

# Smart medicinteknik som utvecklar Diabetesvården!

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What's Next  
in Diabetes?

Centre of Excellence



# Conflicts of interest

Lecture/Advisory board:

Novonordisk, Sanofi, Boehringer Ingelheim, Lilly, Abbot, Rubin Medical, Nordic Infucare, MSD, Bayer, Aibetic



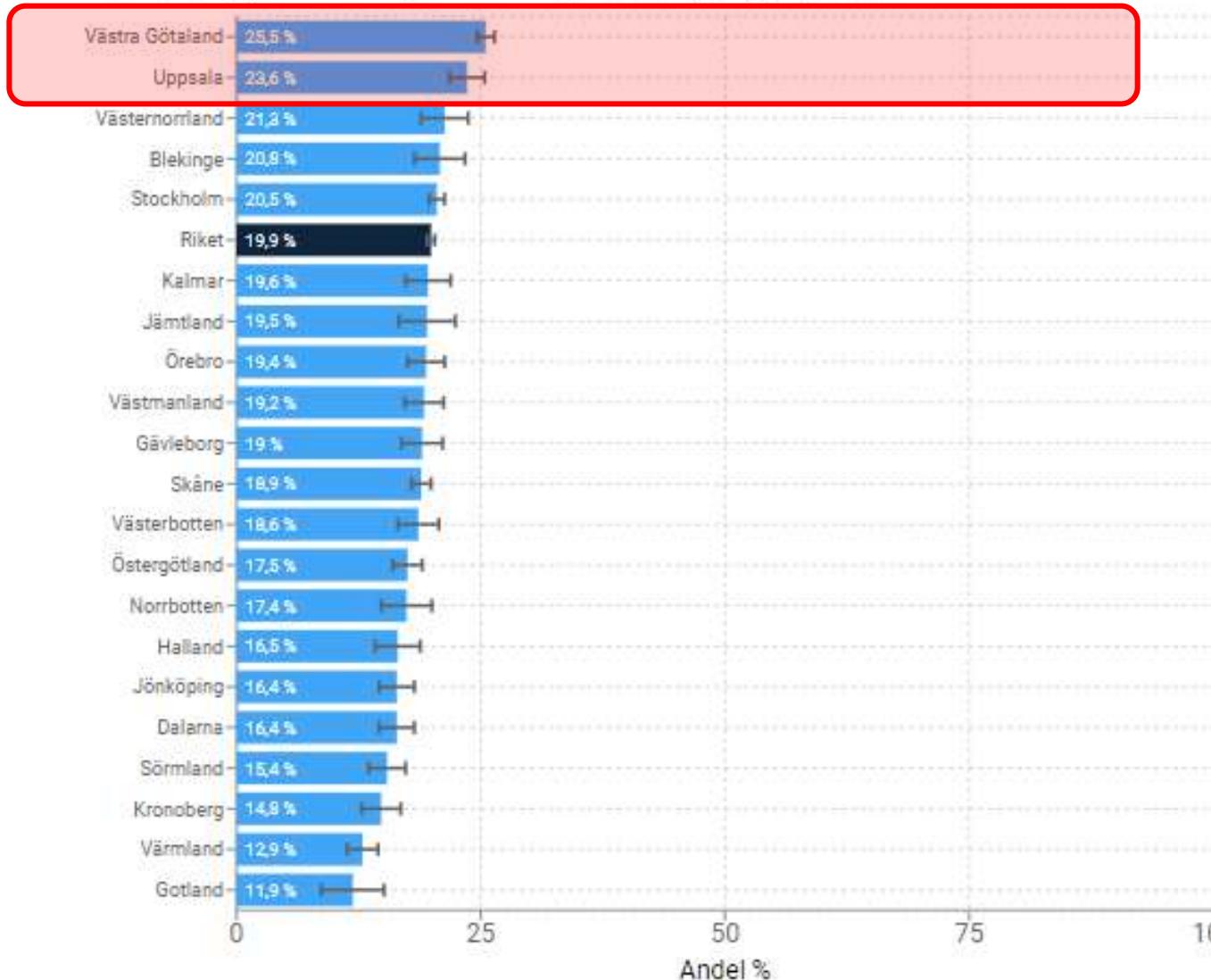




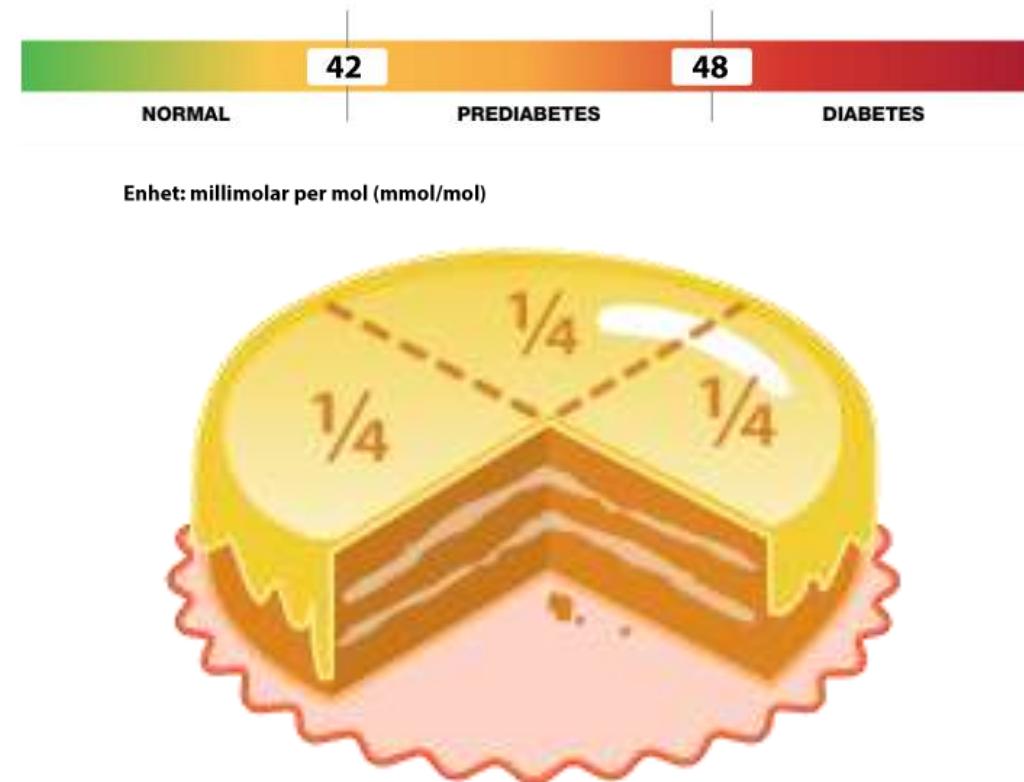
## Typ 1-diabetes Andel HbA1c ≤48

januari 2021 - december 2021

Vårdenhetstyp: Vuxenvård (Medicinklinik), Diabetestyp: Typ 1, Ålder: 18 till 99+ år



VGR och Uppsala har en fjärdedel med  $\leq 48$  mmol/mol!



## Innehåll:

1. Automatiska pumpar
2. Smarta pennor/appar
3. Icke invasiv glukosmätning

FUTURE  
TRENDS

## HYBRID CLOSED-LOOP

THE FUTURE OF  
TIRE DESIGN



# INTERNATIONAL GUIDELINES INSULIN PUMP T1D

CONSENSUS REPORT | OCTOBER 18 2021

**The Management of Type 1 Diabetes in Adults. A Consensus Report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD)** FREE

2021

## Mode of Delivery

There are several options for the mode of insulin delivery, and the choice of device should be individualized. Hybrid closed-loop systems are the most effective means of maintaining glucose in the normal range in people with type 1 diabetes ([90,91](#)).

- 90.** Bergenstal RM, et al. Safety of a Hybrid Closed-Loop Insulin Delivery System in Patients With Type 1 Diabetes. *JAMA*. 2016 Oct 4;316(13):1407-1408
- 91.** Brown SA, et al; iDCL Trial Research Group. Six-Month Randomized, Multicenter Trial of Closed-Loop Control in type 1 Diabetes. *N Engl J Med*. 2019 Oct 31;381(18):1707-1717.

