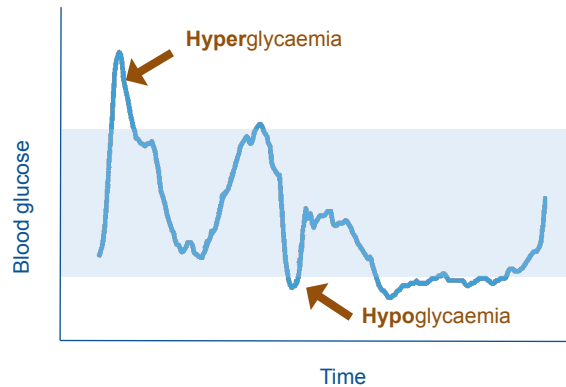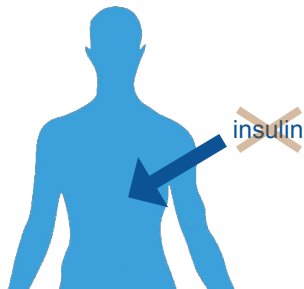# Cycling analytics for individuals with Type 1 Diabetes

A project in collaboration with Team Novo Nordisk and the Bern University Hospital

Eva van Weenen | May 12, 2021

Background - Type 1 Diabetes

Hyperglycaemia

Blood glucose

Hypoglycaemia

Time

In individuals with **Type 1 Diabetes**, the pancreas does not produce enough insulin to regulate blood sugar. It is therefore important for individuals with Type 1 Diabetes to keep their blood glucose within a **target range**. Otherwise they risk having either too high blood glucose levels (**hyperglycaemia**), with long-term effects of damage to the nerves, kidneys, bloodvessels and eyes. Or they risk having too low blood glucose levels (**hypoglycaemia**), which may lead to acute seizures, loss of consciousness, heart arrhythmia, coma or even death. This can be regulated with **continuous glucose monitoring**.

Background - Exercise and diabetes

Regular exercise is recommended for individuals with diabetes

Essential for health, fitness and longevity

Exercise with Type 1 Diabetes is **challenging**

- There are many variables that can cause blood glucose to fluctuate significantly
- For individuals engaging in *professional* endurance exercise, there is less information about the needs and about the real-time glycaemic response

<u>Objective</u>: Support professional cyclists with Type 1 Diabetes in glucose management during exercise

Regular exercise is **essential** for individuals with both types of diabetes, for health, fitness and longevity. For example, it can reduce risk factors for cardiovascular disease. In addition, exercise can improve blood glucose control and insulin sensitivity. However, exercise for individuals with Type 1 Diabetes is also **challenging**. There are many factors that can influence blood glucose during exercise, which must be balanced with insulin and the right amount of carbohydrates. For medium-level intensity sports, glycaemic management has been well documented. However, for **professional** endurance sports, there is still a gap that needs to be bridged. For endurance exercise on a professional level, there is much less information about the needs of the individual, as well as the real-time glycaemic response. Our **objective** of this project is therefore to support professional sportsmen with Type 1 Diabetes in their glucose management during exercise. As this project is together with Team Novo Nordisk, we are analyzing the data of professional **cyclists**.

Data - Team Novo Nordisk

11 professional cyclists over the course of one training season (year)
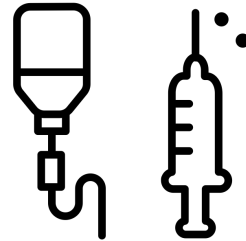
Cycling   **Glucose**

For this project we are analyzing the data of Team Novo Nordisk. This is a professional cycling team solely consisting of people with diabetes. They closely manage their diabetes while training and competing at a professional level. The data from Team Novo Nordisk consists of the cycling data and glucose data of 11 professional athletes over the course of one training season (year).

