Bass Model and Look-alike Analysis

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```
knitr::opts_chunk$set(echo = TRUE)
library(ggplot2)
library(diffusion)
library(readxl)
library(ggpubr)
```

Innovation The aim of this short research is to perform a look-alike analysis with the bass diffusion model to understand the possible behavior of new products in the market. For this research was selected AI-powered smart device"iLet Bionic Pancreas" that links to a tube plugged into a patient's body for getting the dosage of insulin right.

Chosen product has a high potential for growth, since the healthcare industry is getting bigger every year, and the number of people who has Diabetes is also rising. This device will be used by patients to monitor their condition and glucose level constantly, as well as getting the dosage right. There are some products in the market that provide similar opportunity for the customers such as smart insulin pens, however, as various research has shown, a credit-card-sized AI-powered smart device that links to a tube plugged into a patient's body devices give better estimate of insulin dosage and shots insulin itself, unlike other smart devices.

Looks-alike Product For the looks-alike product, I chose smart insulin pens.Smart insulin pens are innovative devices designed to assist individuals with diabetes in managing their insulin injections more effectively. These pens typically incorporate advanced technology such as Bluetooth connectivity and companion mobile applications to offer features like dose tracking, reminders, and data analysis.The choice of smart insulin pens is justified by two main factors. Firstly, smart insulin pens cater to the needs of individuals requiring insulin therapy by offering features such as dose tracking, reminders, and dose adjustment assistance. This constant support ensures users have access to vital information and assistance in managing their condition effectively. Secondly, there is a growing interest among young adults in utilizing digital health monitors to optimize their lifestyle choices, including diet and exercise as well as tracking health in a digital way instead of checking every 1-2 months in hospitals.