Richard I.G. Holt, J. Hans DeVries, Amy Hess-Fischl, Irl B. Hirsch, M. Sue Kirkman, Tomasz Klupa, Barbara Ludwig, Kirsten Nørgaard, Jeremy Pettus, Eric Renard, Jay S. Skyler, Frank J. Snoek, Ruth S. Weinstock, Anne L. Peters; The Management of Type 1 Diabetes in Adults. A Consensus Report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes Care* 1 November 2021; 44 (11): 2589–2625.



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# Better TIR, HbA1c, and less hypoglycemia in closed-loop insulin system in patients with type 1 diabetes: a meta-analysis

Jiao X (Nanchang University, China)

Metaanalys med 11 randomiserade studier med minst 8 veckors behandlingstid med closed loop  
Totalt 817 patienter med typ 1 diabetes (både vuxna och barn)

## RESULTAT

Time In Range (3.9- 10 mmol/L): ↑ **10,32 %** (95% CI 8,70 till 11.95; p <0,00001)

HbA1c: ↓ **0.30%** (95% CI -0.41% till -0.19%, p<0.00001)

TBR (< 3,9 mmol/l): ↓ **1.09%**, (95% CI -1.54% till -0.64%; p< 0,00001)

CV (coefficient of variation of glucose): ↓ **1.41%** (95% CI -2.38 till -0.44, p=0.004)

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"CLS is a better solution than control treatment in optimizing blood glucose management in patients with T1DM. CLS could become a common means of treating T1DM in clinical practice. "





# Insulin **och** glukagon - "Back to basics..!"



# FULLY CLOSED LOOP(BIHORMORMONAL)



**Helga Blauw**



**Hans DeVries**  
Amsterdam



**INREDA DIABETIC SYSTEM, insulin och glukagon** (2 Enlite sensorer från Medtronic)

Ingen aktivitet vid måltid eller fysisk träning, **helt automatiskt system** (1-2 fingertest/dygn)

Studie Closed loop versus "open loop"?

RCT crossover design 2 veckor i varje arm utanför sjukhus (2 veckor wash out)

