

LA TECNOLOGIA PER LA CURA DEL DIABETE

DALLA SMART MDI ALL'HYBRID CLOSED LOOP

Importanza delle Analisi dei Dati da Remoto: la Sanità Interconnessa

LUDOVICO DI GIOIA

ROMA, 02/04/2025

Ludovico Di Gioia dichiara di aver ricevuto negli ultimi due anni compensi o finanziamenti dalle seguenti Aziende Farmaceutiche e/o Diagnostiche:

Abbott, Eli Lilly, Medtronic, Novo Nordisk,
Roche Diabetes Care, Sanofi, Theras Biocare, Lusofarmaco
(relazioni a convegni, supporto per partecipazione a congressi)

Dichiara altresì il proprio impegno ad astenersi, nell'ambito dell'evento, dal nominare, in qualsivoglia modo o forma, aziende farmaceutiche e/o denominazione commerciale e di non fare pubblicità di qualsiasi tipo relativamente a specifici prodotti di interesse sanitario (farmaci, strumenti, dispositivi medico-chirurgici, ecc.).

Daily Use of CGM/Smart Pen Data

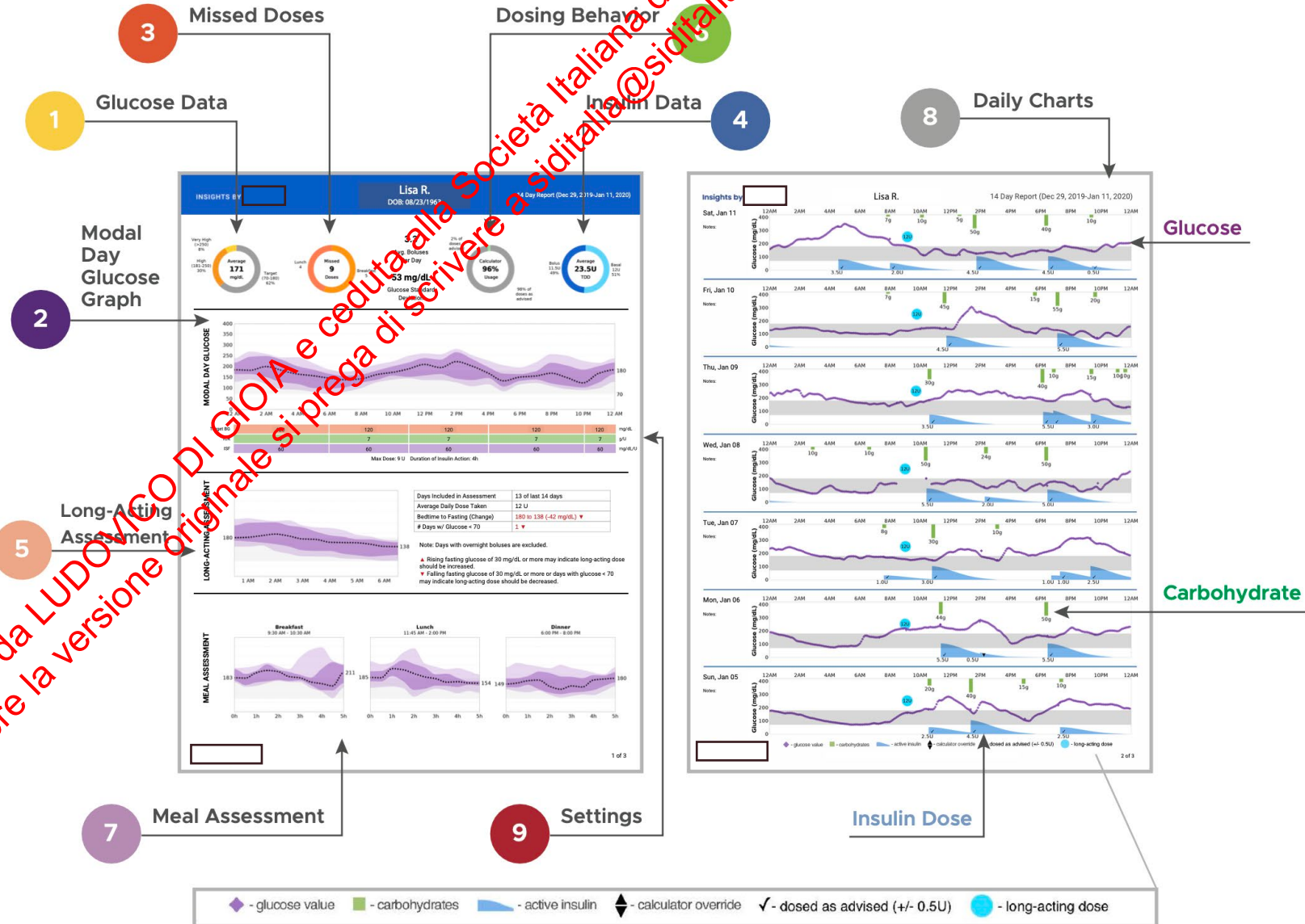


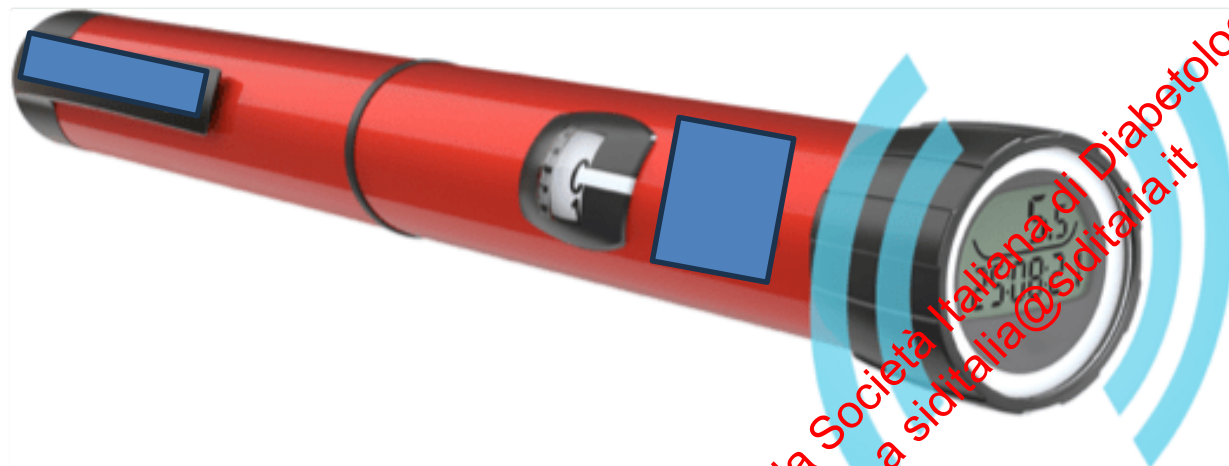
Diapositiva preparata da LUDOVICO DI GIOIA e ceduta alla Societa Italiana di Diabetologia.
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Daily Use of CGM/Smart Pen Data



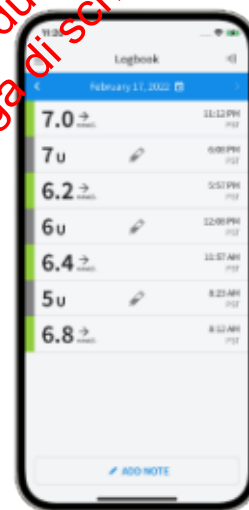
Daily Use vs. Retrospective Analysis





Connect

Scan and add a compatible smart connected insulin pen¹ to automatically transfer insulin doses to the app^{2,0}



Review

Patients can easily track past insulin doses and their impact. Seeing this information may help your patients avoid missing a dose or taking insulin doses too close together

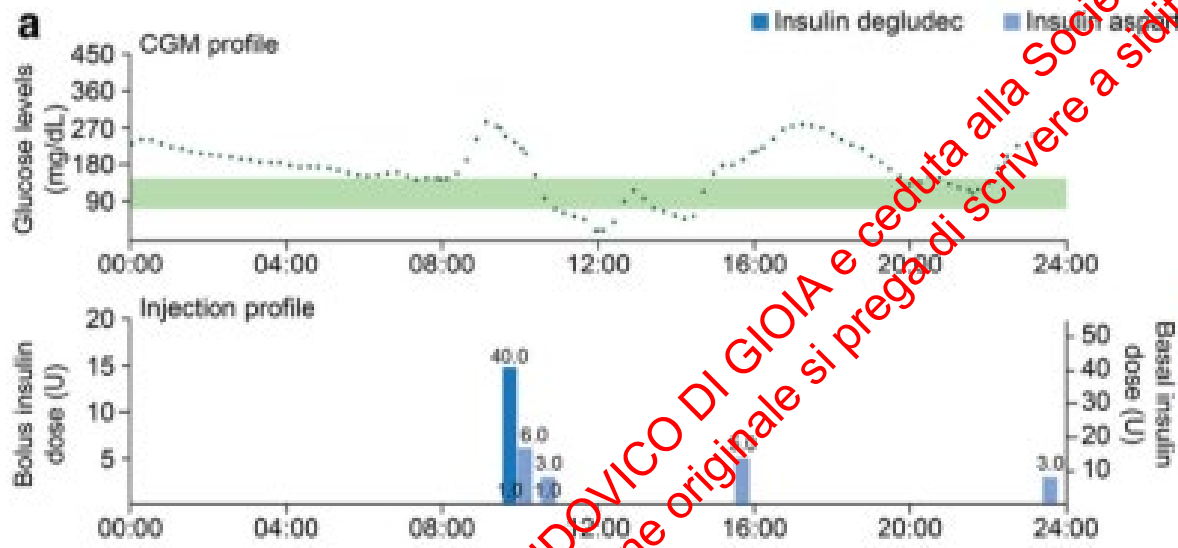
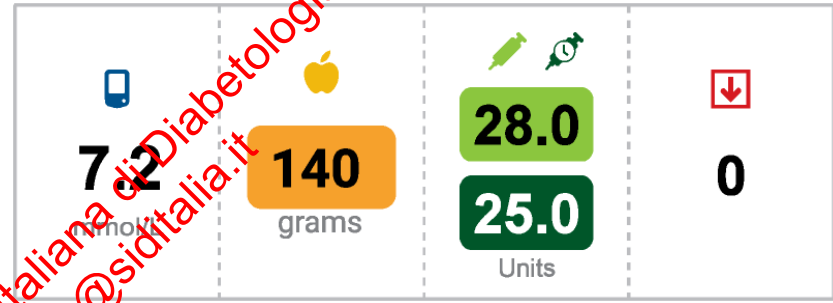
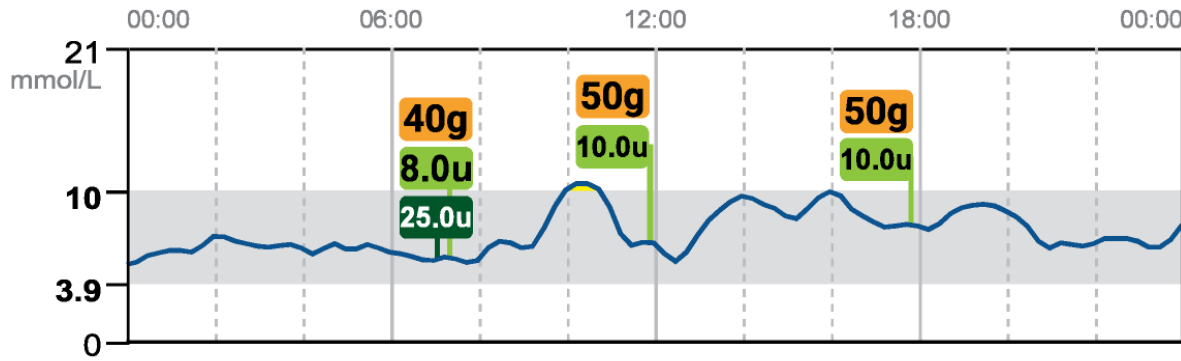


