Clinical Experiences with a Mobile Diet Logging Application

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- **We know**
  - Thousends of apps support diabetes care
  - Transmission of blood glucose data is not a problem
  - We have good solutions also for physical training monitoring

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Depicting our patient

Detailed Nutritional data

Workout through the day

Blood sugar values

Applied doses of Insilin

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Nutrition as a topic

However the routine of nutrition is not explored in most diabetic patients

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- **We also know**
  - we can use very simple and very sophisticated methods to solve our problems
- **We have seen solutions**
  - which ignored the way information was generated and transferred to a well functioning telecare center
  - which used very complex algorithms to generate information based on the image of the mobile phone camera

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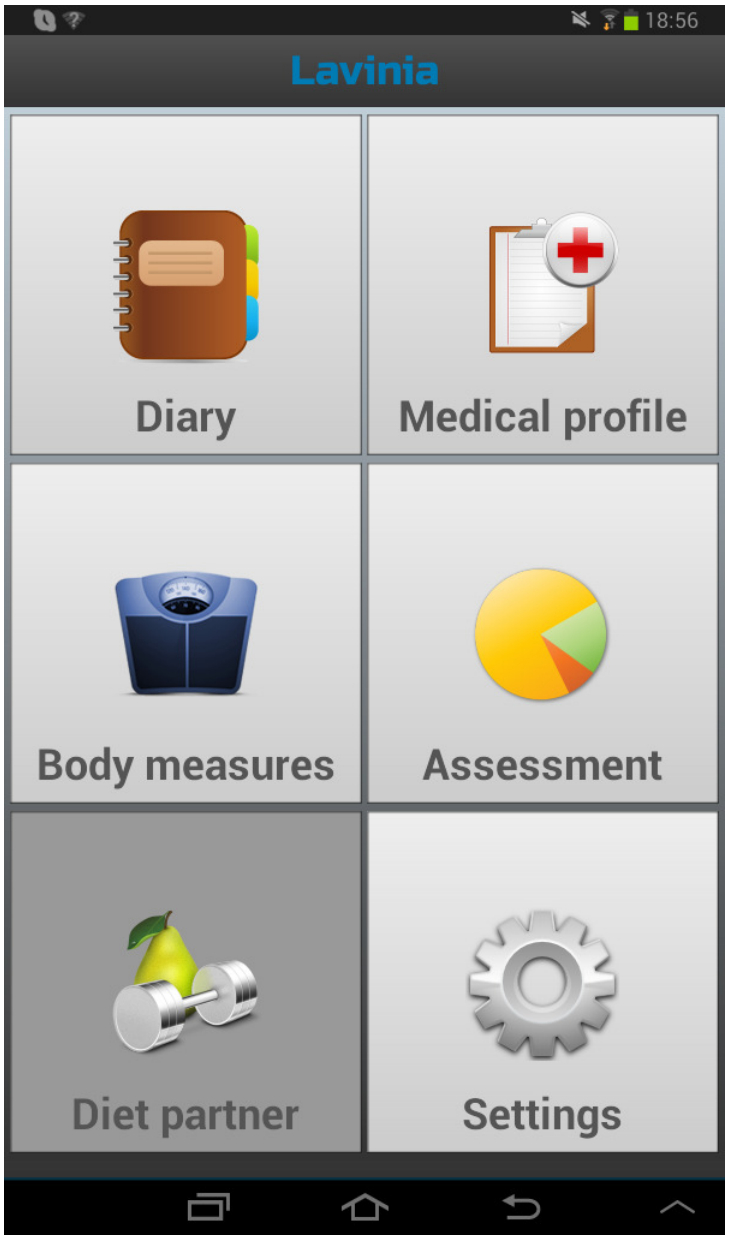
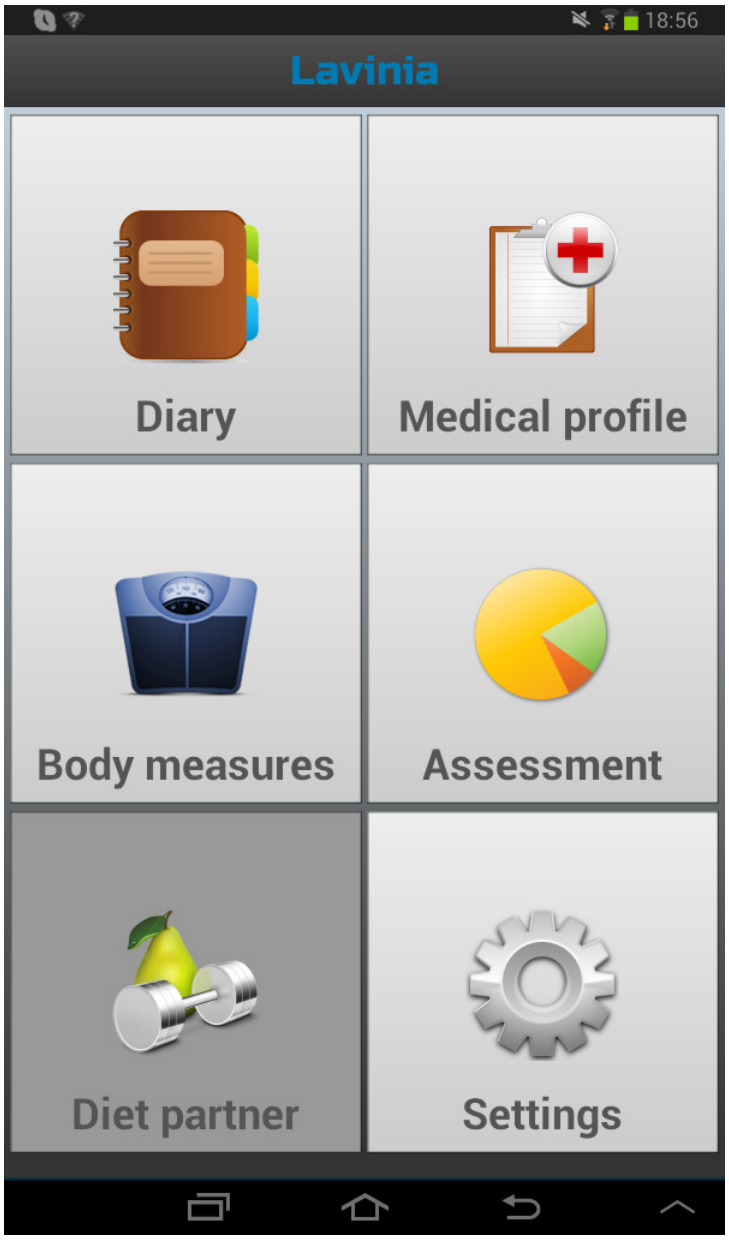
Concept of Lavinia Life style logging



