



# OPEN SOURCE ARTIFICIAL PANCREAS SYSTEMS USED FROM BULGARIAN CHILDREN AND YOUNG PEOPLE WITH DIABETES

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## INTRODUCTION:

Do It Yourself /DIY/ - an online platform for sharing knowledge and experience among the users.

Patients and parents of children with diabetes created and started to use Open Source Artificial Pancreas System (Loop - Dana Lewis /Medtronic/ and AndroidAPS - Milos Kozak /DanaR/) insulin pump, controlled by a glucose sensor (Dexcom or Enlite) via the internet - based Nightscout platform for remote monitoring of the interstitial glucose either by the patients, family members or the treating team.

### How the system works (1)?

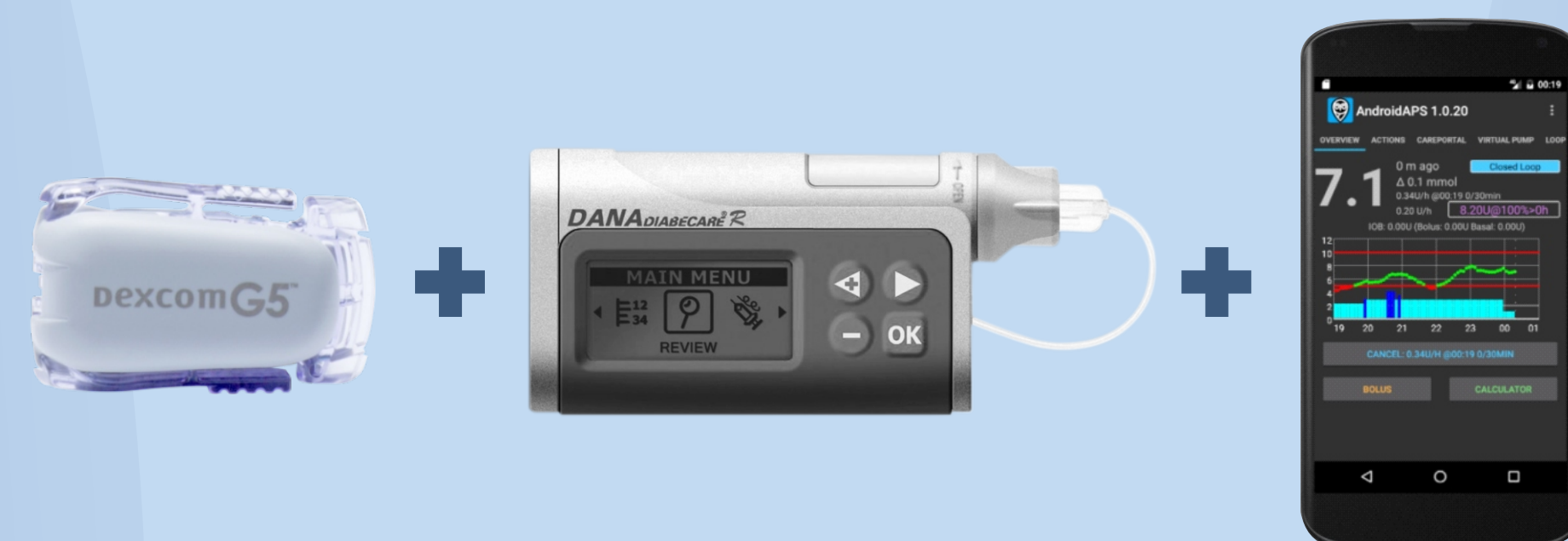
1. Every 5 minutes the proposed glucose value based on the actual one, its tendency, the active insulin and the patient's profile /Carb ratio and Insulin sensitivity/ is calculated. The result is compared with the target and changes the Temporary basal are done.

- The CHO are announced.
- The treatment can be commanded by a parent/caregiver remotely through "sms" function.
- Small Micro Bolus "smb" is an option to give more insulin upfront instead of letting temporary basal run for a longer time.

## Android APS



- ✓ CGM: DEXCOM G4, G5, FREESTYLE LIBRE (XDRIP)
- ✓ ANDROID GSM VERSION > 5
- ✓ DANAR PUMP
- ✓ ANDROIDAPS APP
- ✓ NIGHTSCOUT & NSCLIENT



In Bulgaria more than 100 T1D patients use Open APS. The systems are applied by the patients/parents step-by-step, educated for its use and controlled by the creators and the team of the parents association "Culture without borders".