Share

Reports showing glucose and insulin data together for more informed patient consultations

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Fri
07 Jan



Insulin degludec		Insulin aspart	
Time of day	Dose (U)	Time of day	Dose (U)
09:45	1.00	10:04	6.00
09:45	40.00	10:43	1.00
		10:43	3.00
		15:42	5.00
		23:35	3.00

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🏠 Diabetes Technology & Therapeutics > Just Accepted

Research Article |  OPEN ACCESS | Published Online: 17 May 2024



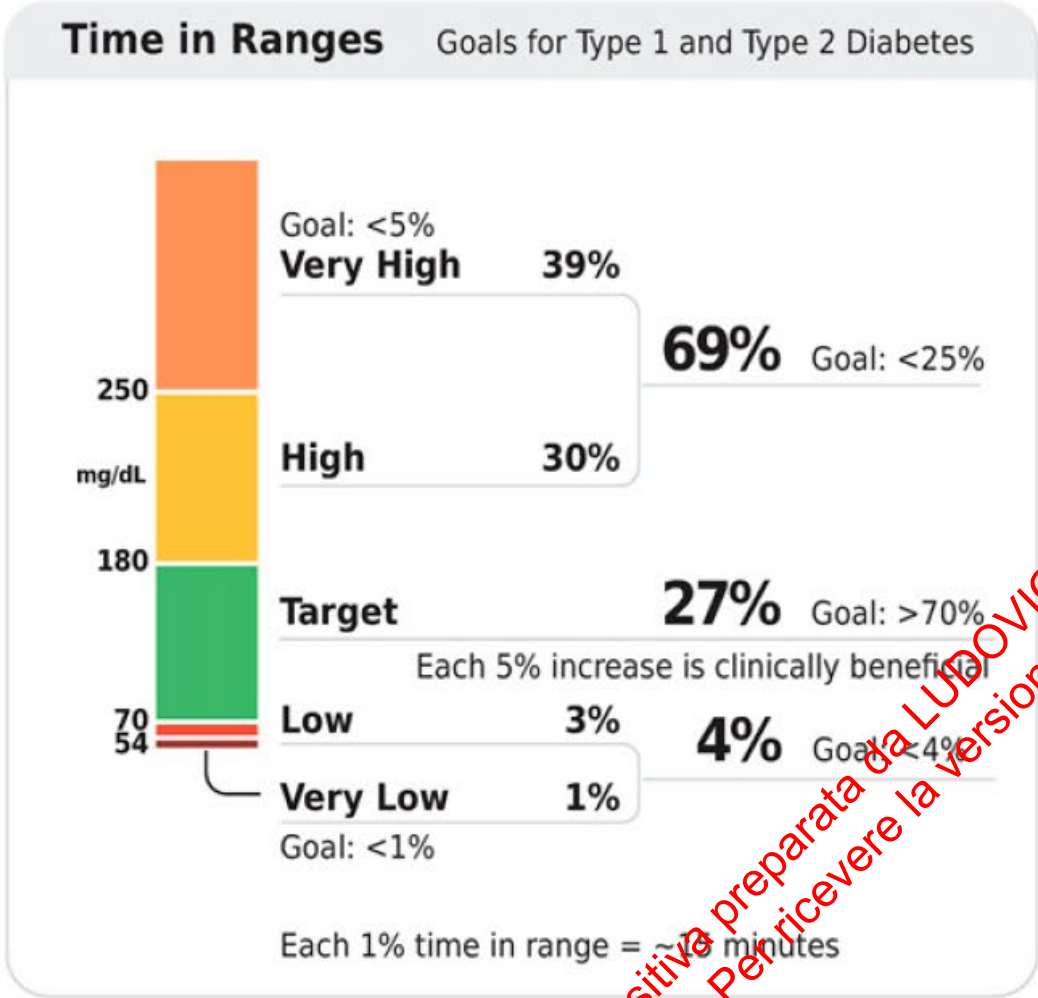
Expert Panel Recommendations for a Standardized Ambulatory Glucose Profile Report for Connected Insulin Pens

Authors: Dr. Gregg D. Simonson, Dr. Amy Criego, Prof. Tadej Battelino, Dr. Anders L. Carlsson, Dr. Pratik Choudhary, Dr. Sylvia Franc, Ms. Dana Gershenoff, ... [SHOW ALL](#) ..., and Dr. Richard M Bergenstal | [AUTHORS INFO & AFFILIATIONS](#)

Publication: Diabetes Technology and Therapeutics • <https://doi.org/10.1089/dia.2024.0107>

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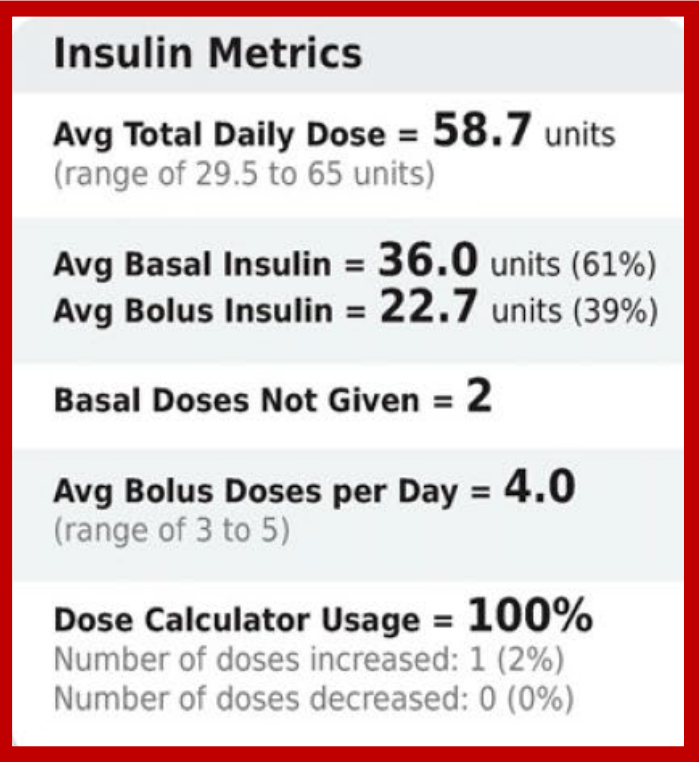
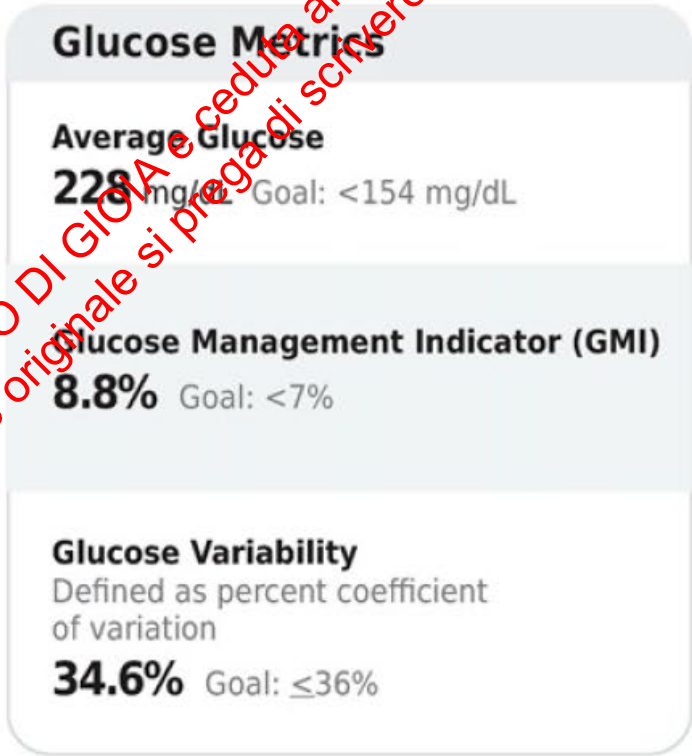
AGP Report: Connected Insulin Pen



Sam Test Patient DOB Jan 1970

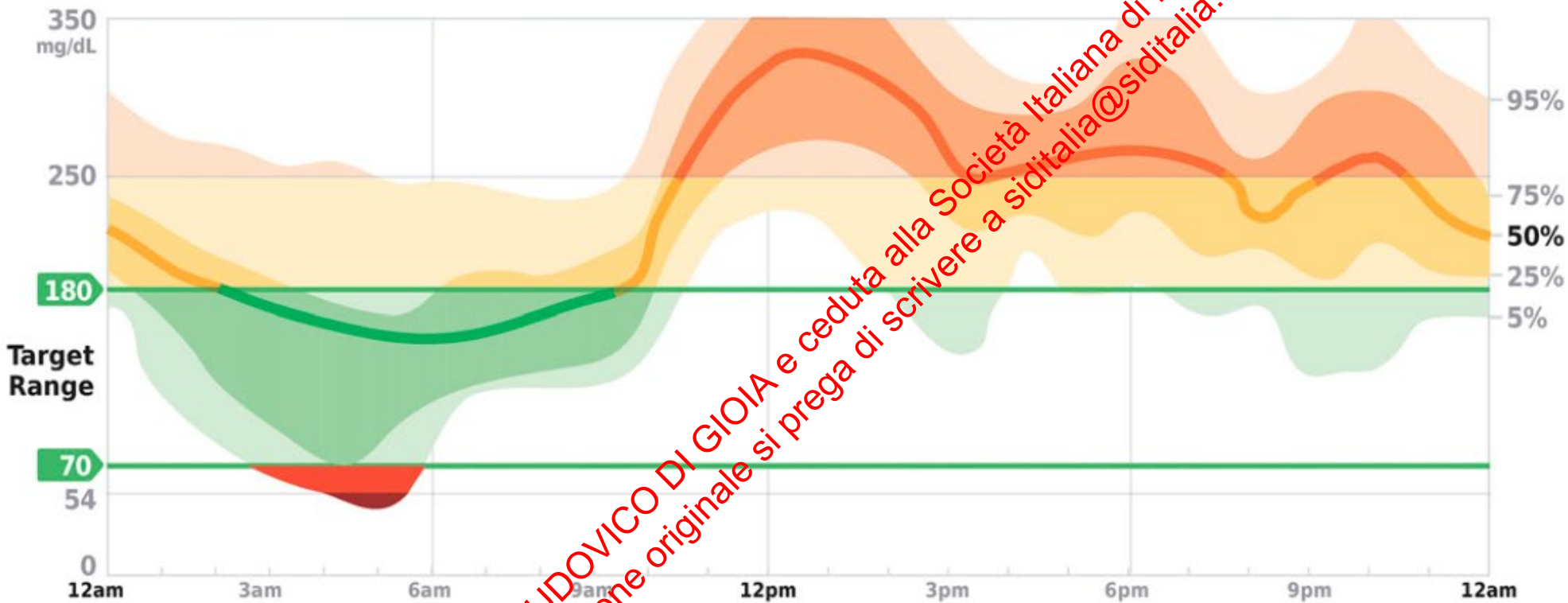
14 Days: May 5-May 18, 2023

Time CGM Active: 97%



Ambulatory Glucose Profile (AGP)

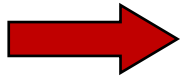
AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if they occurred in a single day.