```
library(readxl)
data <- read_xlsx("/Users/macbook/Desktop/hw_1ma/SIP_Revenue_region.xlsx", sheet = 2)
```

```
## New names:
## * `` -> `...2`
```

```
data<-data.frame(data)
colnames(data) <- c("year", "worldwide_revenue")
data$worldwide_revenue <- as.numeric(data$worldwide_revenue)
```

```
## Warning: NAs introduced by coercion
```

```r
non_numeric <- is.na(data$worldwide_revenue)
if (any(non_numeric)) {
  cat("Rows with non-numeric values in 'worldwide_revenue' column:\n")
  print(data[non_numeric, ])
}
```

```
## Rows with non-numeric values in 'worldwide_revenue' column:
##                                                                                year
## 1 Smart insulin pens market worldwide between 2016 and 2027, by region (in million U.S. dollars)
## 2                                                                              year
##   worldwide_revenue
## 1                NA
## 2                NA
```

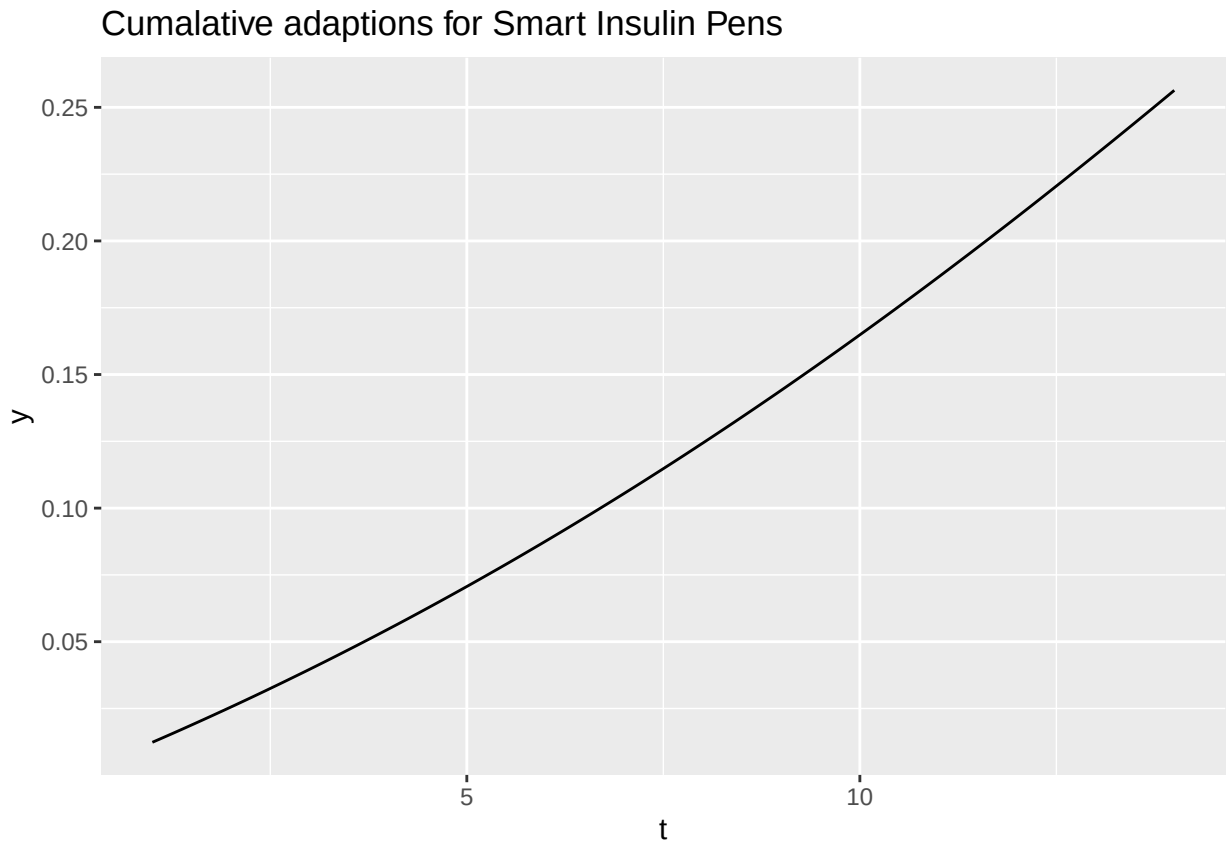
```r
data$worldwide_revenue[non_numeric] <- NA