**23 deltagare med T1D (12- isCGM, 5- rtCGM and 6 - SMBG)**

**43 år i genomsnitt och tidigare pump > 6 månader, HbA1c 56 mmol/mol**



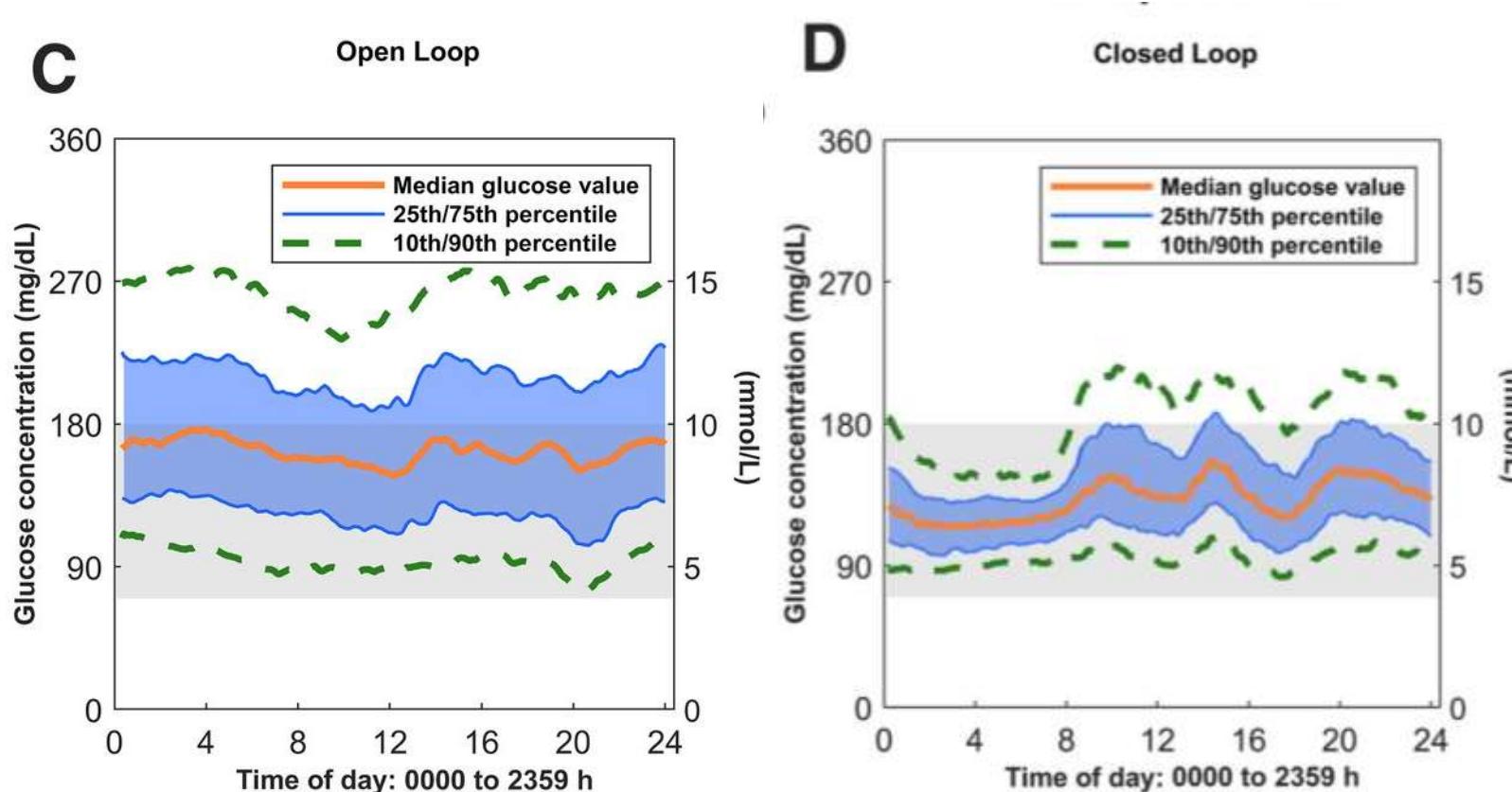
**Blauw H, Onvlee AJ, Klaassen M, van Bon AC, DeVries JH.** Fully Closed Loop Glucose Control With a Bihormonal Artificial Pancreas in Adults With Type 1 Diabetes: An Outpatient, Randomized, Crossover Trial. *Diabetes Care*. 2021 Mar;44(3):836-838.



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# FULLY CLOSED LOOP (BIHORMONAL) RESULTS

- ✓ TIR [3.9–10 mmol/L]  $\uparrow$  **22,7%!** (**86.6%** vs **53.9%**,  $p < 0.0001$ )
- ✓ Time of hypoglycemia [ $<3.9$  mmol/L]  $\downarrow$  **0.4%** vs. **2.0%** ( $P < 0.0001$ )



## Världens största closed loop studie...



# ILET BIONIC PANCREAS-FULLY CLOSED LOOP



**Steven Russell**  
Harvard, Boston

LET Bionic Pancreas (Dexcom G6) – enbart insulin

Inställningar: endast ange **patientens vikt** vid start

3 olika målvärden - normalt, högt eller lågt glukos (kan ställa in delar av dygn, t ex natt)

Ingen kolhydraträkning (måltidsannonsering) doser bestäms av pumpen, kan ej justera

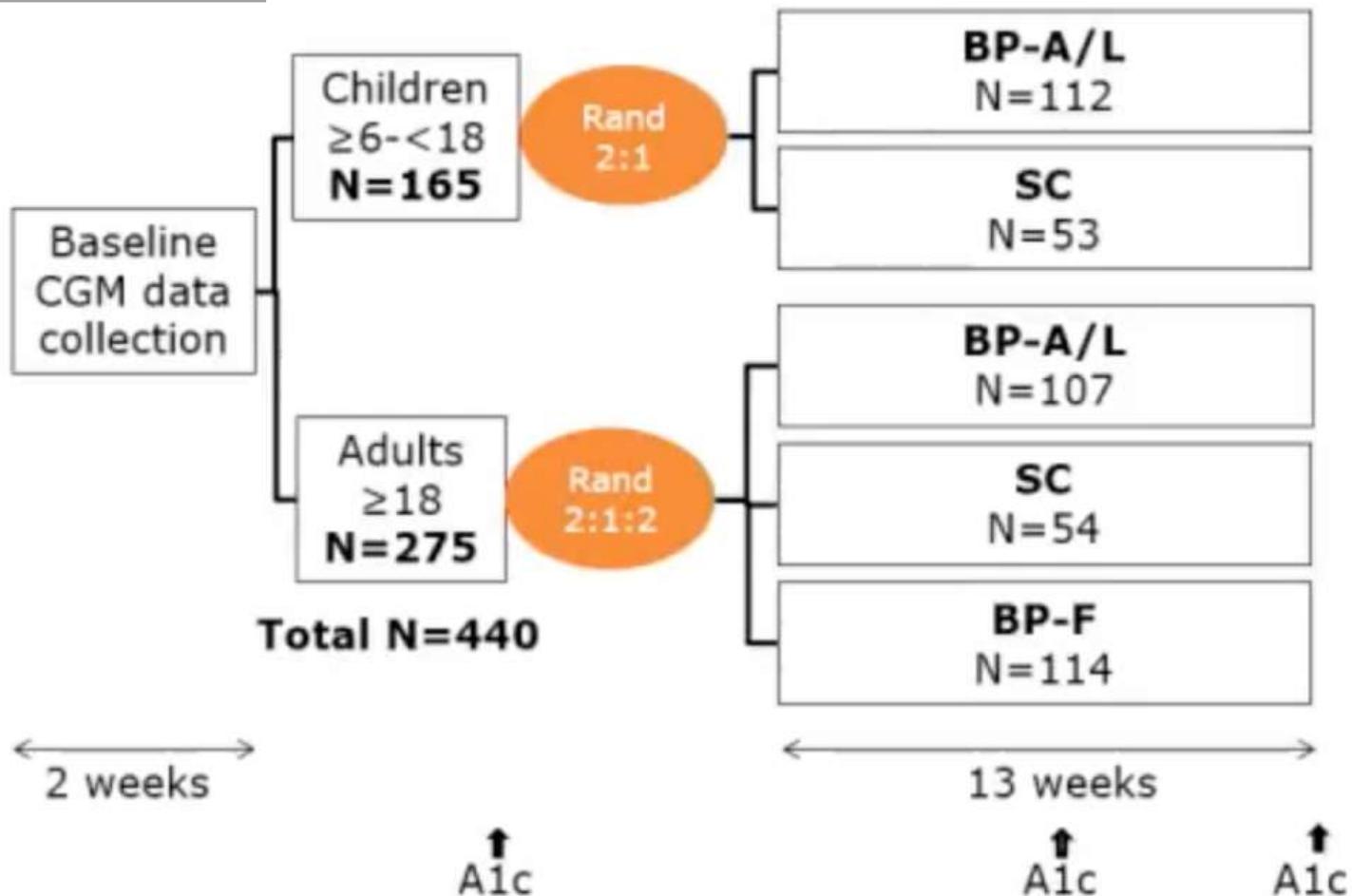
- 
- Randomiserad multicenterstudie (**17 centra, USA**) med **440 patienter under 13 VECKOR**
  - Genomsnittlig ålder **44 år (6-70 år)**, HbA1c **61/63 mmol/mol**
  - **89% med CGM (rtCGM 83%) och 31% med HCL (23% Control IQ och 8% Medtronic 670G)**