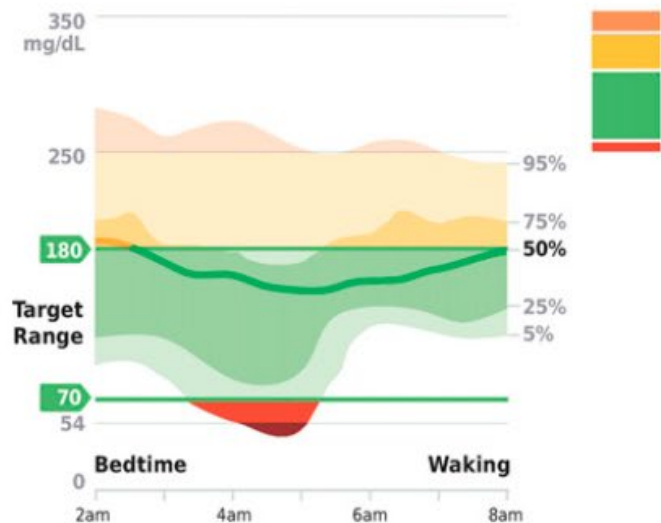
Settings	ICR	1:10	1:7	1:10	1:10	1:10
	CF	1:50	1:50	1:50	1:50	1:50
	Target Glucose	110	100	100	100	110

ICR = Insulin-to-Carb Ratio (unit:mg/grams); CF = Correction Factor (Insulin Sensitivity Factor) in unit:mg/dL above target glucose

Active Insulin Time: 3 hours



Basal (Long-Acting) Insulin Assessment



Days Included in Assessment*	13 of 14 days
Average Daily Basal Dose	36 units (range of 36-36 units)
Time of Basal Insulin (program setting)	11pm
Glucose <70 mg/dL Overnight	3 days
Average Bedtime to Waking (change in glucose)	181 to 174 (-7 mg/dL)

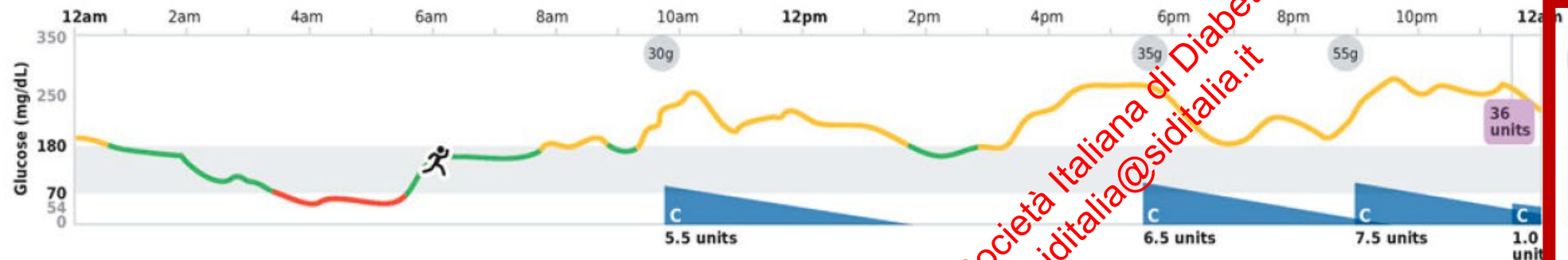
* Note: Days with boluses within 3 hours of bedtime or overnight boluses are excluded.

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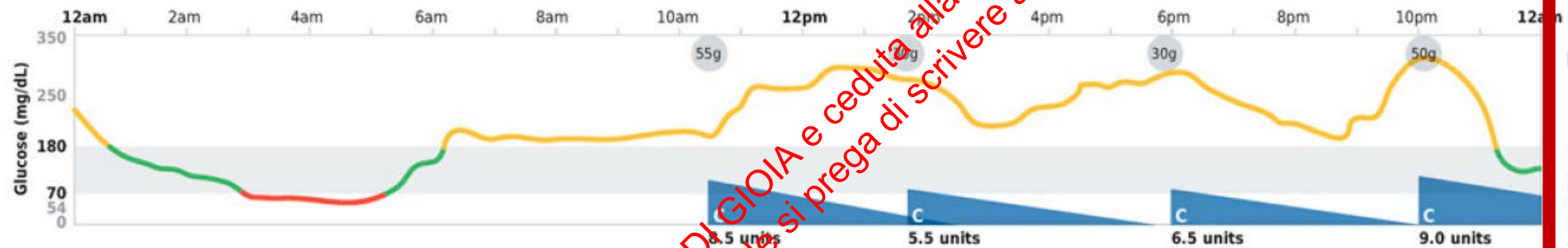
Daily Profiles

Active Insulin Time: 3 hours

Fri
May 5



Sat
May 6



Sun
May 7



— glucose value ● carbohydrates ▲ active bolus insulin C calculated dose ■ basal insulin dose ■ total bolus insulin dose physical activity
 ▼ calculator override M manual dose ■ total basal insulin dose CF correction factor

Data Availability → Analysis → Action

HYPOGLYCEMIA

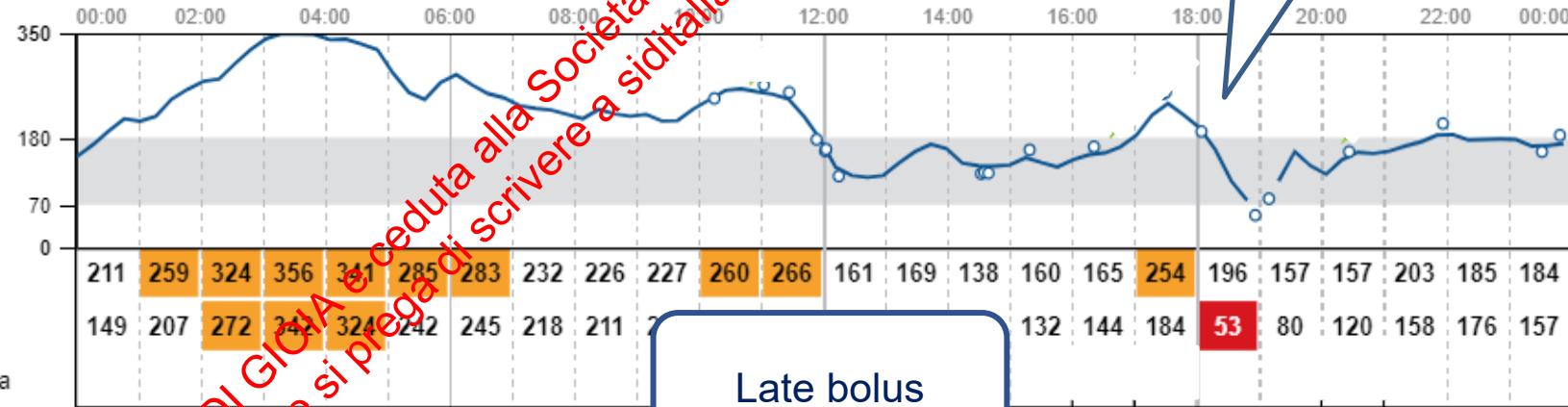
- Incorrect I:CHO ratio
- Excessive correction
- Insulin stacking
- Effect of exercise/alcohol

HYPERGLYCEMIA

- Incorrect I:CHO ratio
- Late/missed bolus
- Insufficient correction
- Overcorrection of hypoglycemia
- Lipohypertrophy

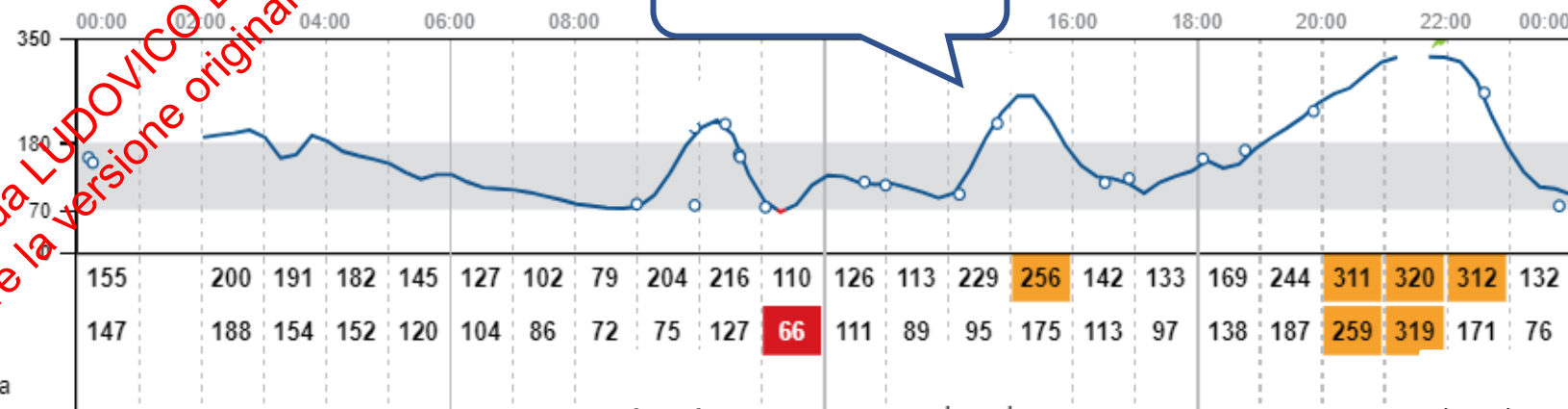
SAB 9 mar

Glucosio mg/dL
Max
min
Insulina ad azione rapida



DOM 10 mar

Glucosio mg/dL
Max
min
Insulina ad azione rapida



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Smart Cap + Basal Insulin Titration App + Digital Record Integration