data$cgm_unit_sold_estimate <- data$worldwide_revenue * 1000000
data
```

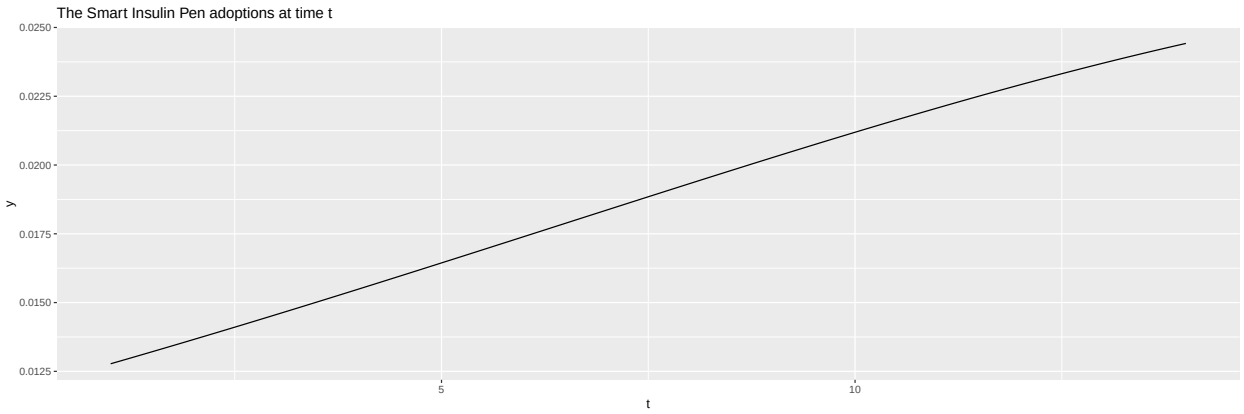
```
##                                                                                year
## 1 Smart insulin pens market worldwide between 2016 and 2027, by region (in million U.S. dollars)
## 2                                                                              year
## 3                                                                              2016
## 4                                                                              2017
## 5                                                                              2018
## 6                                                                              2019
## 7                                                                              2020
##   worldwide_revenue cgm_unit_sold_estimate
## 1                NA                    NA
## 2                NA                    NA
## 3             59.01              59010000
## 4             62.00              62000000
## 5             66.03              66030000
## 6             72.96              72960000
## 7             75.16              75160000
```