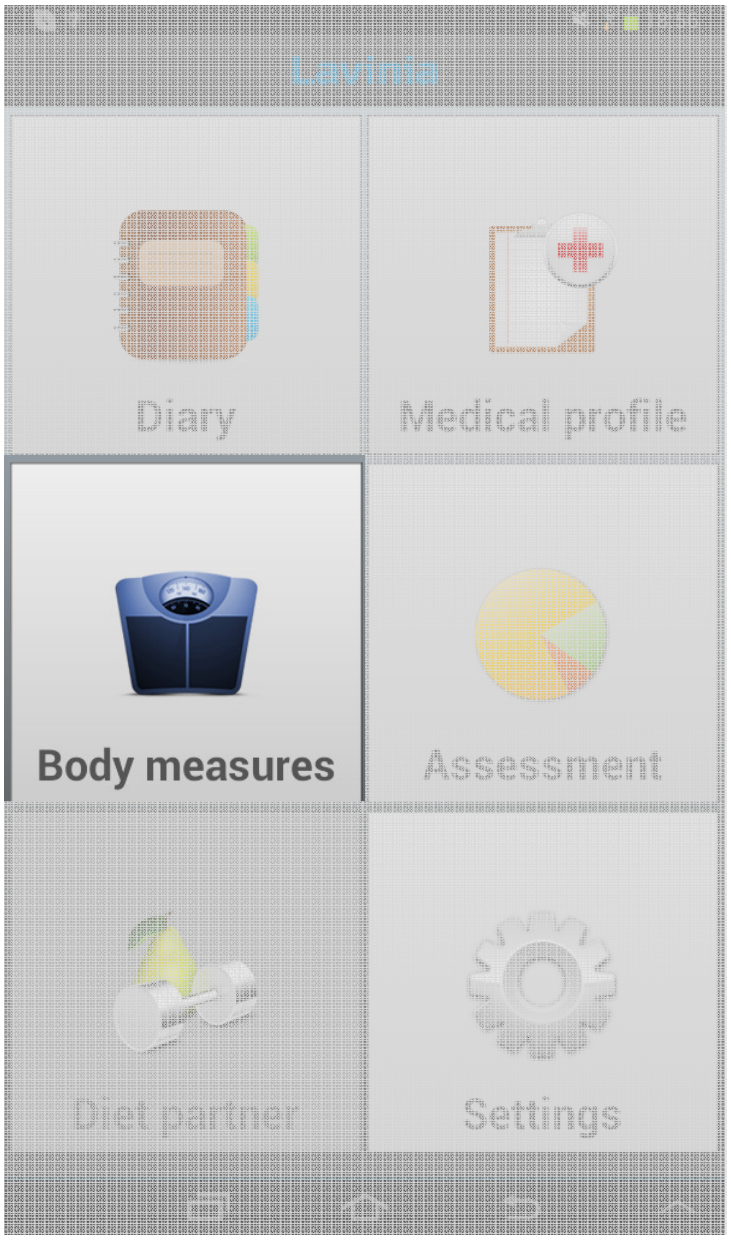
- Simplify the process
- Use simple manual data input in the first development phase
- Support for sensor integration later