Smartphone
Application for
**Automated Titration
of Basal Insulin**

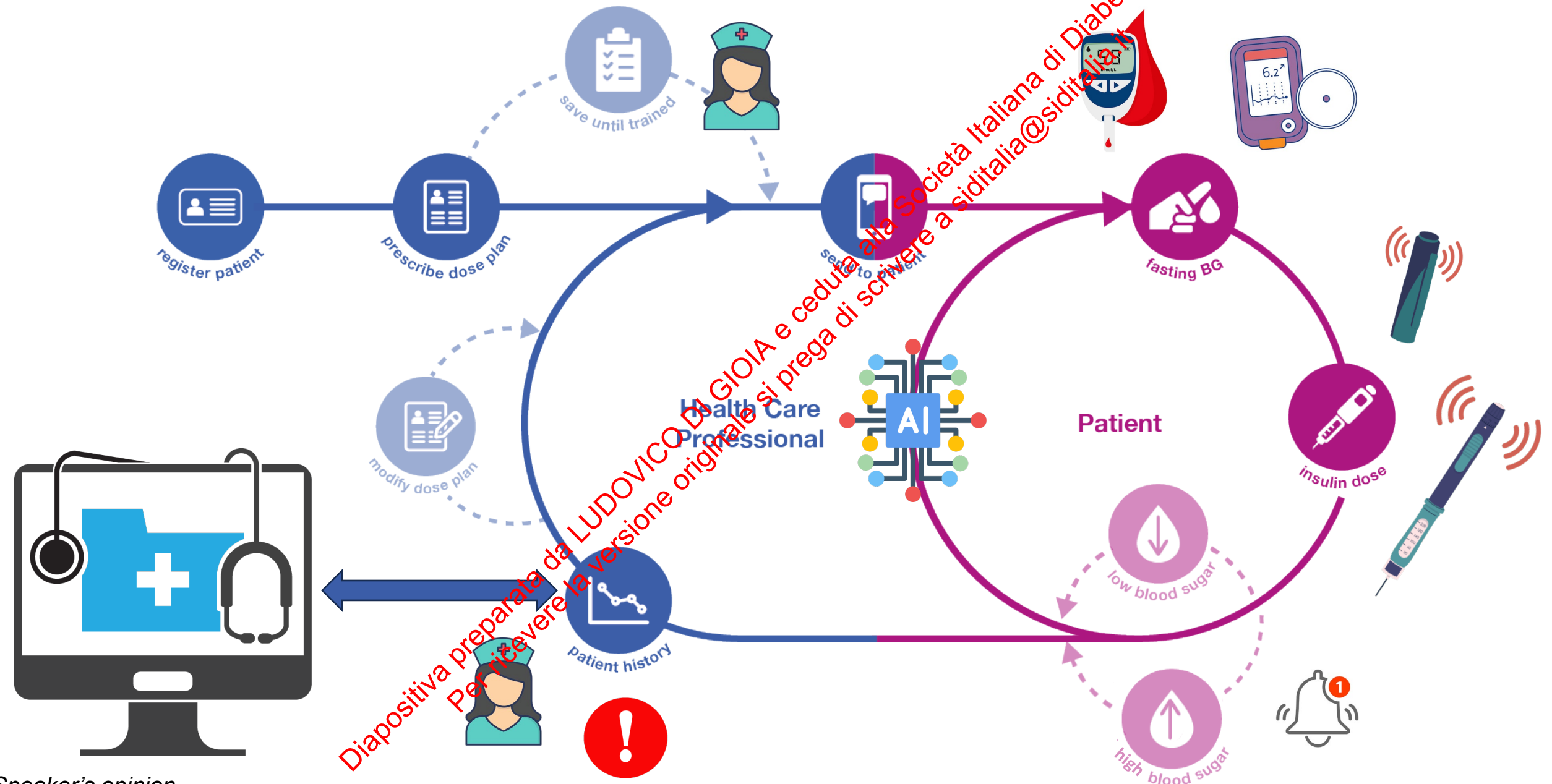
Electronic Medical
Record for Diabetes
Care Integration

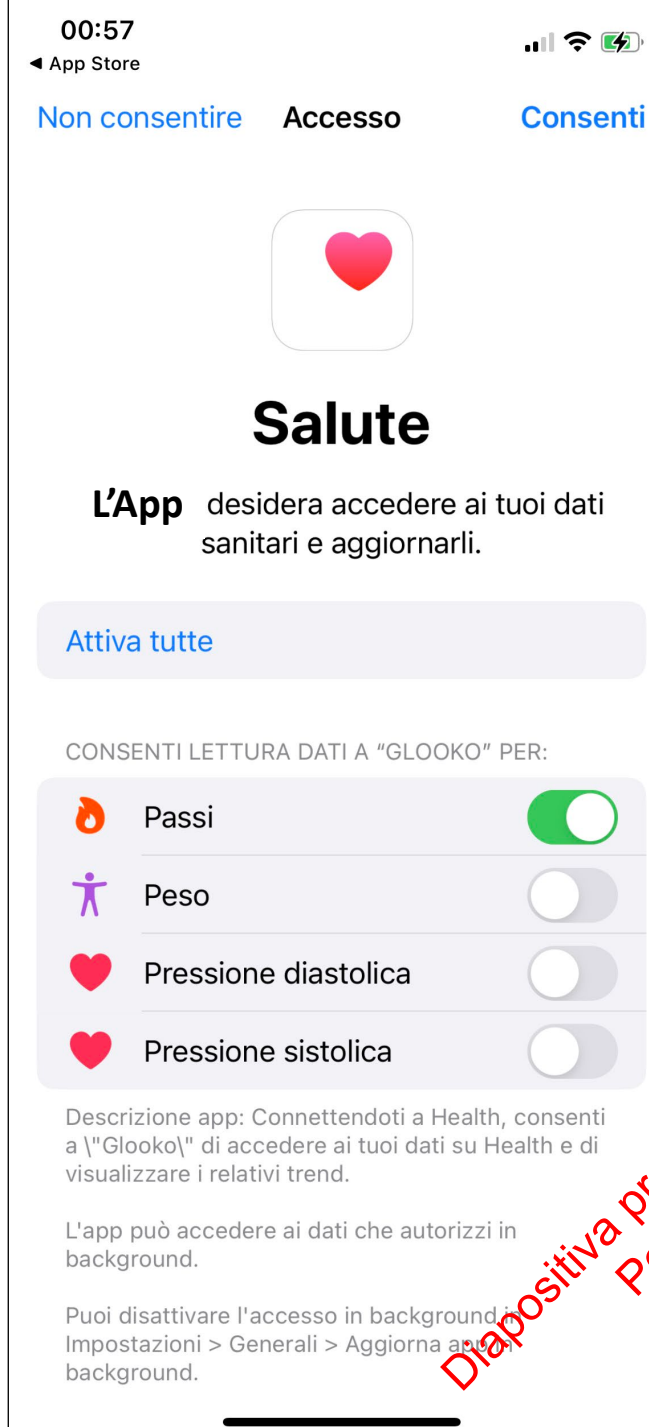
**Connected cap to record the
date, time, and doses of
injected insulin**

**Smart
Cap**



Telehealth Model with Basal Insulin Titration App – Future Perspectives



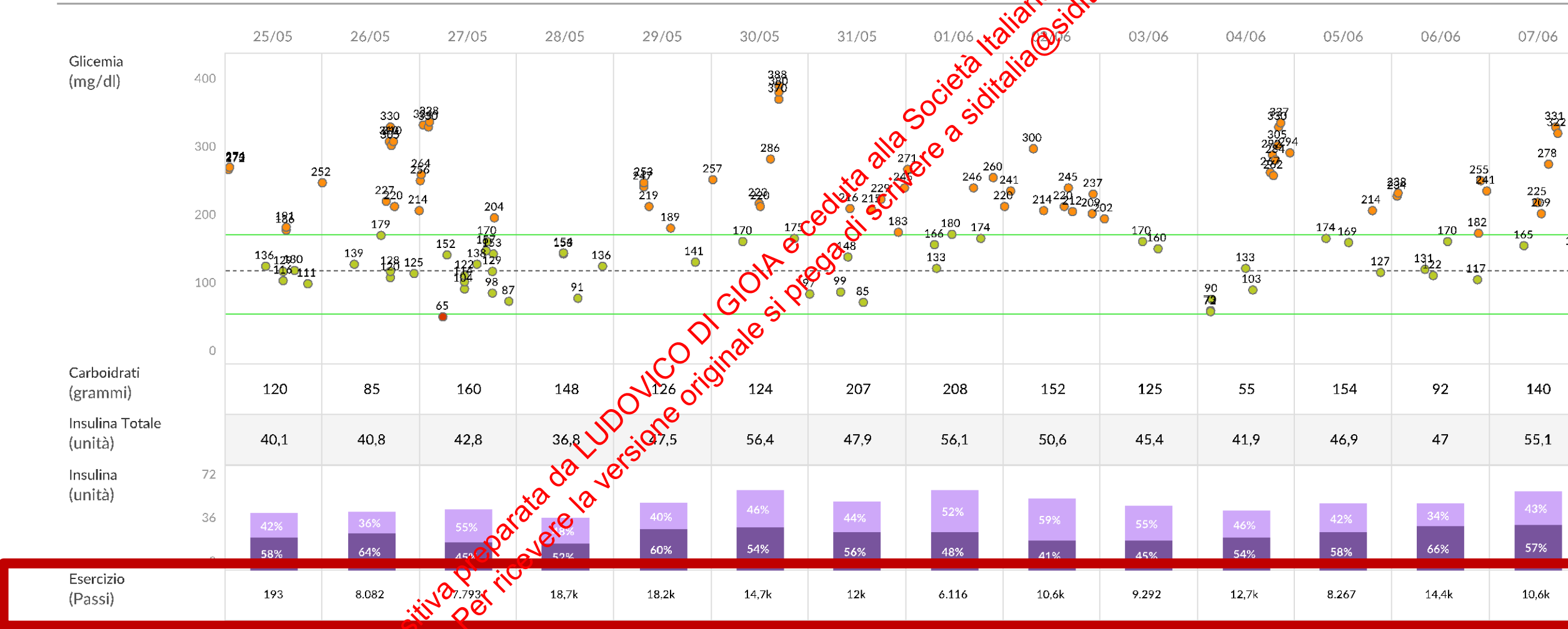


Nome Cognome

Panoramica

DdN: 03 mag, 1996 Diabete: Tipo 1

15 mag, 2022 - 07 giu, 2022 (14 giorni)



AGP: Glucose + Meals + Insulin + Exercise

Glucose

(include data points,
percentiles,
%TBR, %TAR, %TIR)

Insulin bolus dose and timing

Insulin on Board (IOB)

Plasma Insulin Levels

(pharmacokinetics)