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# Pivotal Study RCT Randomization and Analysis

No restrictions diet or physical activity



\*BP-A/L: bionic pancreas aspart/lispro group, F: bionic pancreas Fiasp group, SC: standard-care group

# ILET BIONIC PANCREAS



## Resultat

HbA1c:  $\downarrow 6 \text{ mmol/mol}$  (0,5%;  $p < 0,001$ , ingen skillnad standardbehandling)

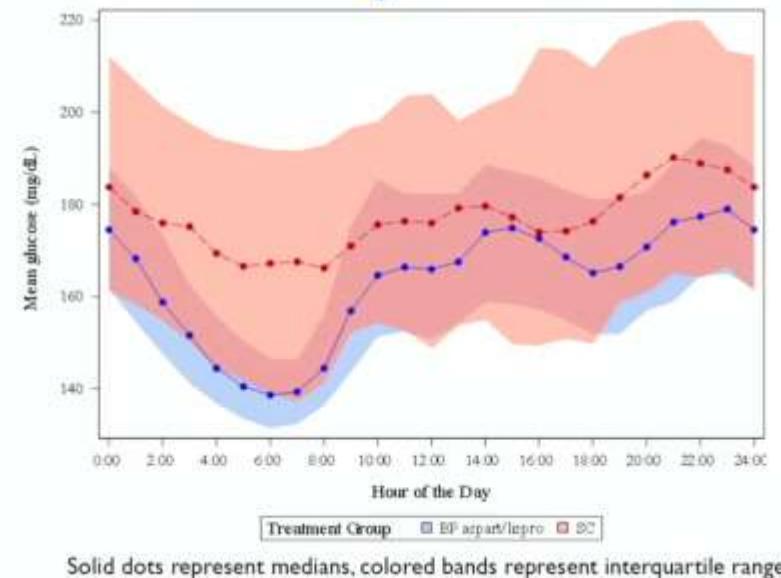
Glukos < 3,0 mmol/l: NS

Time in Range 3,9 -10 mmol/l: **65%, +11% ↑** ( $p < 0,001$ ) = 2,6 timmar/dygn

Time in Range vuxna: **71%\*/69%; + 14%\* ↑ / 11% ↑** ( $p < 0,001$ ) \*= Fiasp vuxna

Inga säkerhetsproblem avseende allvarlig hypoglykemi eller diabetisk ketoacidosis

### Mean Glucose by Hour of the Day



1.Russell SJ, et al. Abstract EASD, Stockholm. 2022 September

2.Russell SJ, Beck RW, Damiano ER, El-Khatib FH, Ruedy KJ, Balliro CA, Li Z, Calhoun P, Wadwa RP, Buckingham B, et al. Multicenter, Randomized



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# DRYGT 2 AV 3 MED TYP 1 OCH I PRINCIP ALLA MED TYP 2 DIABETES HAR FORTSATT PENNOR...



## Andel Med insulinpump

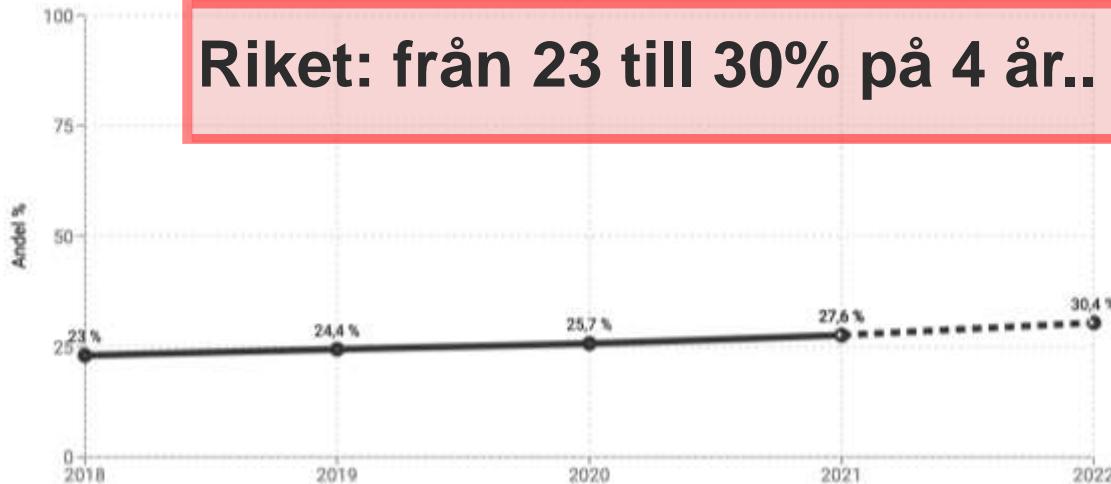
Värdenhetstyp: Vuxenvård (Medicinklinik), Diabetestyp: Typ 1, Ålder: 18 till 99+ år