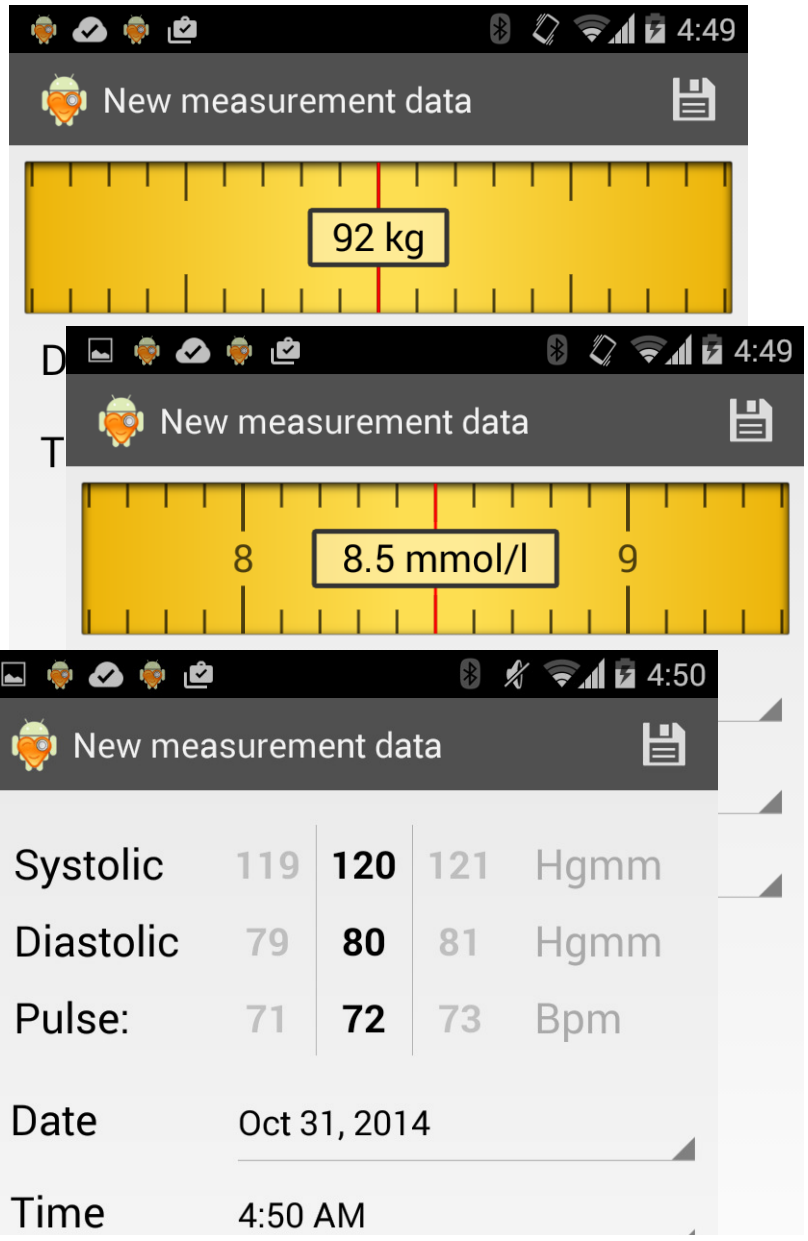
Concept of Lavinia Life style logging



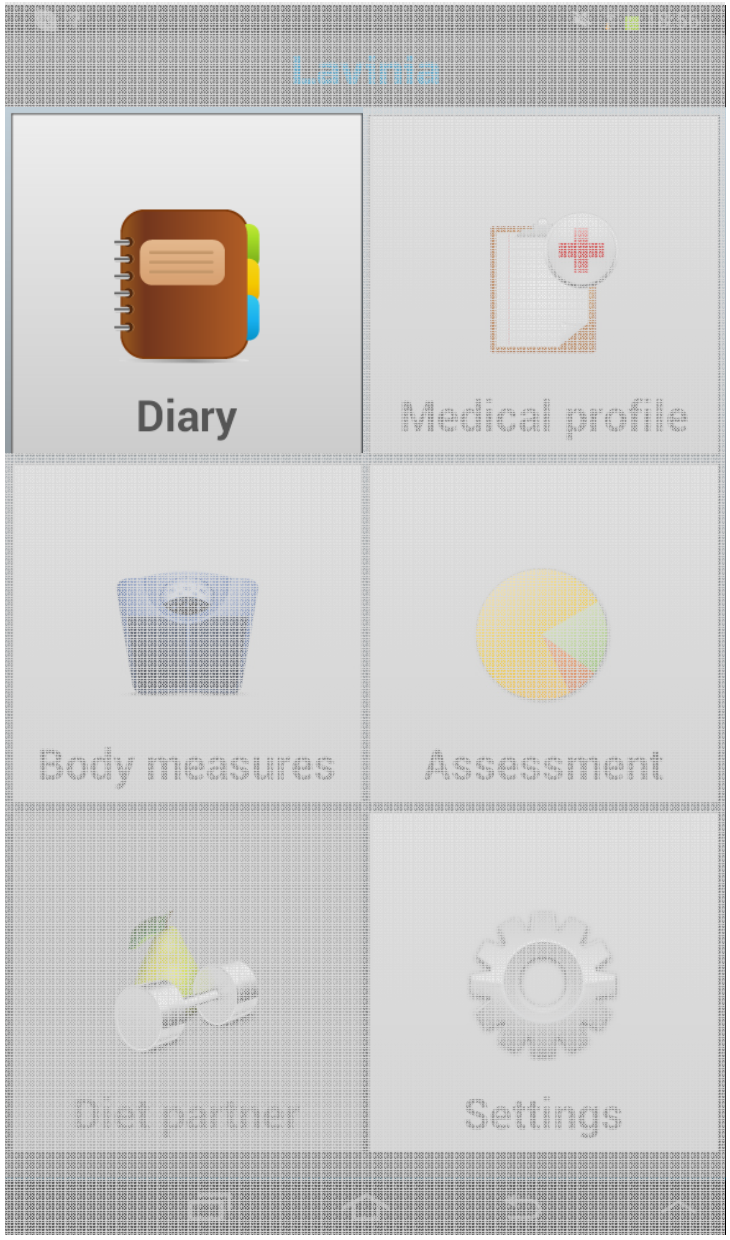
- **Focus**
  - Nutrition
- **Consideration**
  - Greatest problem in diabetes care is that the majority (up to 90-95%) of our patients do not calculate his/her diet