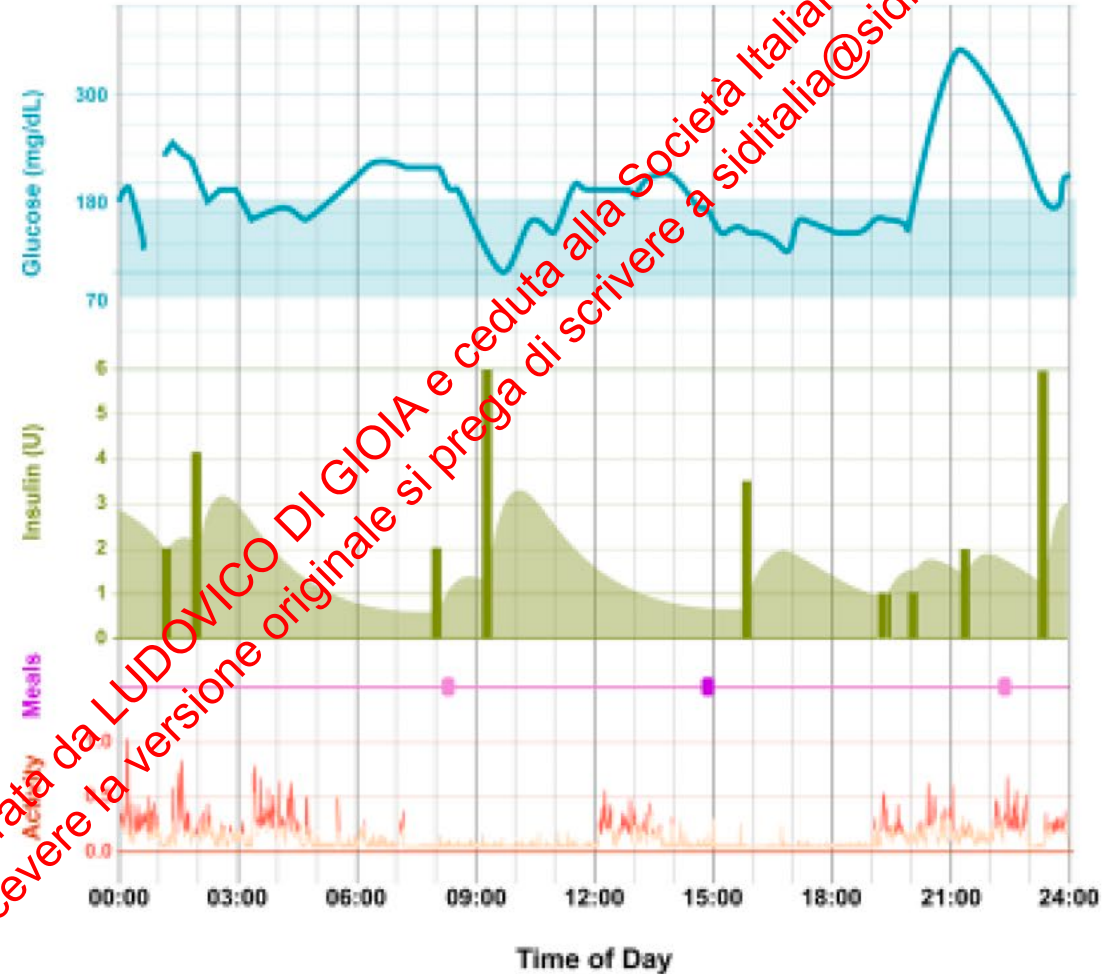
Insulin Action

(pharmacodynamics)

Meals

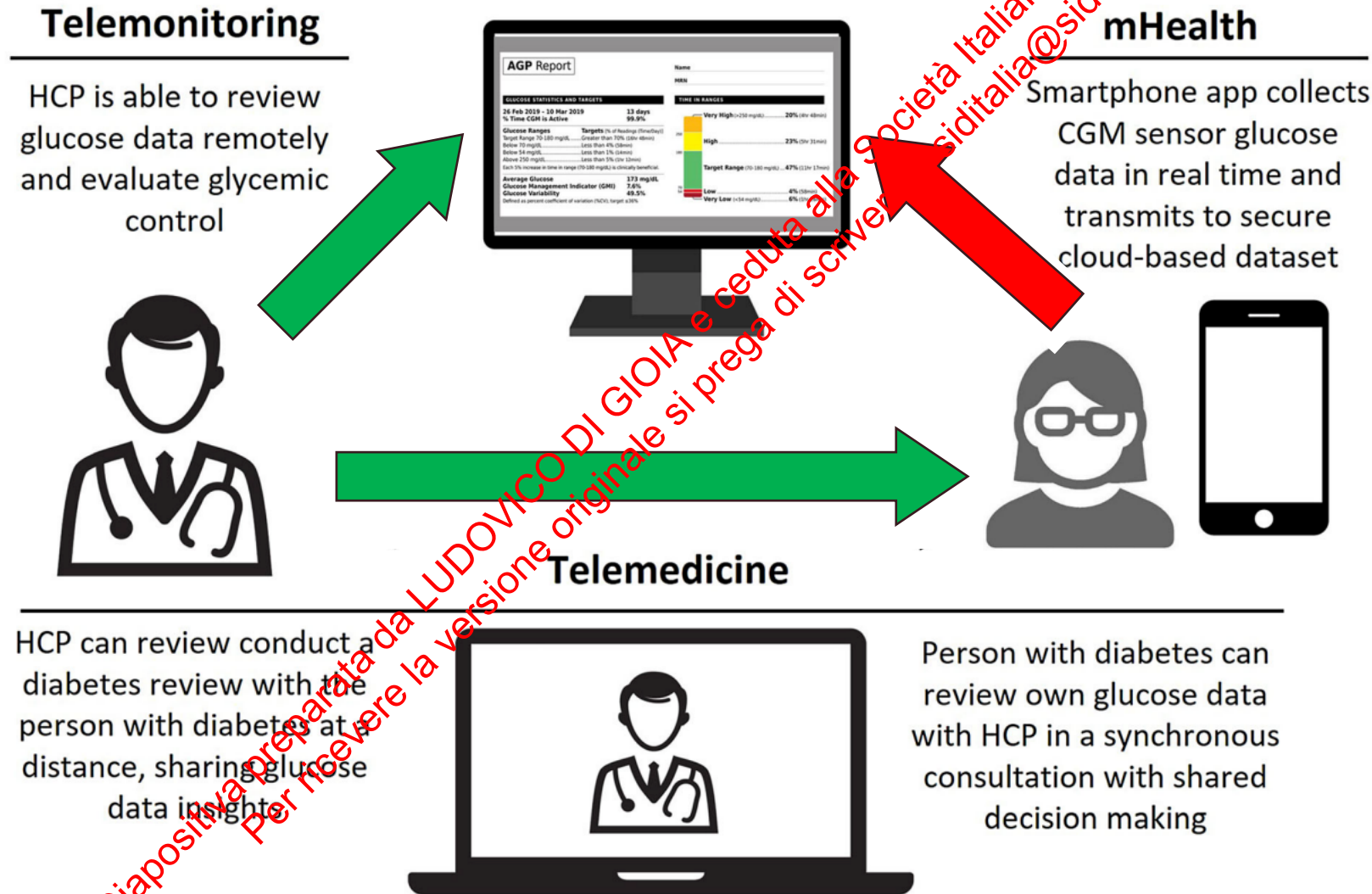
Physical activity

(accelerometer)

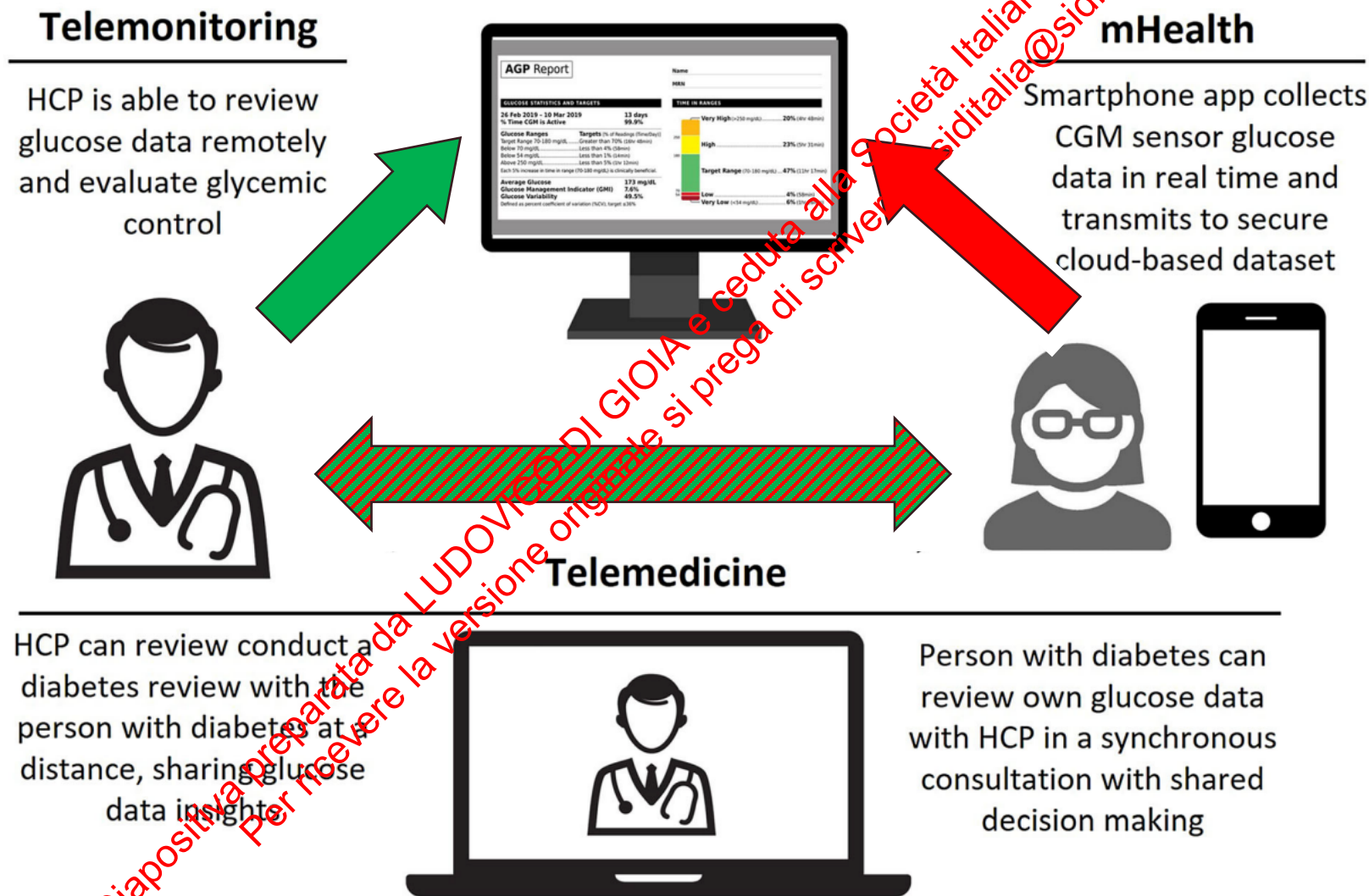


Modified from: Wolpert H, Rodbard D, Polonsky W, Johnson J, He X, Xie J. Presented at ATTD, Madrid, 2020.