Visa pågående  Anpassad y-axel   
år

Uttagsdatum: 2022-05-11

→ Riket

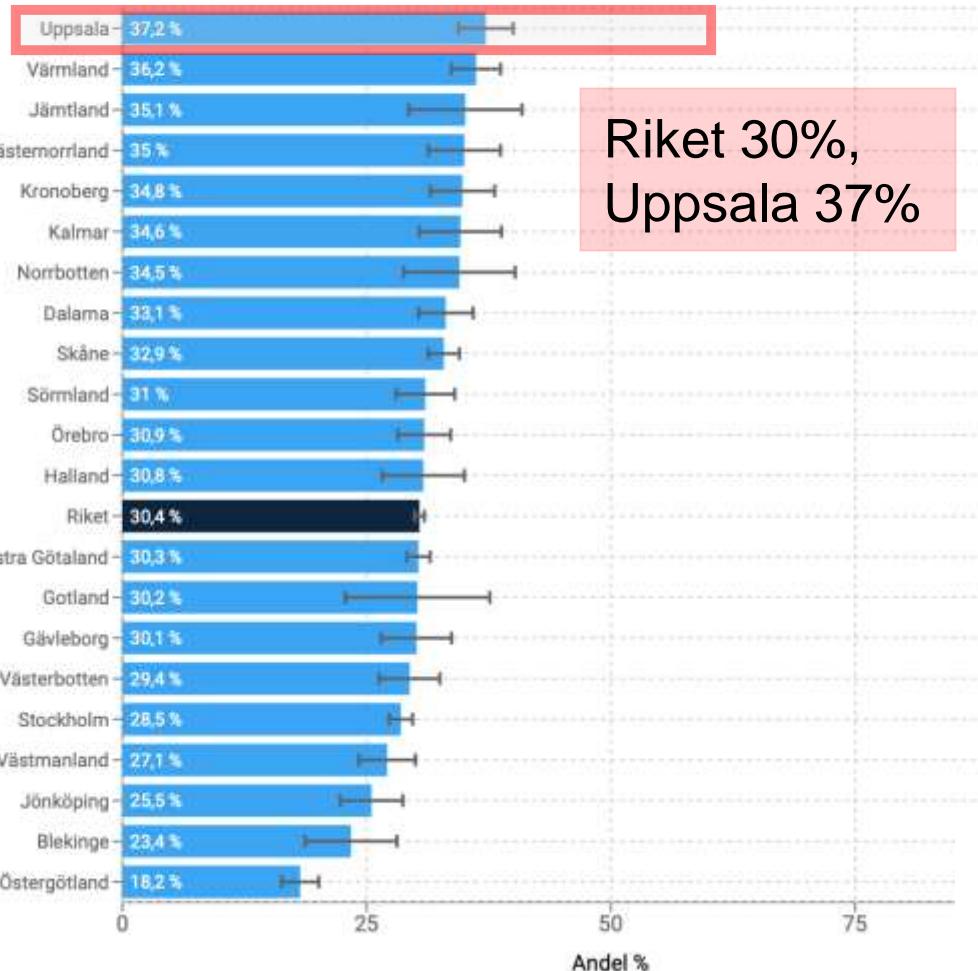
Riket: från 23 till 30% på 4 år..



## Andel Med insulinpump

januari 2022 - maj 2022

Värdenhetstyp: Vuxenvård (Medicinklinik), Diabetestyp: Typ 1, Ålder: 18 till 99+ år



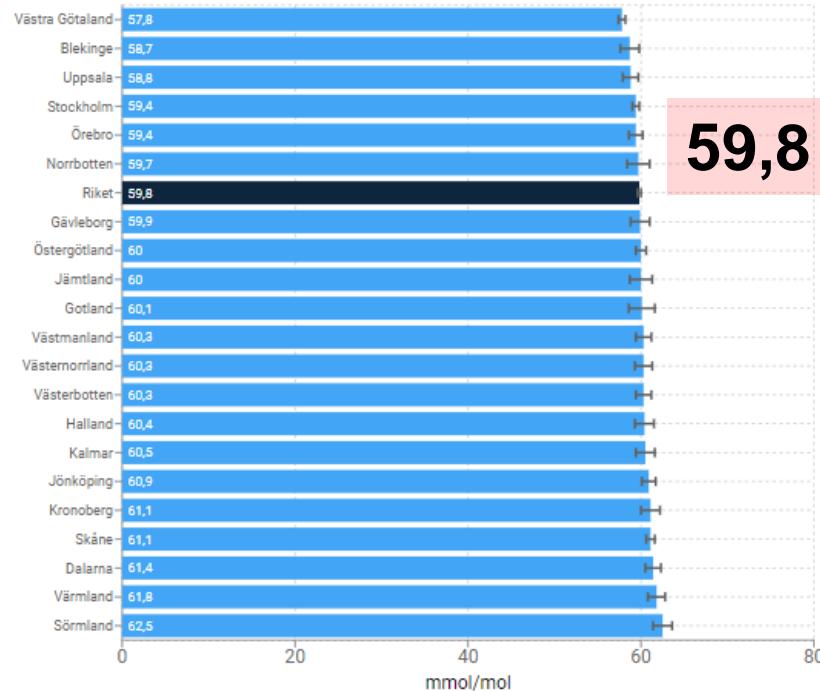
# PUMP MED CGM GER BÄTTRE HBA1C VS PENNA MED CGM