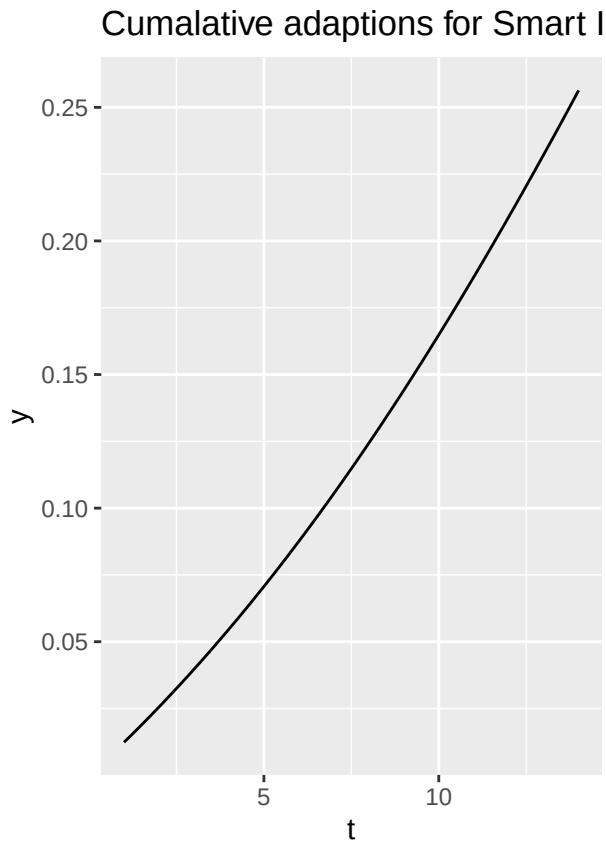
Bass Model Parameters

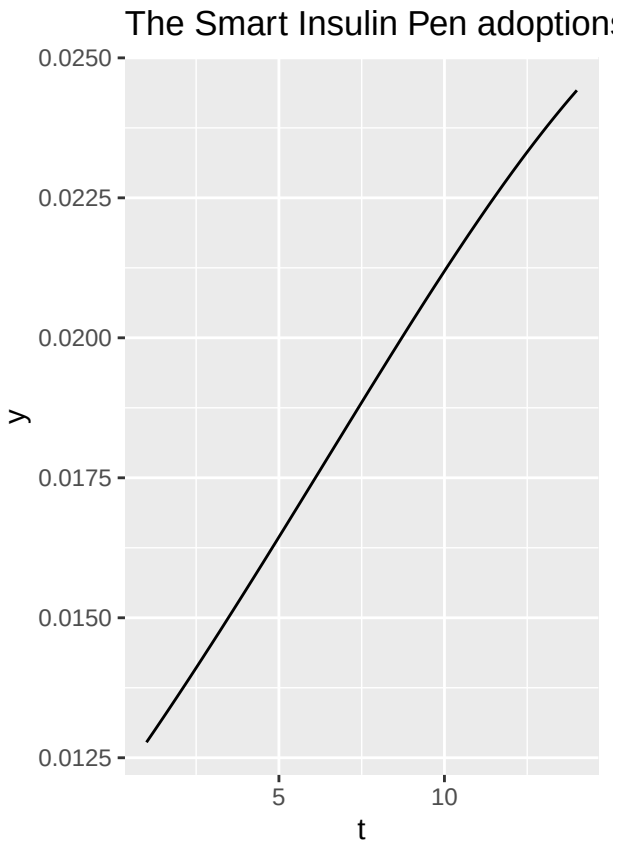
```
## bass model
##
## Parameters:
##                                 Estimate p-value
## p - Coefficient of innovation 1.190000e-02      NA
## q - Coefficient of imitation  8.160000e-02      NA
## m - Market potential          4.741827e+09      NA
##
## sigma: 958669.8214
```

```
##  num [1:5] 59010000 62000000 66030000 72960000 75160000
```


Cumalative adaptions for Smart Insulin Pens
0.25
0.20
0.15
0.10
0.05
y
5
10
t

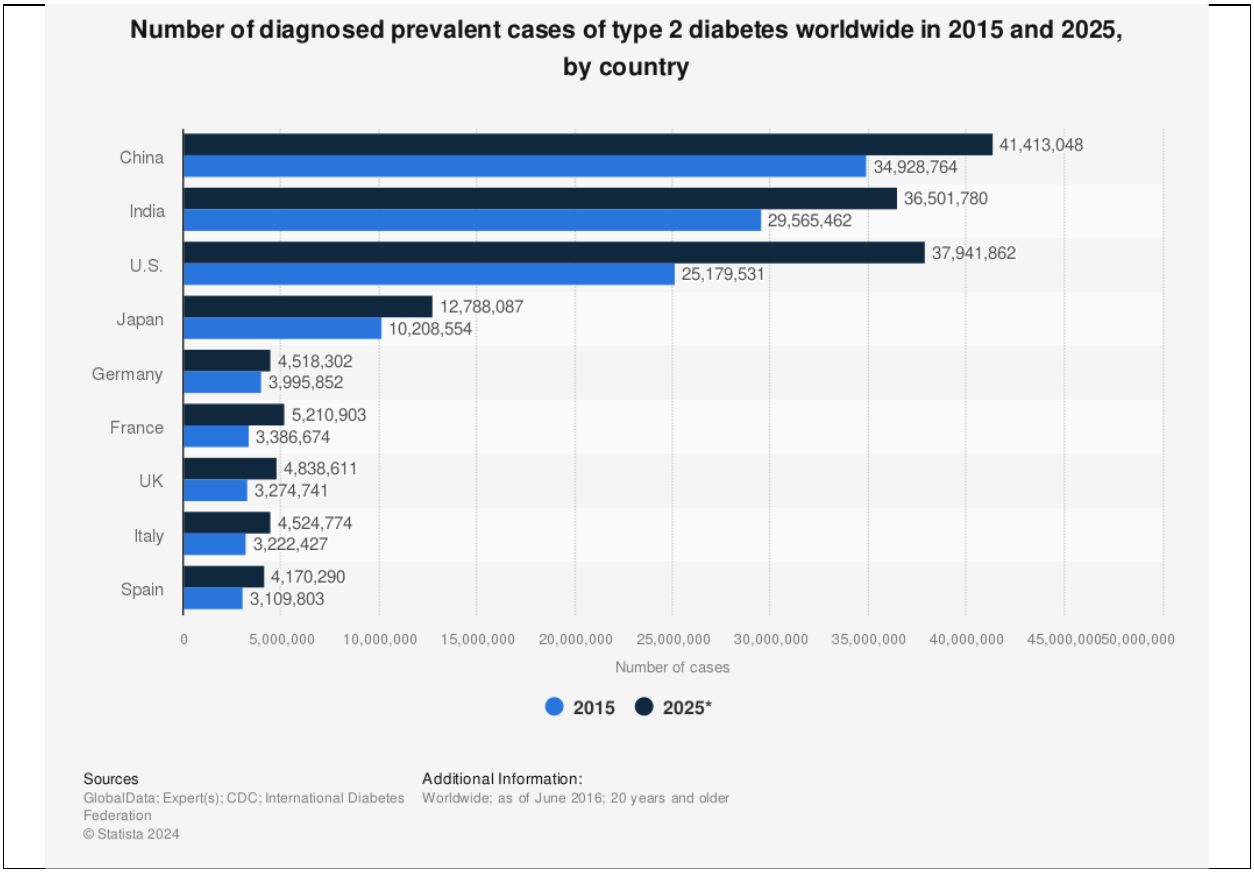

The Smart Insulin Pen adoptions at time t
0.0250
0.0225
0.0200
0.0175
0.0150
0.0125
y
5
10
t





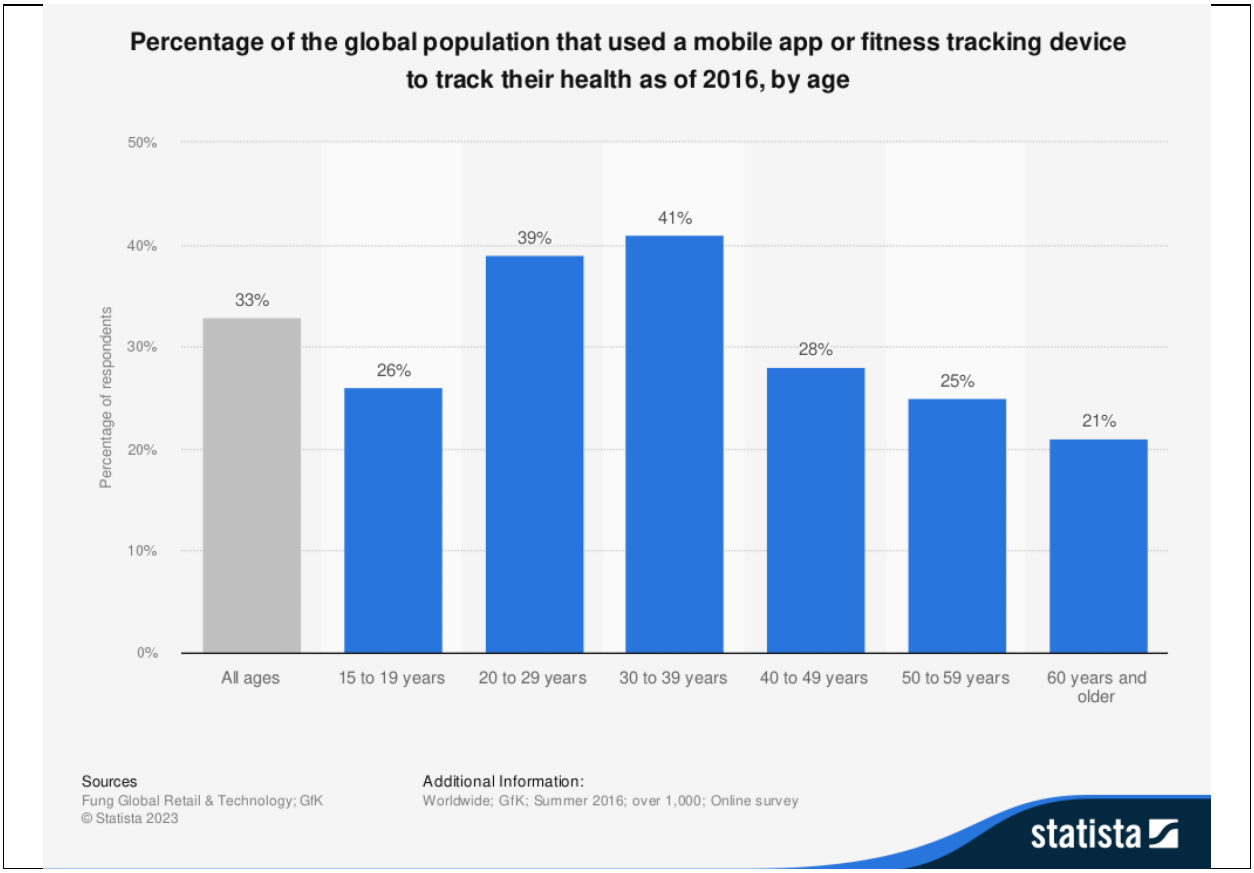
With the Bass model coefficients p(coefficient of innovation) and q(coefficient of imitation) were estimated. In order to estimate potential sales of iLet Bionic Pancreas, first I will try to estimate the potential market size of the product.

