 77,19

- Relatively high dropout rates
- More Severe Hypoglycaemia in Control group
 - Maybe should be an exclusion criteria
- Costs depend on patient's ability to recall expenses
- INE average salaries as a source of costs
 - But no real effect on results
- Large SD
- No follow up at 1year

conclusion

- Telemedicine applied to people with DM1 treated with MDI and inadequate metabolic control **is a valid strategy** that:
 - provides **comparable clinical results** to face to face visits in relation to the improvement in glycemic control, the acquisition of knowledge, the perceived quality of life and adherence
 - with a **significant reduction in the time** required, especially for the patient.
- **TELEMEDICINE OFFERS SIMILAR TO QUALITY CARE USUAL CARE, WITH A CLEAR COST REDUCTION FOR THE PATIENT WITHOUT RAISING PROFESSIONAL'S DEDICATION.**

Grupo Telemed-Diabetes

Participantes

Aguayo Anibal, Carmena Rafael, Casimiro-Soriguer Federico, Castaño Luis, Del Valle Laura, Esmatjes Enric, Gaztambide Sonia, Gomis Ramón, Guerrero Mercedes, Jansà Margarida, Martínez Sergio; Pérez-Ferre Natalia, Roca Daria, Ruiz de Adana Marisol, Serrano-Ríos Manuel, Sola-Morales Oriol, Vazquez Federico, Vidal Mercè

Financiación

Ciberdem

no hay conflictos de interés

Colaboración

Menarini Diagnostics

ciberdem

Centro de Investigación Biomédica en Red de
Diabetes y Enfermedades Metabólicas Asociadas