## Typ 1-diabetes

### Medelvärde HbA1c

januari 2021 - december 2021

Vårdenhetstyp: Vuxenvård (Medicinklinik), Diabetestyp: Typ 1, Diabetesbehandling: Insulin, Metod att ge insulin: Injektion, Kontinuerlig glukosmätning (CGM/FGM): Ja, Ålder: 18 till 99+ år

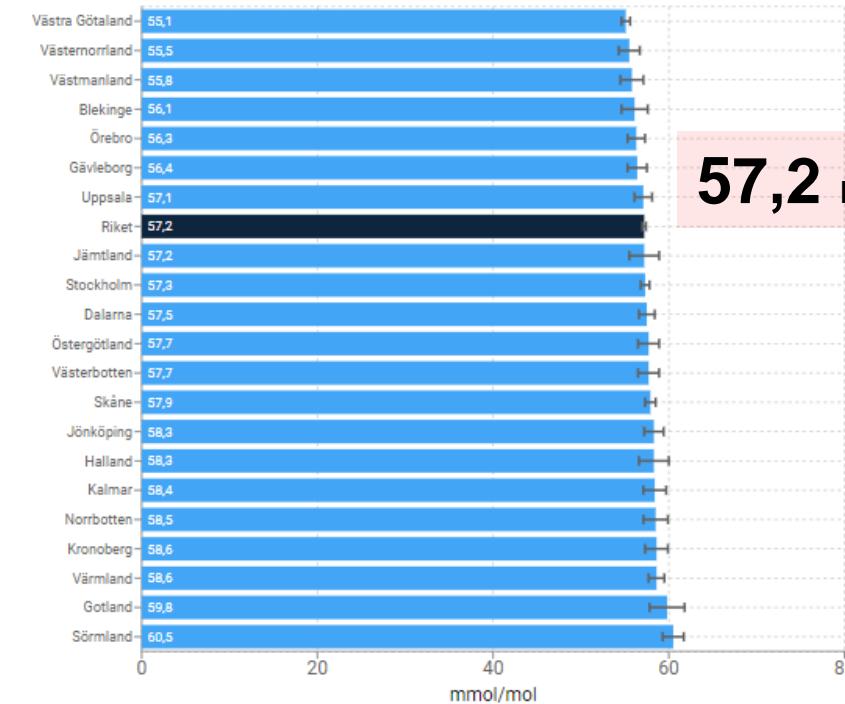


**59,8** mmol/mol

### Medelvärde HbA1c

januari 2021 - december 2021

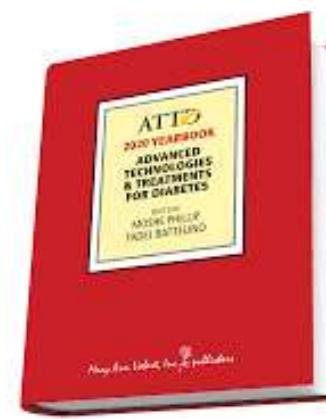
Vårdenhetstyp: Vuxenvård (Medicinklinik), Diabetestyp: Typ 1, Diabetesbehandling: Insulin, Metod att ge insulin: Insulinpump, Kontinuerlig glukosmätning (CGM/FGM): Ja, Ålder: 18 till 99+ år



**57,2** mmol/mol

	HbA1c riket	Akademiska
CGM + penna	59,8 mmol/mol	58,6 mmol/mol
CGM + pump	57,2 mmol/mol	56,7 mmol/mol
<b>FÖRDEL PUMP</b>	<b>- 2,6 mmol/mol</b>	<b>- 1,9 mmol/mol</b>

ORIGINAL ARTICLE

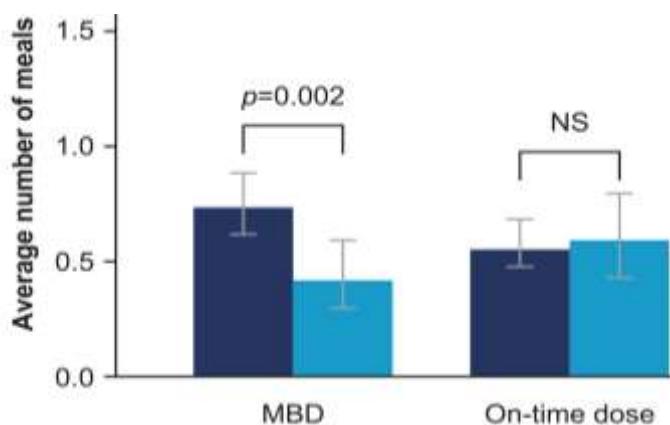


## Increased Time in Range and Fewer Missed Bolus Injections After Introduction of a Smart Connected Insulin Pen

Peter Adolfsson, MD, PhD,<sup>1,2</sup> Niels Væver Hartvig, MSc, PhD,<sup>3</sup> Anne Kaas, MD, PhD,<sup>4</sup>  
 Jonas Bech Møller, MSc, PhD,<sup>5</sup> and Jarl Hellman, MD<sup>6</sup>

Pilotstudie 94 st med typ 1 diabetes (12 centra,  $\geq 5$  besök):

1. TIR (3,9-10 mmol/l)  $\uparrow 8\%$ , +1.9 tim/dygn ( $p<0.001$ )
2. HYPO (<3,0 mmol/l)  $\downarrow 1,5\%$ , -0.3 tim/dygn ( $p=0.004$ )
3. MBD (missade bolus)  $\downarrow 43\%$ , från 0.74 st/dygn till 0.42 st/dygn ( $p=0.002$ )





# The Segoclock2 trial



EFFICACY OF THE INSULIN PEN SMART  
CAP INSULCLOCK IN PEOPLE WITH  
UNCONTROLLED TYPE1 DIABETES  
MELLITUS (T1DM): A MULTICENTER,  
RANDOMIZED CLINICAL TRIAL