## OBJECTIVES:

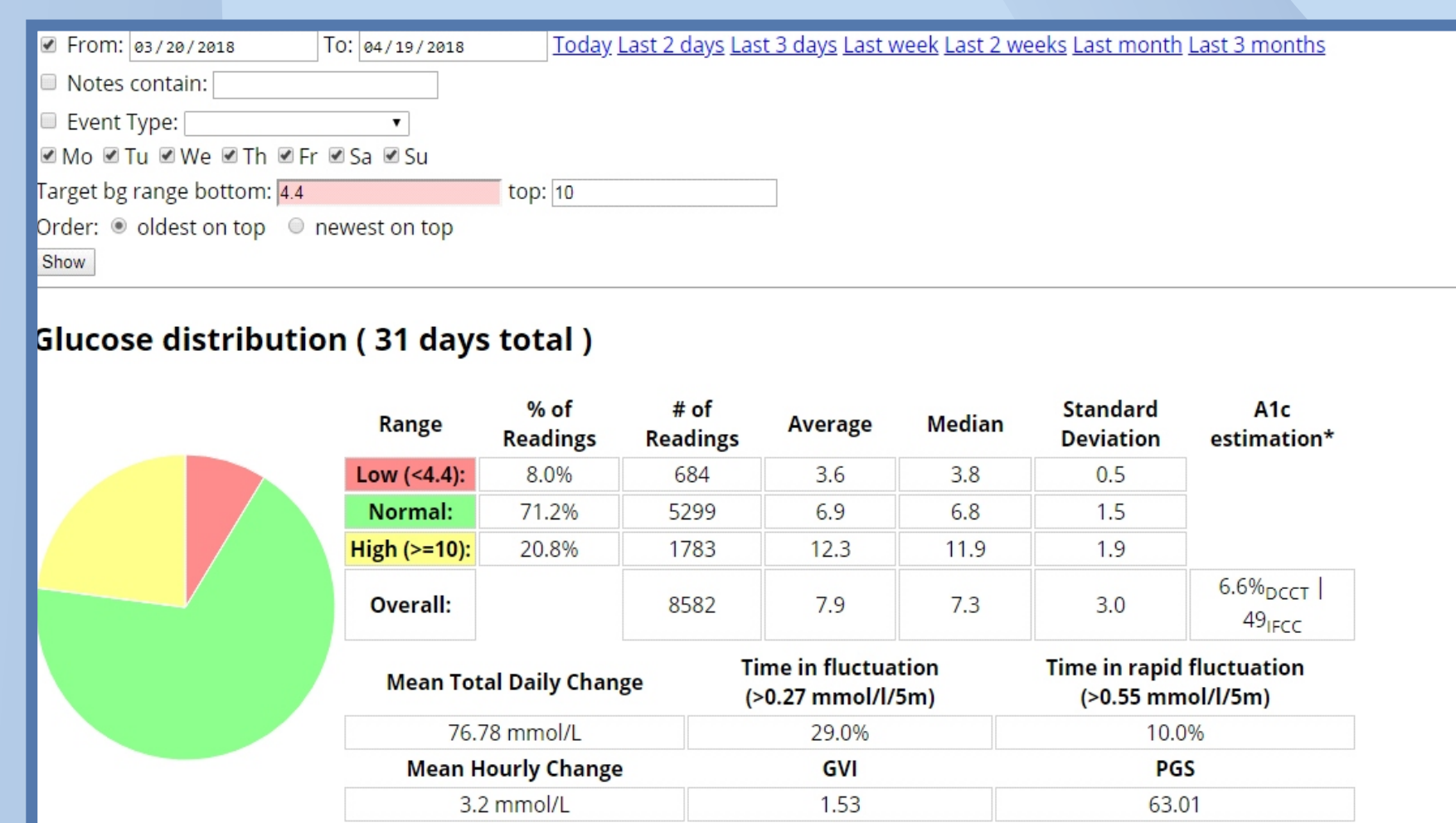
To present the results for 20 Bulgarian patients with AndroidAPS and Loop, who gave the presenters access to their Nightscout data.



## MATERIALS AND METHODS:

20 patients (6 males), average age 13.5 yrs (3.8-39.9); Duration of T1D -7.52 yrs (1.8 to 28.3); 18 - using AndroidAPS and 2 - using Loop with 3 months to 2.3 years duration; Variation analysis was applied for the data obtained from Nightscout platform.

The evaluated data comprised: % low <4.4/, % in range 4.4 - 10.0; % high >10.0 mmol/L, HbA1c in % and Mmol/Mol; GVI /glycemic variability index/ and PGS /patient's glycemic status/ - both elaborated by Dexcom (2).



## RESULTS:

Nightscout Data from April and September 2018 for both 90 and 30 days are shown on the Table.

### 1. Stable overall control:

- HbA1c - <6.6% (48Mmol/Mol)
- Hypoglycemia is <7%
- In range - 76%
- High < 18%

### 2. Indices for the glycemic variability are in the range of the optimal values:

- GVI: 1.38 - 1.41
- PGS < 48

### 3. No severe hypoglycemia or DKA have been observed.

### 4. All the patients and parents show high satisfaction from the APS and no one has refused the systems.

### 5. The existing differences for the individual parameters give opportunities for the patients/creators/physicians to fine-tune the personal settings and evaluate the results.

April 2018	%Hypo <4.4 mmol/L	%In range >4.4-<10.0	%Hyper >10.0	HbA1c %	HbA1c Mmol/Mol	GVI (<1.5)	PGS (35-100)
30 days	5.9	76.1	17.96	6.43	46.71	1.39	46.1
90 days	7.0	76.3	16.3	6.44	46.9	1.41	48
Sept. 2018							
30 days	6.39	75.88	17.63	6.55	48.0	1.38	46.16
90 days	6.09	76.01	17.88	6.57	48.0	1.41	45.76

## IN CONCLUSION:

DIY OpenAPS and AndroidAPS show safety of the systems, excellent results for all the parameters for precise control of diabetes, as well as high satisfaction of the treatment options.

## REFERENCE:

- <https://openaps.readthedocs.io/en/latest/docs/while%20You%20Wait%20For%20For%20Gear/Understand-determine-basal.html>
- <http://web.archive.org/www.healthline.com/diabetesmine/a-new-view-of-glycemic-variability-how-long-is-your-line/gvi-calculation>

The authors declare no conflict of interests.

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