Successful Integration of mHealth, Telemonitoring and Telemedicine in Diabetes

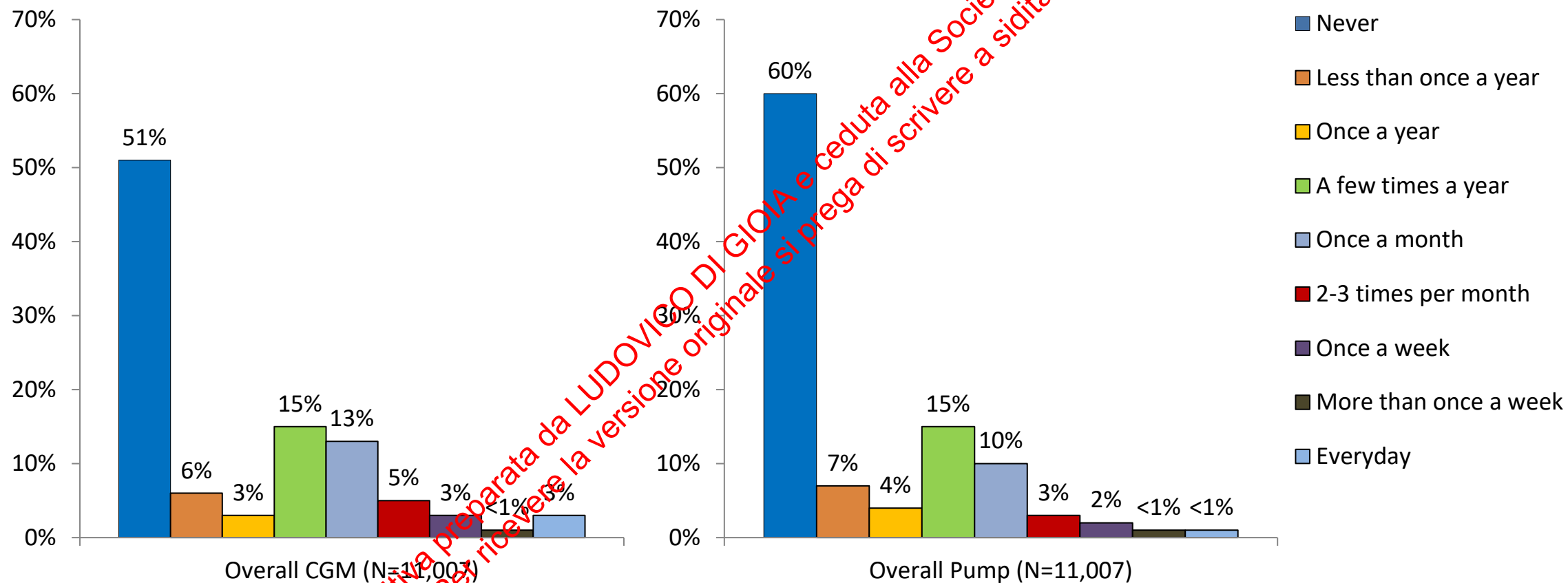


Successful Integration of mHealth, Telemonitoring and Telemedicine in Diabetes



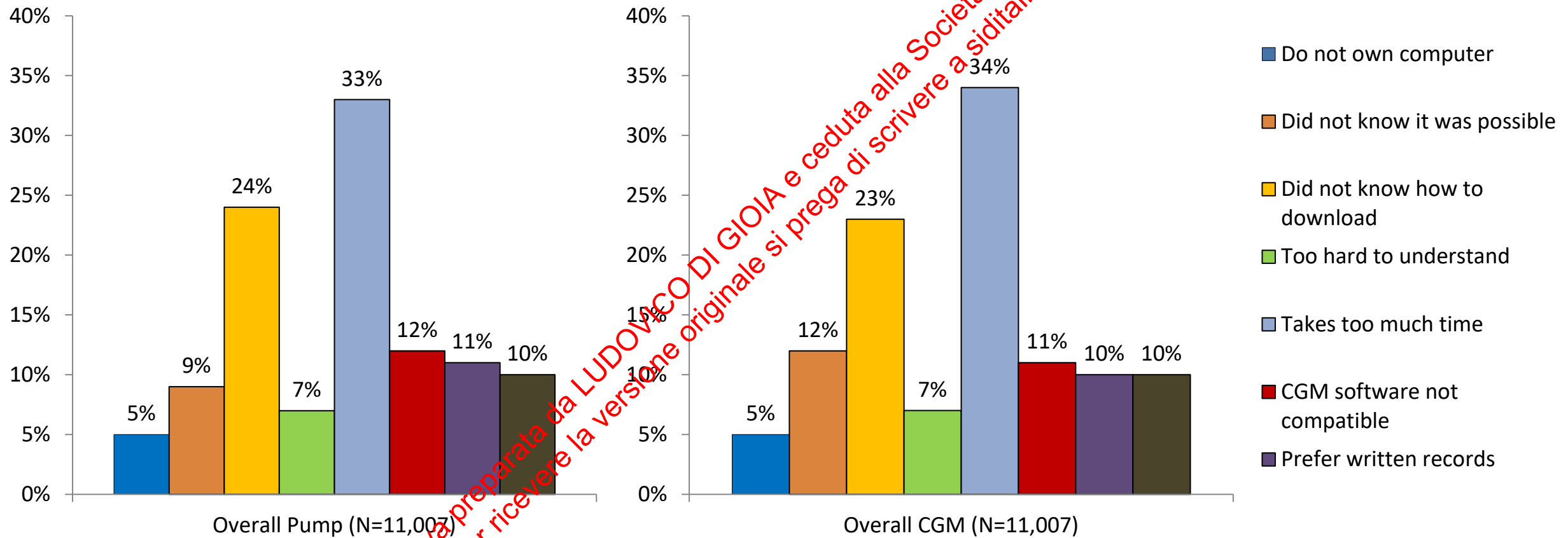
Frequency of CGM/Pump Data Download

T1D Exchange Registry 2016-2018



Reasons for Infrequent Downloading

T1D Exchange Registry 2016-2018



Retrospective Review of Weekly Automatic rCGM Reports

Perceived Impact on Quality of Life and Health Outcomes

	Improved, N (%)		
	Total	T1D	T2D
→ Hypoglycemia Confidence ^a	302 (75.9%)	148 (74.0%)	154 (77.8%)
→ WHO-5 Well-Being ^a	199 (50.0%)	96 (48.0%)	103 (52.0%)
→ Powerlessness ^a	256 (59.3%)	104 (52.0%)	132 (66.7%)
→ Management distress ^a	295 (74.1%)	138 (69.0%)	157 (79.3%)

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Association of Caregiver's Fear of Hypoglycemia with Whether Child's Diabetes Data was Reviewed in Between Clinic Visits

Single-centre observational cross-sectional study, n = 191 caregivers of children with T1D

	Review = Yes	Review = No		FDR adjusted	Adjusted for covariates ^b	
	(n = 116)	(n = 37)	P value	P value ^a	Mean diff (95% CI)	P value
Fear of hypoglycemia						
Behavior	(n = 109)	(n = 36)				
	31.9 (5.6)	27.7 (6.3)	.0002*	.002*	3.3 (1.0, 5.6)	.0001*
Worry	(n = 111)	(n = 32)				
	34.4 (12.9)	30.4 (10.5)	.11	.25	3.7 (−1.4, 8.9)	.25
Total	(n = 105)	(n = 32)				
	66.3 (16.0)	58.4 (15.2)	.02*	.05*	6.4 (−0.2, 13.0)	.03*

Abbreviations: CI, confidence interval; CGM, continuous glucose monitoring; FDR, false discovery rate.

Significant results are highlighted in bold and indicated by an Asterisk.

^aP value from Benjamini-Hochberg correction for multiple testing to control the false discovery rate (FDR) at .05.

^bAdjusted for child's age and CGM use.

Routine vs Non-Routine Reviewers

Single-centre observational cross-sectional study, n = 155 adults and 185 caregivers of children with T1D

Participants, characteristic	Routine Reviewers	Non-Reviewers	P
Adults			
Number of participants	185	136	
Mean age (years)	44.9 ± 13.3	32.9 ± 16.2	0.003
Sex (% male)	61%	48%	0.29
Ethnicity (% minority status)	11%	27%	0.15
Education level (% with at least college degree) ^a	83%	66%	0.13
Insurance status (% with non-private insurance)	11%	25%	0.18
Mean duration of type 1 diabetes (years)	28.7 ± 15.5	17.2 ± 12.7	0.0006
Mean A1c (%)	7.2 ± 1.0	8.1 ± 1.6	0.03
Children			
Number of participants	50	132	
Mean age of child (years)	10.8 ± 4.0	12.3 ± 3.9	0.02
Sex of child (% male)	58%	53%	0.55
Ethnicity (% minority status)	14%	21%	0.33
Caregiver education (% with at least college degree)	75%	64%	0.17
Insurance status (% with non-private insurance)	11%	22%	0.10
Mean duration of type 1 diabetes (years)	3.7 ± 3.1	5.5 ± 3.8	0.005
Mean A1c (%)	7.8 ± 1.4	8.6 ± 1.7	0.001

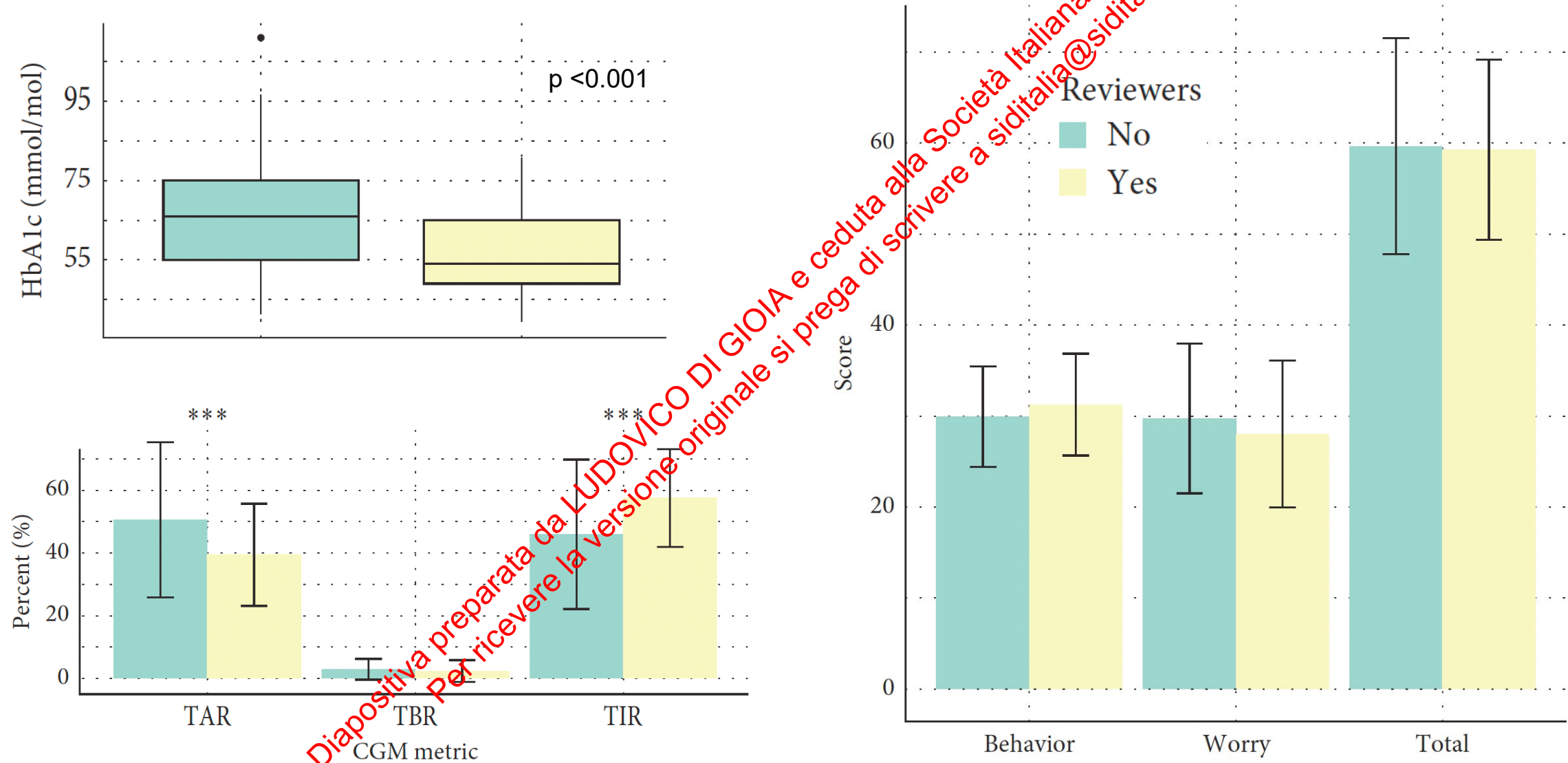
Unadjusted mean ± SD values or frequencies are shown, as indicated. *P* values were obtained from *t* tests for continuous variables and χ^2 tests for dichotomous variables.