Fernando Gomez-Peralta,  
Endocrinology and Nutrition Unit.  
Hospital General de Segovia  
Spain

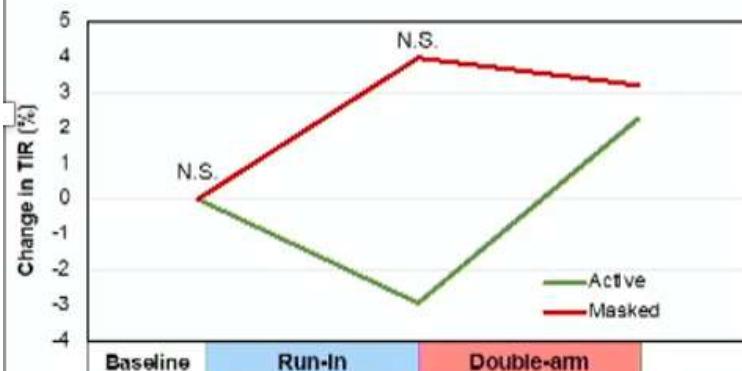


- RCT (1:1) 55 patienter, 41 år, GMI 59 mmol/mol, TIR 56% , TBR 4% CV 36%
- (Abstract ATTD-22)



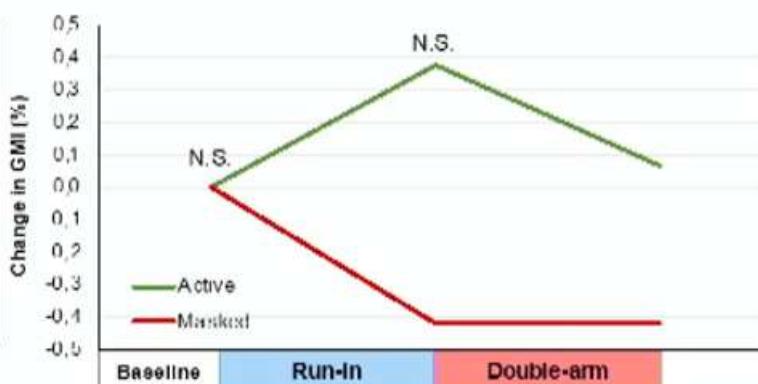
## Results: glycemic control

**Increase in TIR**



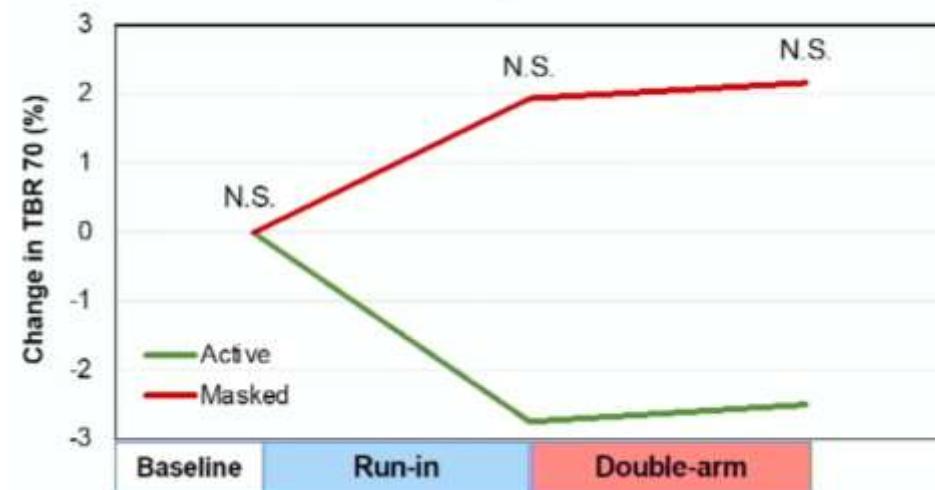
**+5.2% vs -0.8%,  
Dif +6%; p = 0.016**