Logging of Physiological Measurements

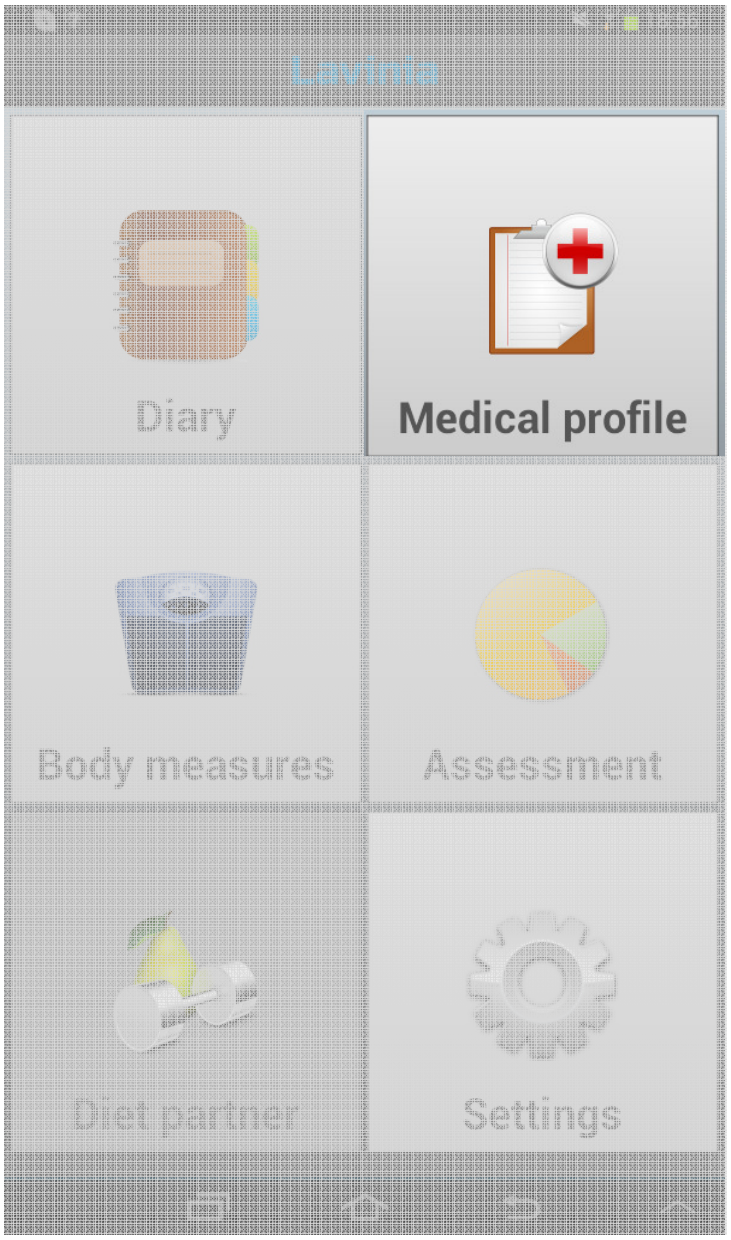


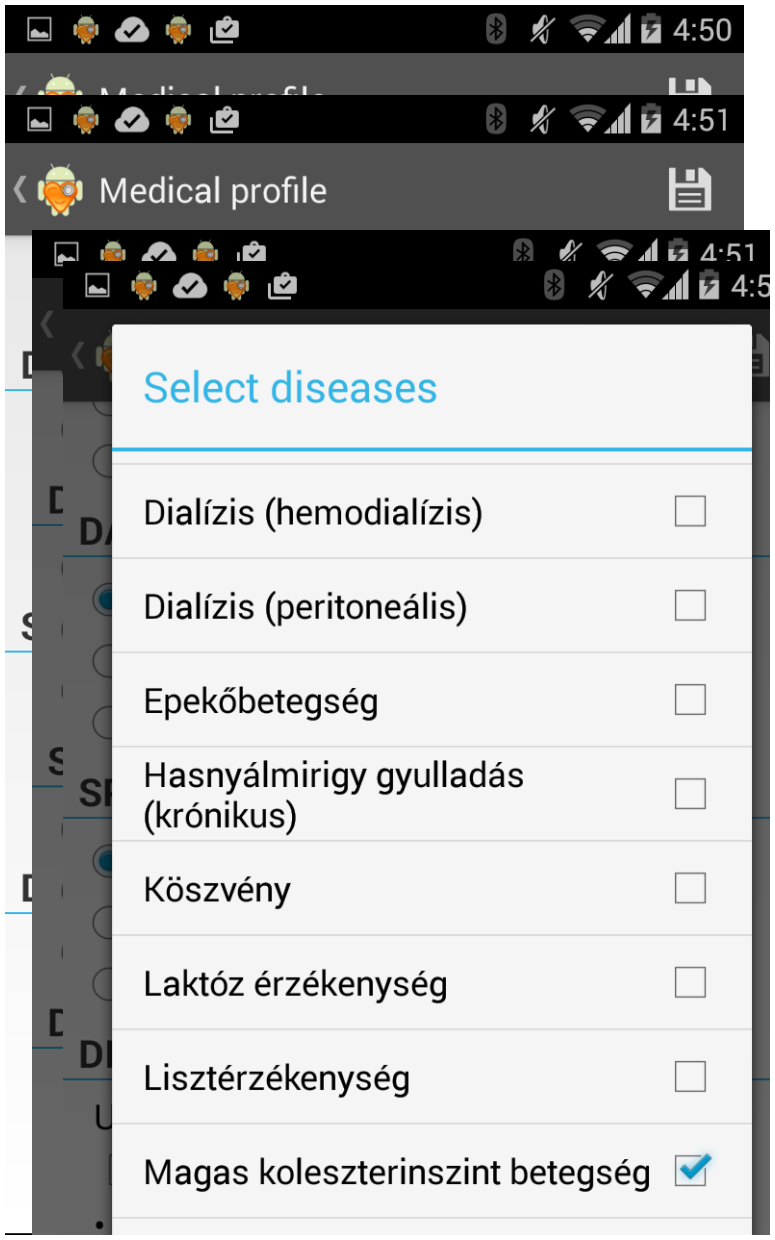