```
library(png)
img <- readPNG("/Users/macbook/Desktop/hw_1ma/diabetes_2_people.png")
par(mar = rep(0, 4))
plot(1, type = "n", xlab = "", ylab = "", xlim = c(0, 0), ylim = c(0, 0))
rasterImage(img, 0, 0, 1, 1)
library(grid)
grid.raster(img)
```



As evident from the graph, there has been a significant surge in the number of individuals diagnosed with diabetes. This upward trend underscores the pressing need for innovative solutions to manage the condition effectively. In light of this, the demand for advanced insulin delivery products like Smart Insulin Pens and iLet Bionic Pancreas is poised to rise, offering promising avenues for better diabetes management and improved quality of life.

```
library(png)
img <- readPNG("/Users/macbook/Desktop/hw_1ma/tracking_device_usage.png")
par(mar = rep(0, 4))
plot(1, type = "n", xlab = "", ylab = "", xlim = c(0, 0), ylim = c(0, 0))
rasterImage(img, 0, 0, 1, 1)
library(grid)
grid.raster(img)
```



According to statistics from Statista, approximately one-third of the population utilizes different tracking devices and apps to monitor their fitness activities. With this data, we estimate that around 20.7 million individuals track their state of health using look-alike technology.

Share of U.S. adults actively tracking health metrics by health conditions and type as of 2019

People tracking health metrics by health conditions U.S. by type 2017-2019

	Obesity	Diabetes	Heart disease	Hypertension
Heart rate - analog tracking	11%	9%	19%	9%
Heart rate - digital tracking	9%	14%	20%	11%
Blood sugar - analog tracking	23%	36%	22%	16%
Blood sugar - digital tracking	13%	29%	18%	11%
Weight - analog tracking	45%	31%	44%	38%
Weight - digital tracking	23%	21%	20%	17%
Food or diet- analog tracking	30%	22%	25%	22%
Food or diet - digital tracking	16%	16%	13%	10%
Blood pressure - analog tracking	31%	24%	34%	39%
Blood pressure - digital tracking	20%	22%	24%	24%

2

Note(s): United States; July 26 to August 9, 2019; around 4,000
Further information regarding this statistic can be found on Page 4.