^aParticipants 18 to <26 years of age were categorized as having a college degree if they had completed at least some college.

A1c, hemoglobin A1c.

Adolescent-Initiated Retrospective Glucose Data Review is Associated with Improved Glycemia in Type 1 Diabetes Mellitus

Single-centre observational cross-sectional study, n = 112 adolescents aged 12–18 years with T1D



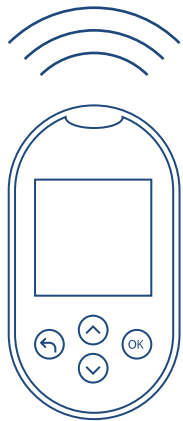
*** indicate significant difference between reviewers and non-reviewers.

Adapted from Chenoweth DJ et al. Pediatric Diabetes, 2024 Sept

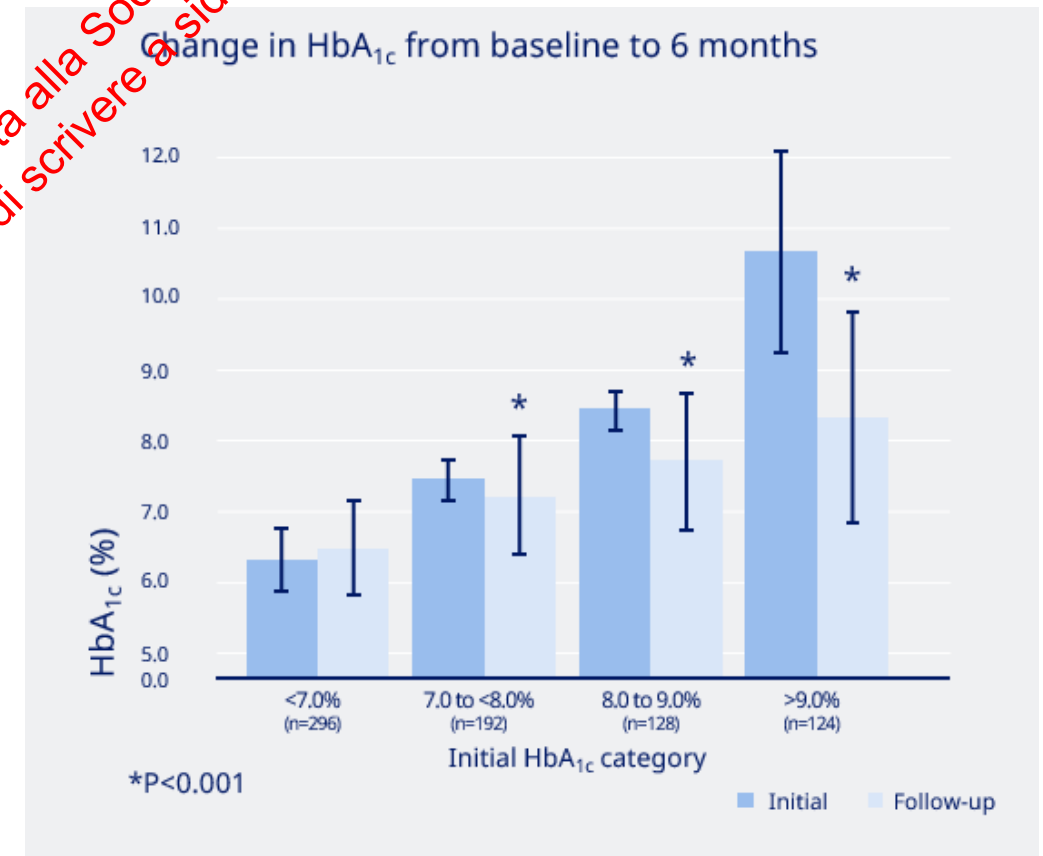
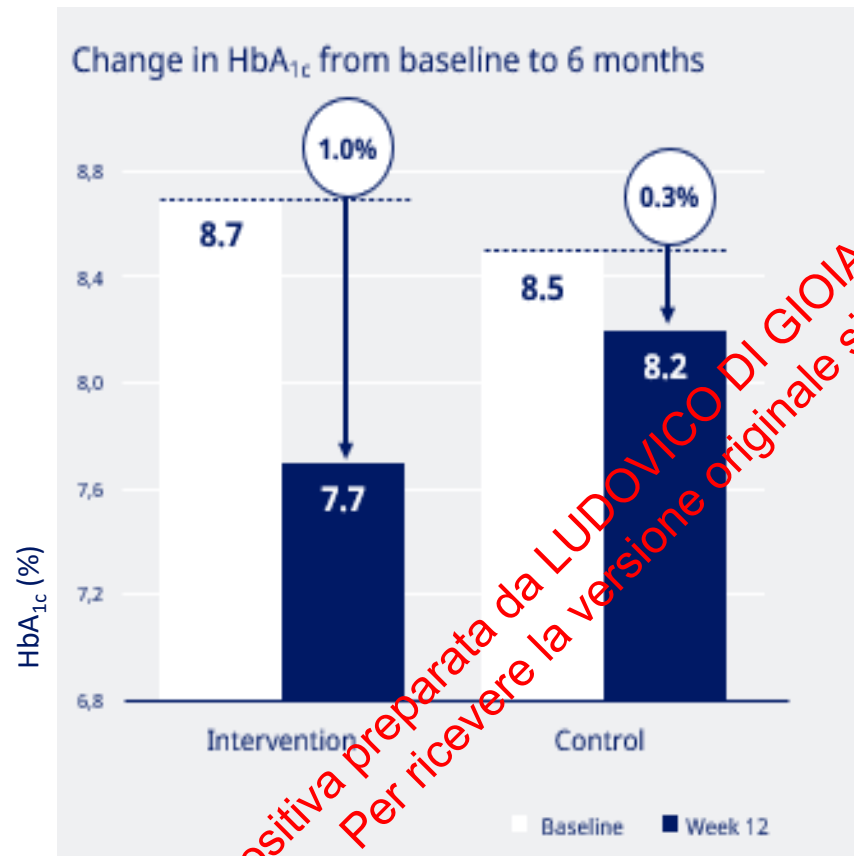
Digital Health Interventions are Associated with Improved Glycaemic Control

Glucometer + app to automatically determine the next insulin dose and HCP support compared to HCP support alone.

Virtual diabetes care model for adults with T2D combining connected devices, remote lifestyle coaching, and clinical support via a mobile app.