Recording of meals
on the Lavinia Android platform



Basic patient data
on the Lavinia Android platform

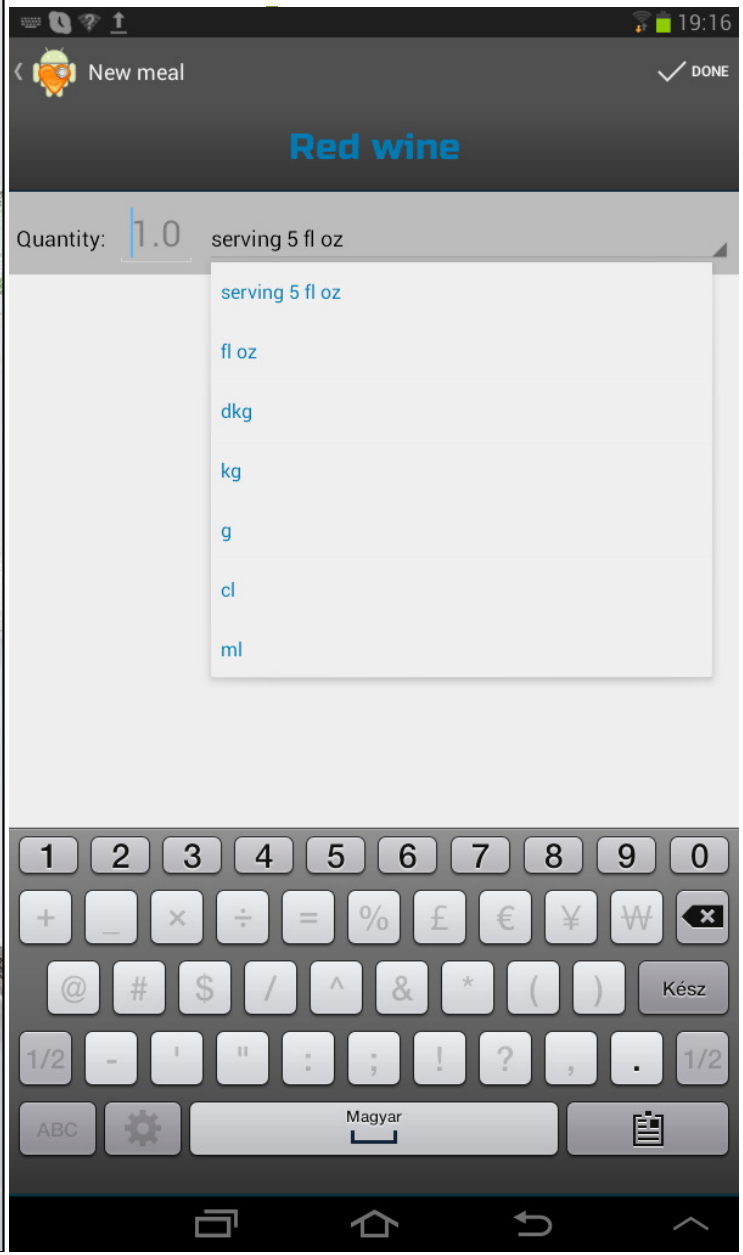


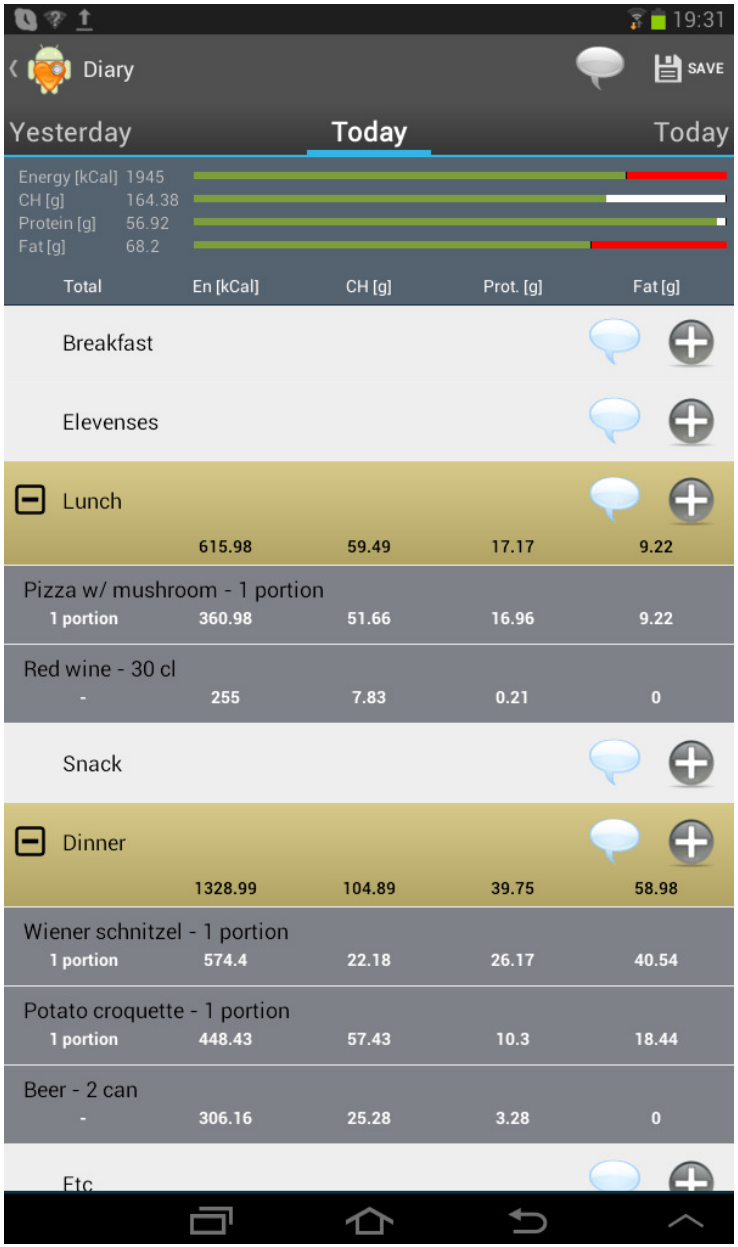


Recording of meals