**Reduction in GMI**



**-0.3% vs 0.01%,  
Dif -0.3%; p = 0.024**

**No change in TBR**





## Results: Insulin injections adherence



# Promising Performance of a Non-Invasive Glucose Monitoring System

Irl B. Hirsch, MD



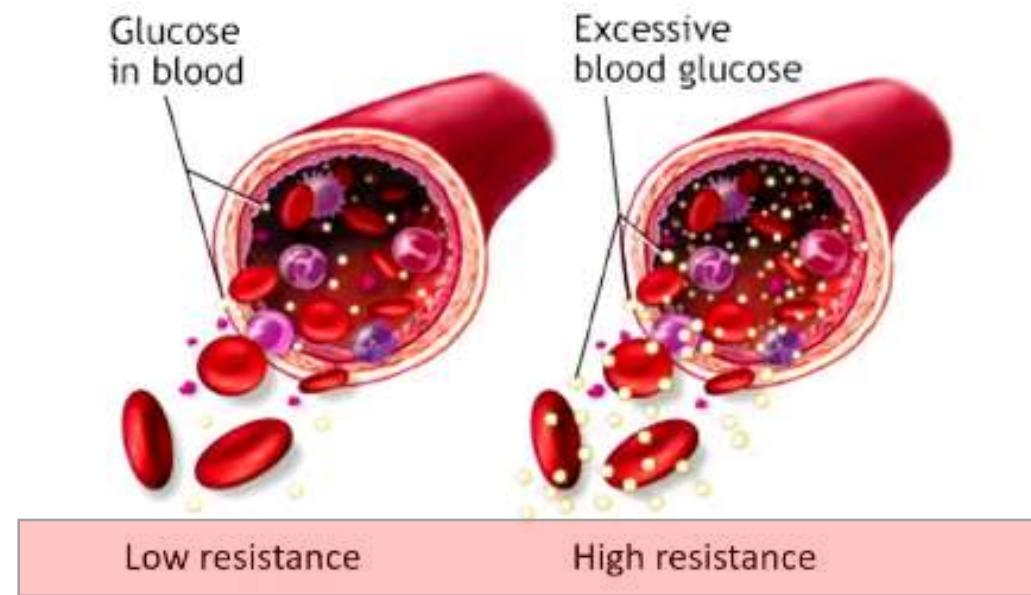
## RADIOFREQUENCY (RF) TECHNOLOGY





# Skin Impedance and Glucose Levels

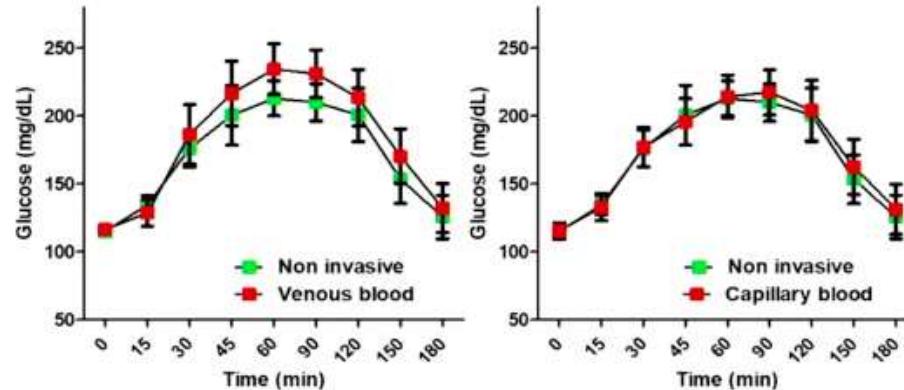
- Previous studies show that skin impedance measured in high frequency (>200 kHz) can reflect the electrical properties of the deeper layers of the skin.
- At these frequencies, the influence of the epidermis decreases dramatically, *and skin impedance-based techniques can effectively estimate changes in blood glucose levels.*
- The appropriate model for blood conduction (or resistance) assumes an insulating and conductive phases.



# Clinical Data: Study 1

75 g OGTT at Sheba Medical Center

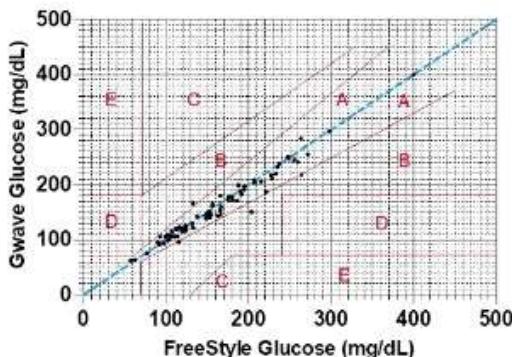
N = 5 with 45 data points; comparator = Abbott Freestyle blood glucose strip and venous glucose



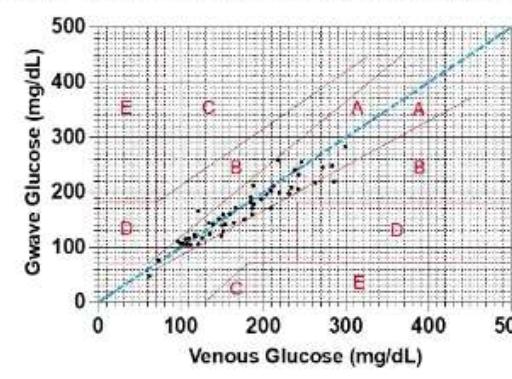
## Aggregate Data to Date

- N=53

Gwave-FreeStyle correlation Overlayed on a Clarke Error Grid



Gwave-Venous correlation Overlayed on a Clarke Error Grid



- The data to date suggests the Gwave monitor may be an excellent noninvasive substitution to our current invasive CGM. The hope is this revolutionary technology will replace our current interstitial CGM.



# FDA Breakthrough Status



October 22, 2021

Hagar NIG  
 Taire Rubin, Partner  
 Andrei Sakharov 9 Street  
 Matam Park, Building 15  
 Haifa, 3508409  
 Israel

Re: Q211753  
 Trade Device Name: GWave Non-Invasive Continuous Glucose Monitoring (CGM) System  
 Received: August 25, 2021

Dear Taire Rubin:

The Center for Devices and Radiological Health (CDRH) of the Food and Drug Administration (FDA) has received the above submission requesting designation as a Breakthrough Device. The proposed indications for use includes:

\*The GWave Glucose Monitoring System (GWave) is a real time, non-invasive, continuous glucose monitoring device indicated for the management of diabetes in persons.\*

## OCTOBER 22, 2021

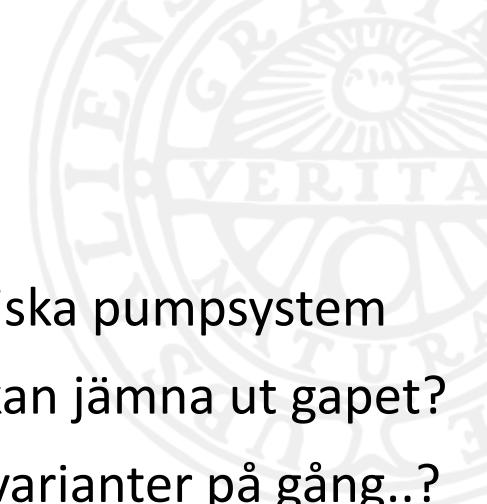


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**Var inte för  
optimistisk  
Ljuset i tunneln  
kan vara ett tåg!**





# SAMMANFATTNING

- ✓ HCL ger allra bäst resultat idag vid T1D och runt hörnet fullt automatiska pumpsystem
- ✓ Pump ger bättre kontroll än pennor med nya smarta pennor/appar kan jämna ut gapet?
- ✓ CGM är standard vid T1D, blir allt bättre (MARD↓) och icke invasiva varianter på gång..?
- ✓ **HbA1c < = 48 mmol/mol ett allt mer vanligt resultat vid typ 1 diabetes...**



# THANK YOU FOR LISTENING