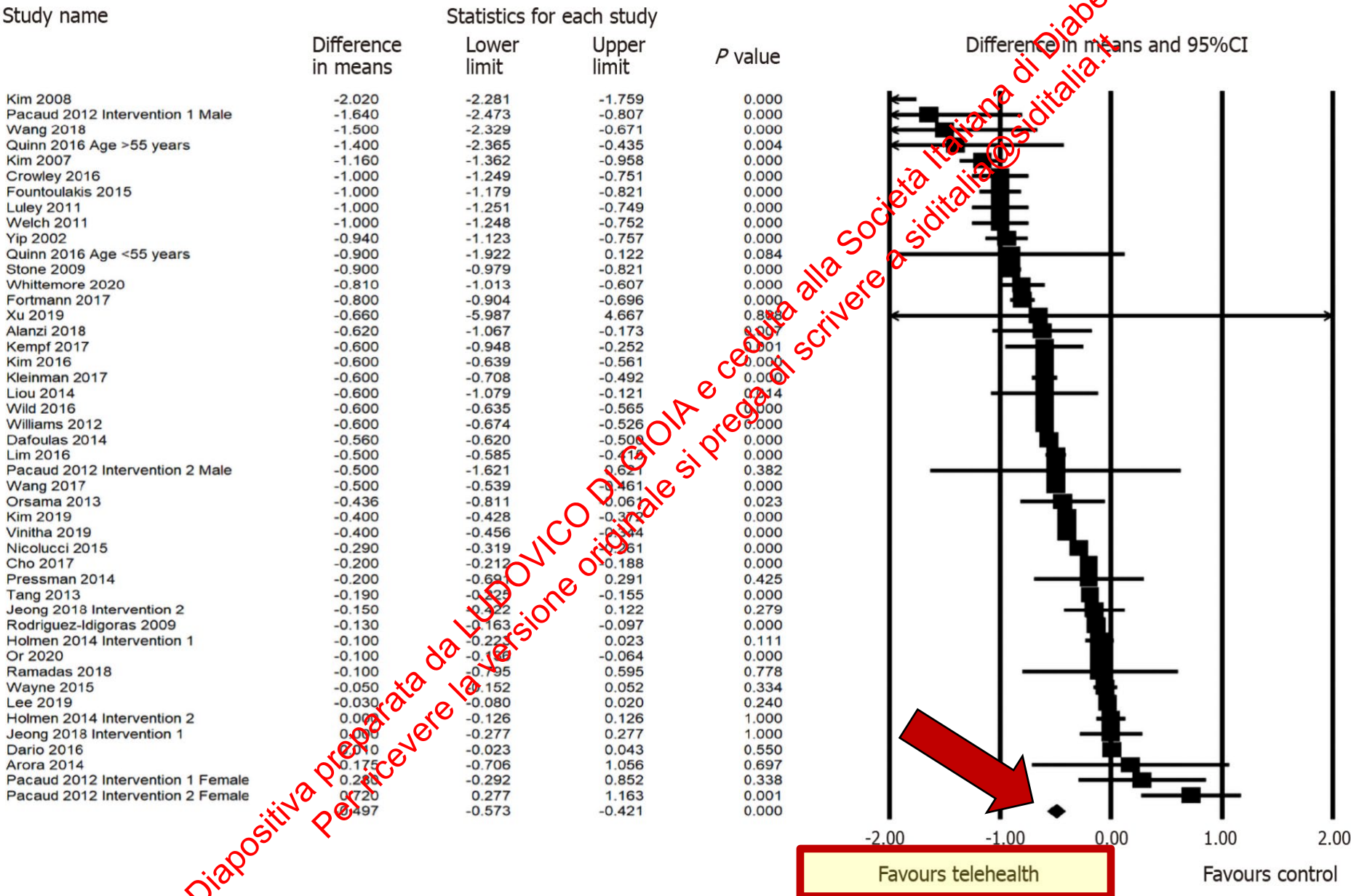


P<0.0001

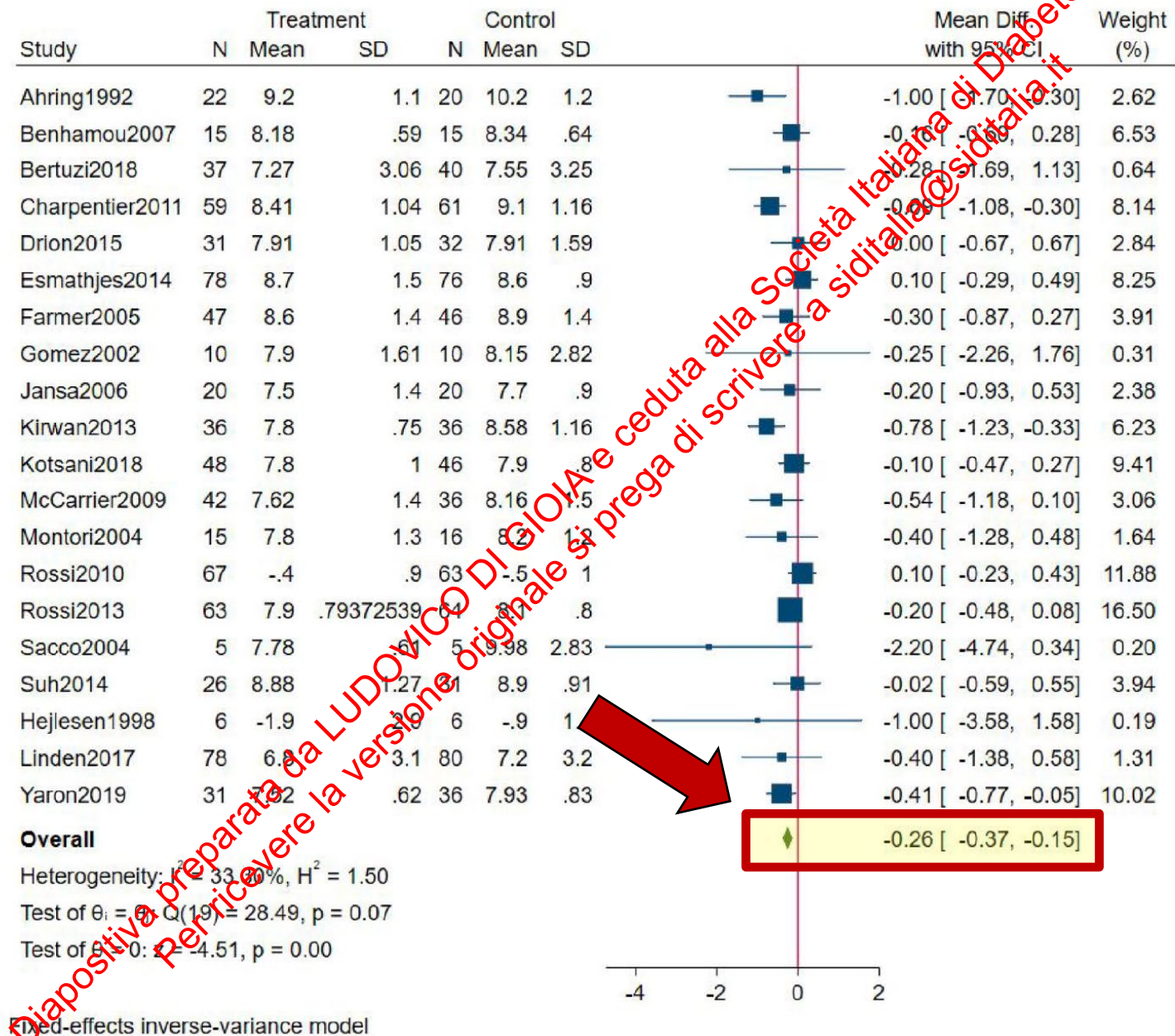


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Effects of Telehealth Intervention on HbA1c in Type 2 Diabetes



Effects of Telehealth Intervention on HbA1c in Type 1 Diabetes



Tappe Fondamentali della Televisita



- Calendarizzazione degli appuntamenti per i pazienti candidati;



- Contatto telefonico preliminare per descrivere la modalità della televisita;



- Acquisizione della ricetta dematerializzata;



- Attività di televisita utilizzando infrastrutture di telecomunicazione atte a garantire la comunicazione verso l'utente, l'acquisizione e la trasmissione dei dati;

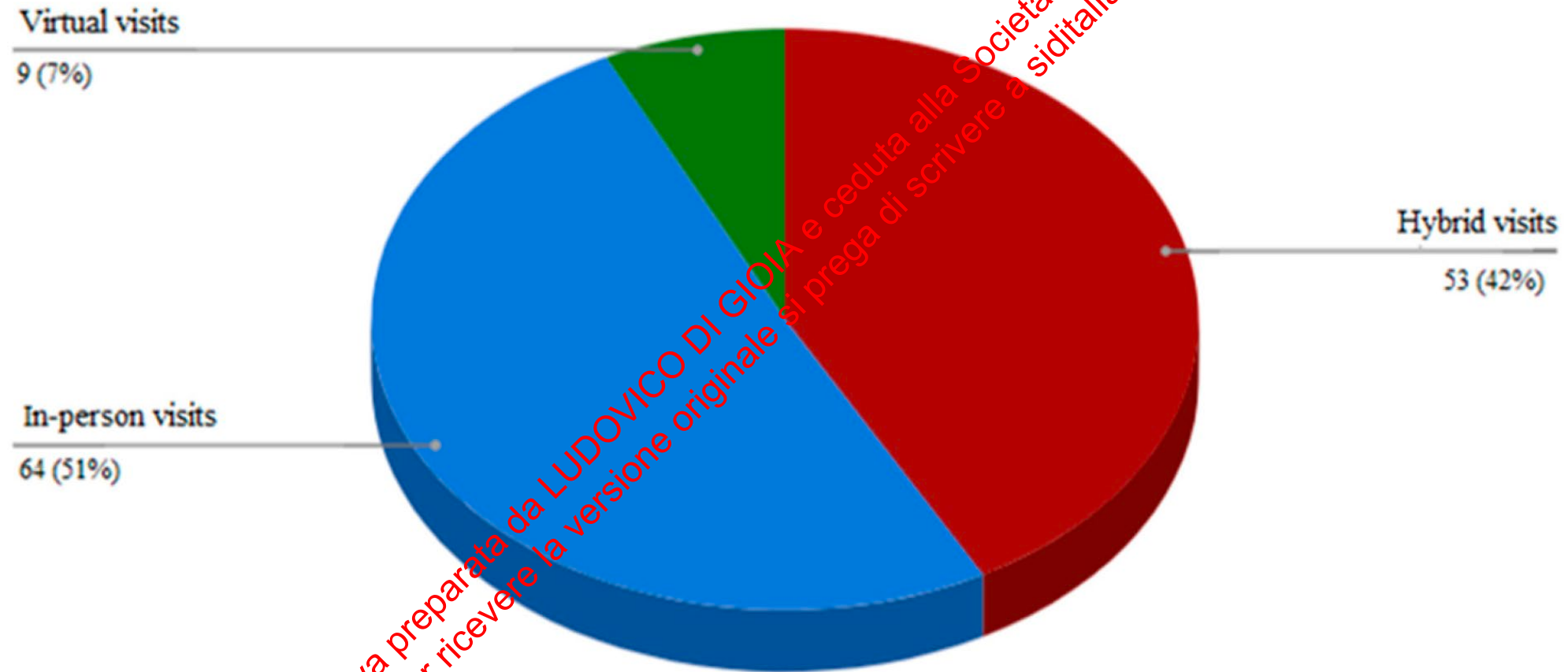


- Refertazione della televisita da inviare all'utente;



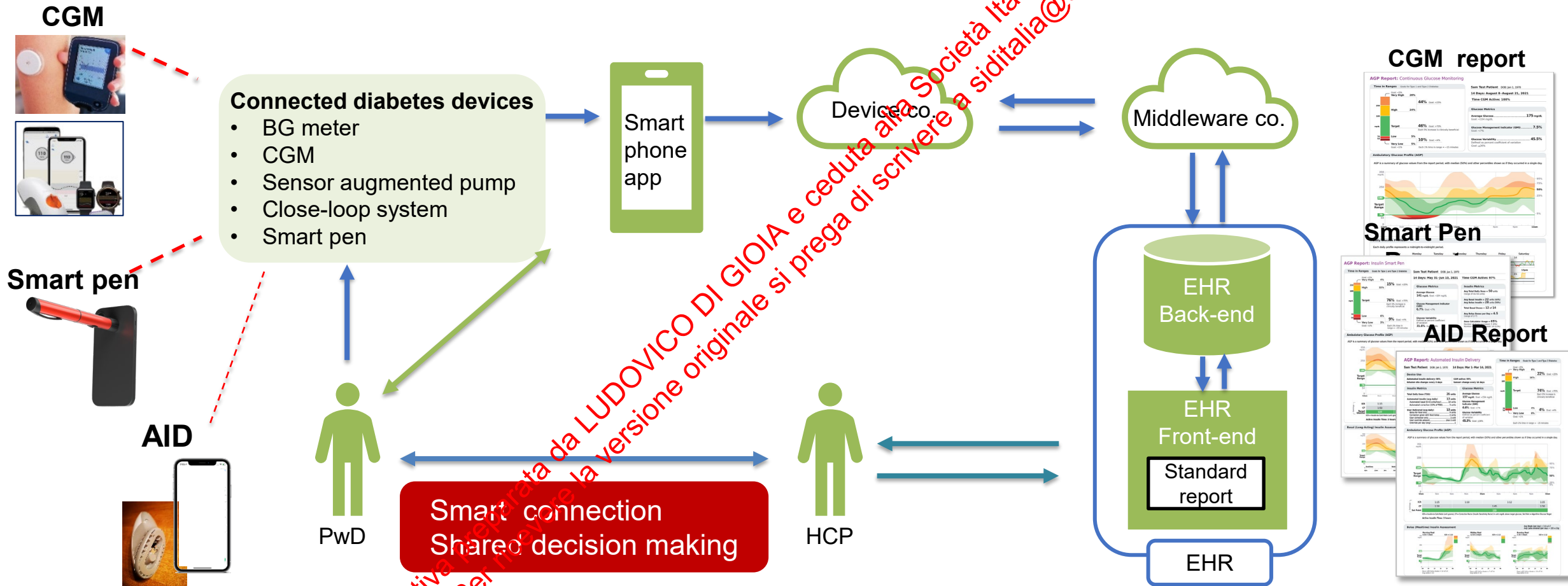
- Certificazione della prestazione sanitaria effettuata.

Many Subjects with T1D wish to Use Telemedicine in a Hybrid Format



The Digital/Virtual Diabetes Clinic

Recommendations from the International Panel on Diabetes Digital Technology



AID, automated insulin delivery; BG, blood glucose; CGM, continuous glucose monitoring; EHR, electronic health record; HCP, healthcare professional; PwD, person with diabetes.

Phillip M et al. *Diabetes Technol Ther* 2020;23:146–154.

Take Home Messages

- Applications for basal insulin titration represent the updated strategy for an "old" therapy like basal insulin.
- Titration apps help **overcome therapeutic inertia** and achieve **better** outcomes in terms of **glycemic control**, without causing an increase in hypoglycemia or negatively impacting quality of life for people with diabetes.
- The use of these technologies will improve clinical outcomes and **optimize resources**, allowing healthcare providers to focus on patients' actual needs, or to identify early those **patients who are most at risk**, ensuring better follow-up care.
- Future scenarios include the implementation of data derived from **glucometers, glucose sensors, and smart pens/caps**, and integration with **electronic health records**. Moreover, these apps will be pivotal with the introduction of **weekly insulins**.

Come Ottenere il Meglio dalla Telediabetologia?

DIABETES TELEMEDICINE

IMPROVED OUTCOMES

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