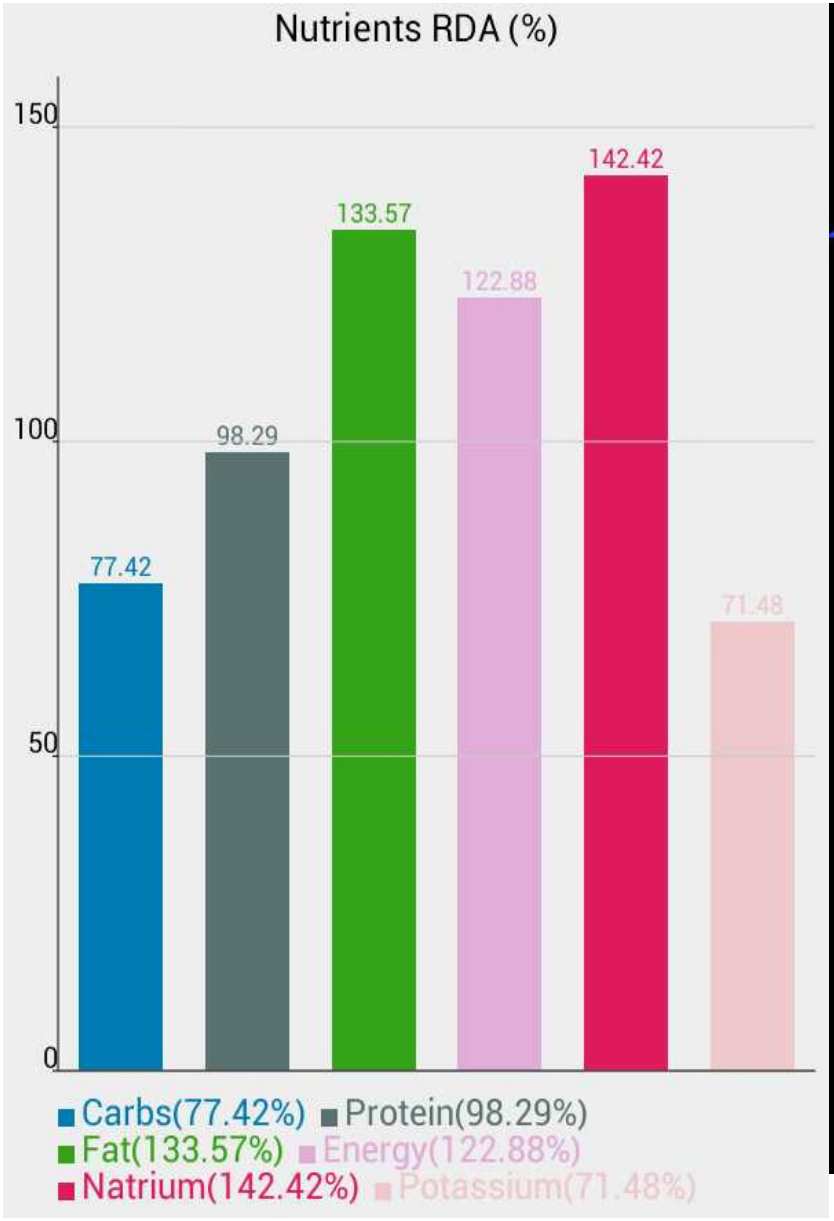
on the Lavinia Android platform

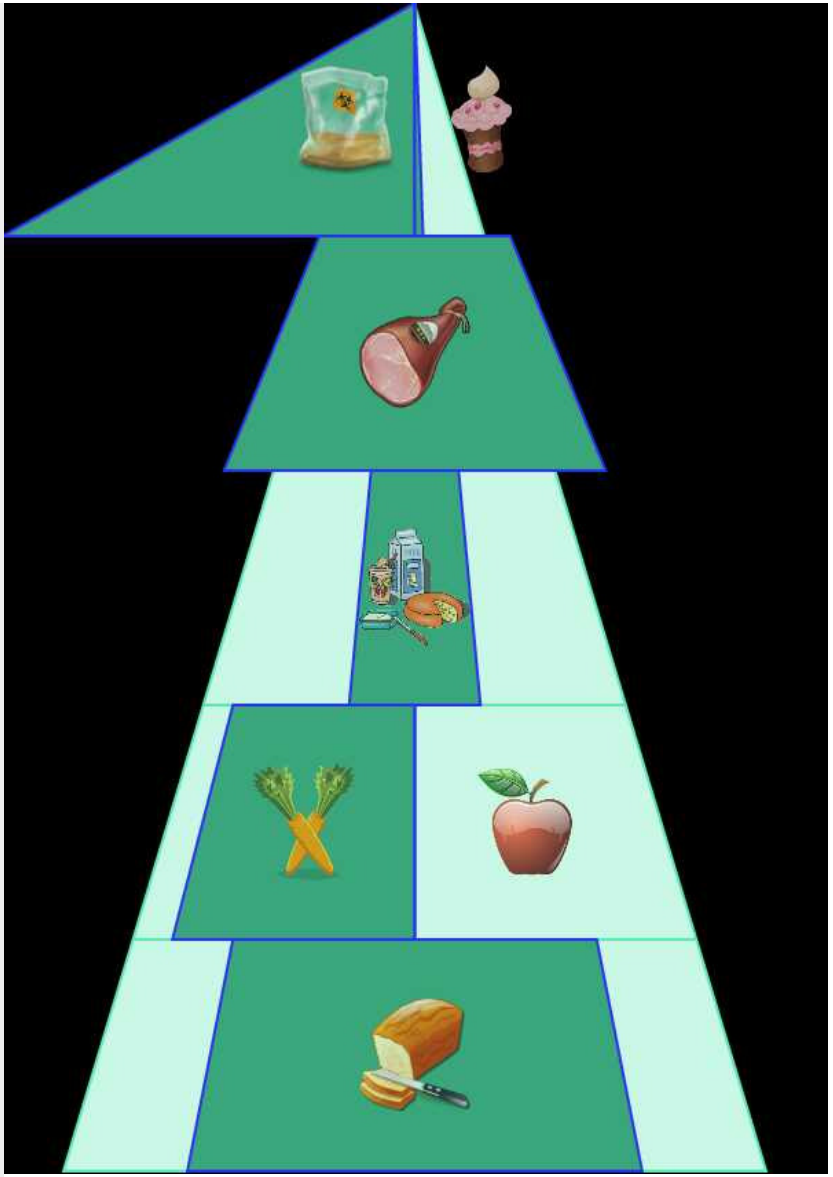