Source(s): Rock Health; Stanford Medicine (Center for Digital Health); Toluna Germany; ID 1102267

statista

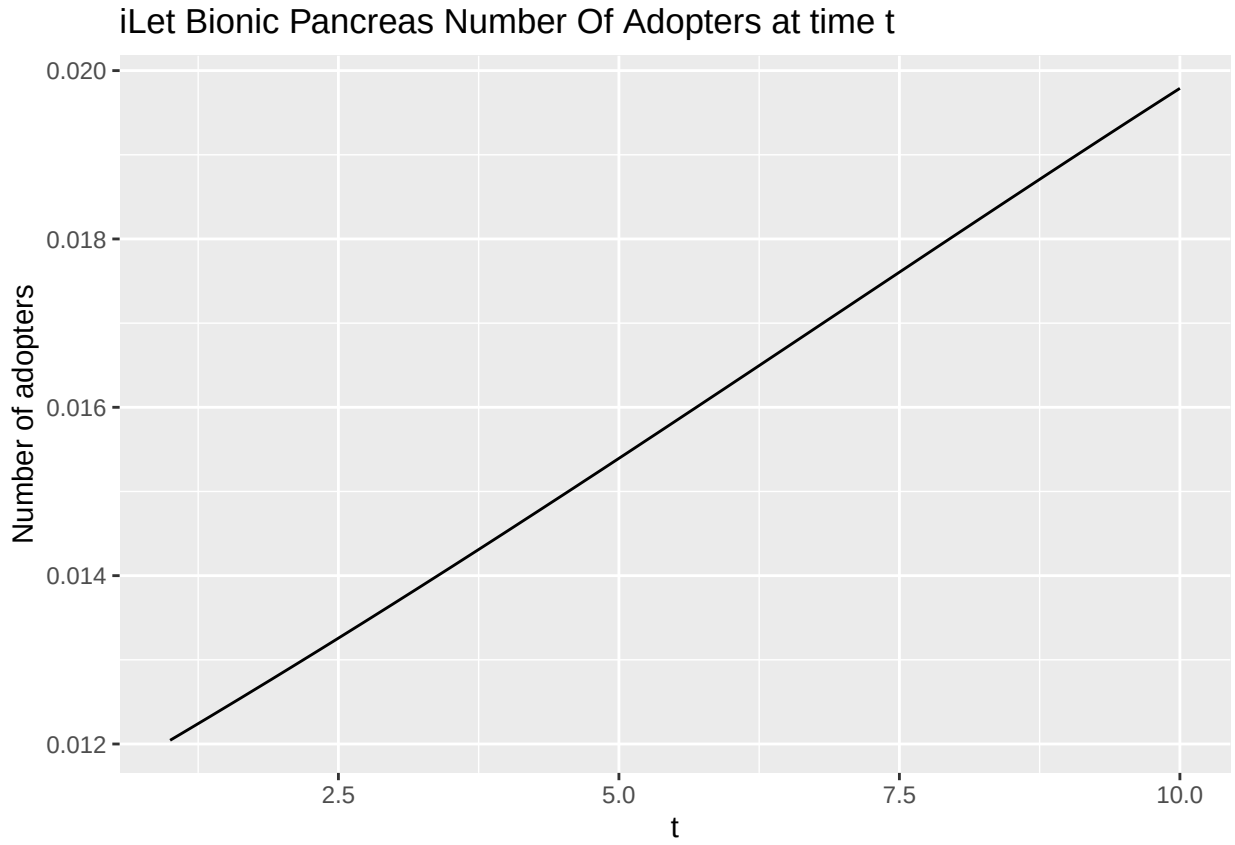
Looking at another data from Statista, we can see that for people with Diabetes: For digital tracking: 29% track blood sugar levels 16% track food or diet 22% track blood pressure

According to the Centers for Disease Control and Prevention (CDC), approximately 10.5% of the U.S. population had diagnosed diabetes in 2018. From our previous statistics on the "Number of diagnosed prevalent cases of type 2 diabetes", estimated number for the U.S population is approximately 37,9 million people by 2025.

Therefore, if we use that statistics, we will get that roughly there could be around 25.4 million adults with diabetes in the United States who would be potential users of digital tracking technology such as smart insulin pens. This number provides a rough approximation of the potential market size for such devices.

```
##   year worldwide_revenue cgm_unit_sold_estimate number_of_adopters
## 3 2016             59.01               59010000          324778.6
## 4 2017             62.00               62000000          347129.9
## 5 2018             66.03               66030000          370193.8
## 6 2019             72.96               72960000          393853.3
## 7 2020             75.16               75160000          417967.0
```

```
## bass model
##
## Parameters:
##                                Estimate p-value
## p - Coefficient of innovation 1.130000e-02      NA
## q - Coefficient of imitation  7.860000e-02      NA
## m - Market potential          2.790755e+07      NA
##
## sigma: 375.9585
```



References

https://www.statista.com/statistics/1286511/smart-insulin-pens-market-worldwide-by-region/

https://www.statista.com/search/?q=diabetes+and+tracking+health&Search=&p=1

https://www.statista.com/statistics/1102267/share-us-adults-tracking-health-metrics-by-health-condition/

https://www.statista.com/statistics/742448/global-fitness-tracking-and-technology-by-age/

https://www.statista.com/statistics/1286510/smart-insulin-pens-market-worldwide-by-product/