Data - Team Novo Nordisk

11 professional cyclists over the course of one training season (year)

Cycling

Glucose

heart rate

power

bike computer

CGM (dexcom)
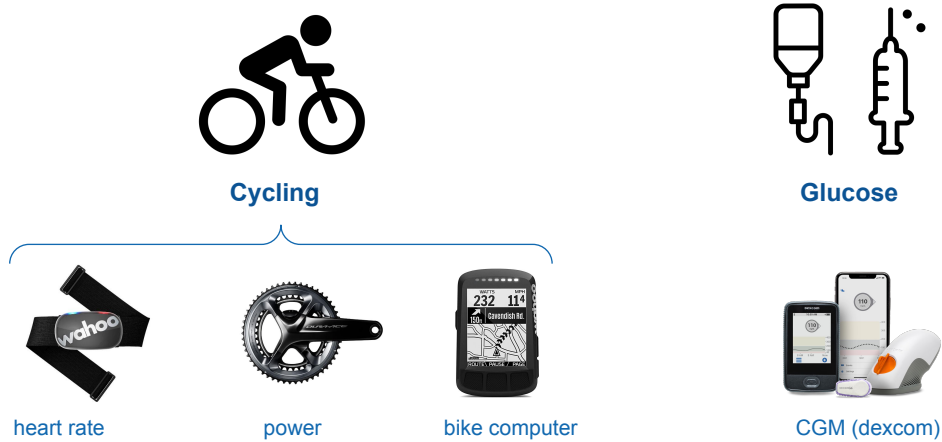
The data that we have during their training sessions consist of a heart-rate band, a power monitor (which can also distinguish between left and right), as well as a bike computer (giving insights into the location, speed, altitude, etc.). This data is at a 1 second interval during each training session. These athletes use the real-time continuous glucose monitoring system "dexcom", which tracks glucose levels continuously at a 5 minute interval. Note that the glucose levels are measured in the interstitial fluid, which shows a 15 minute delay with respect to the blood.

Data - Example of one training session
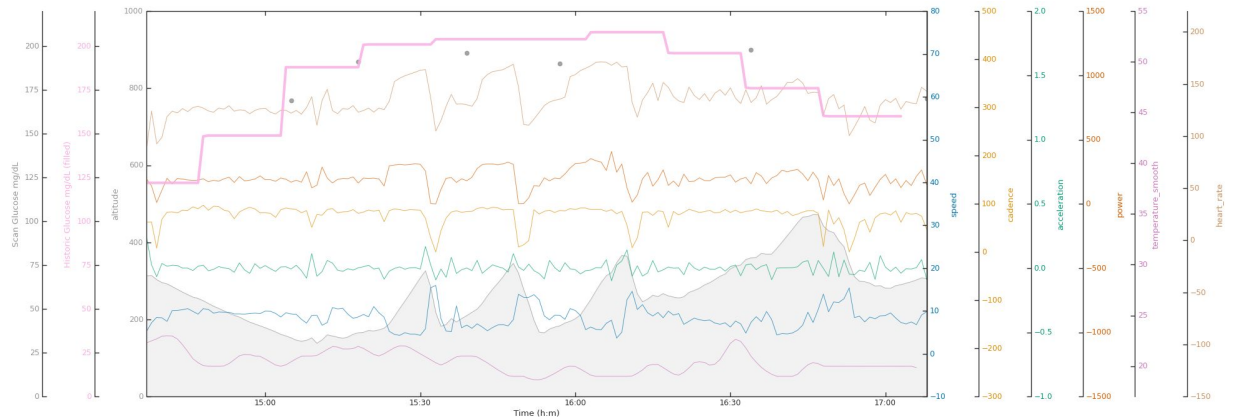
Objective

Support professional cyclists with Type 1 Diabetes in glucose management during exercise

1 Insights in glucose levels *before-*, *during-* and *after* training sessions

Time spent in glucose levels hypo (L1 and L2), within range, and hyper (L1 and L2)

2 Association of **training sessions** with time spent in glucose levels

Correlation between variables such as power, altitude, training stress score, etc. from a training session with glucose

3 **Predict future glucose levels** based on current and past glucose and current and past exercise

More accurate prediction of future glucose + insights in glycaemic response during exercise

The data that we have is quite unique, as it is data of *professional* athletes with Type 1 Diabetes over the course of one year. Therefore there are various ways in which this data can be analyzed.
(List enumeration)
In this way we aim both to support the athletes in their glucose management, e.g. improve it, as well as generate potential insights in the glycaemic response during endurance exercise.

Questions?