Summary of nutriment contents of the logged meals



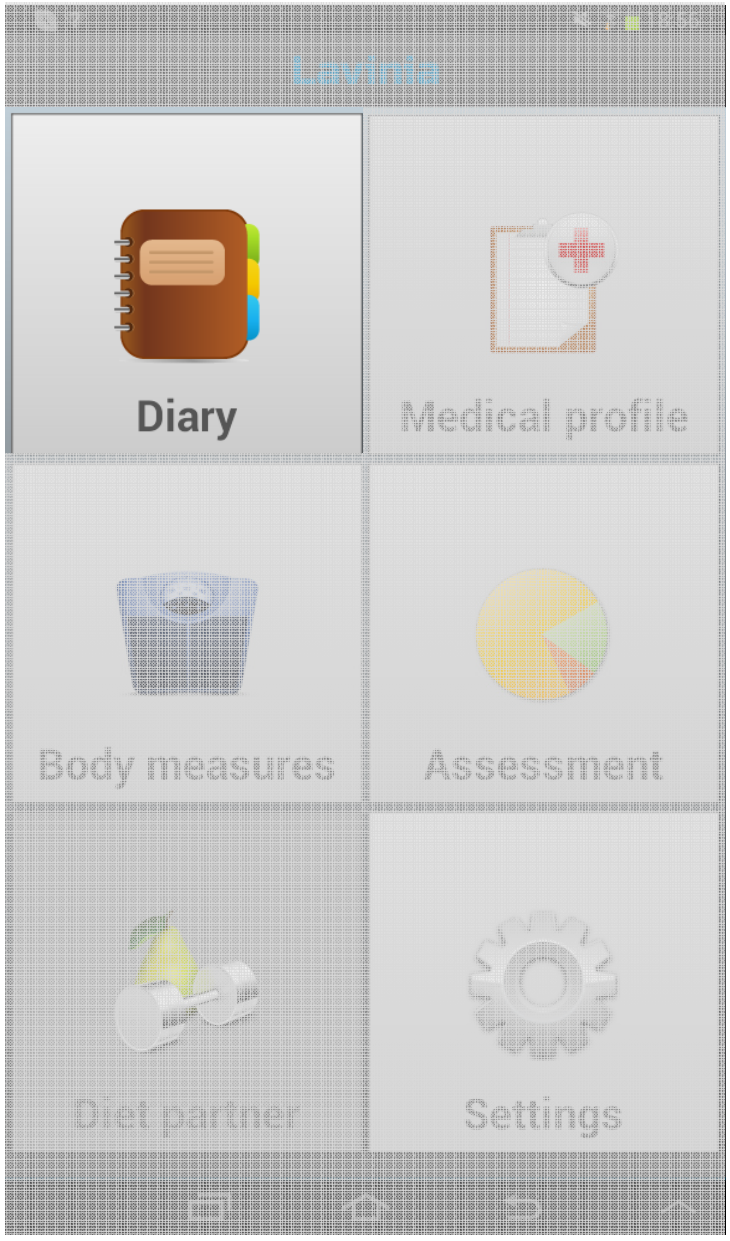


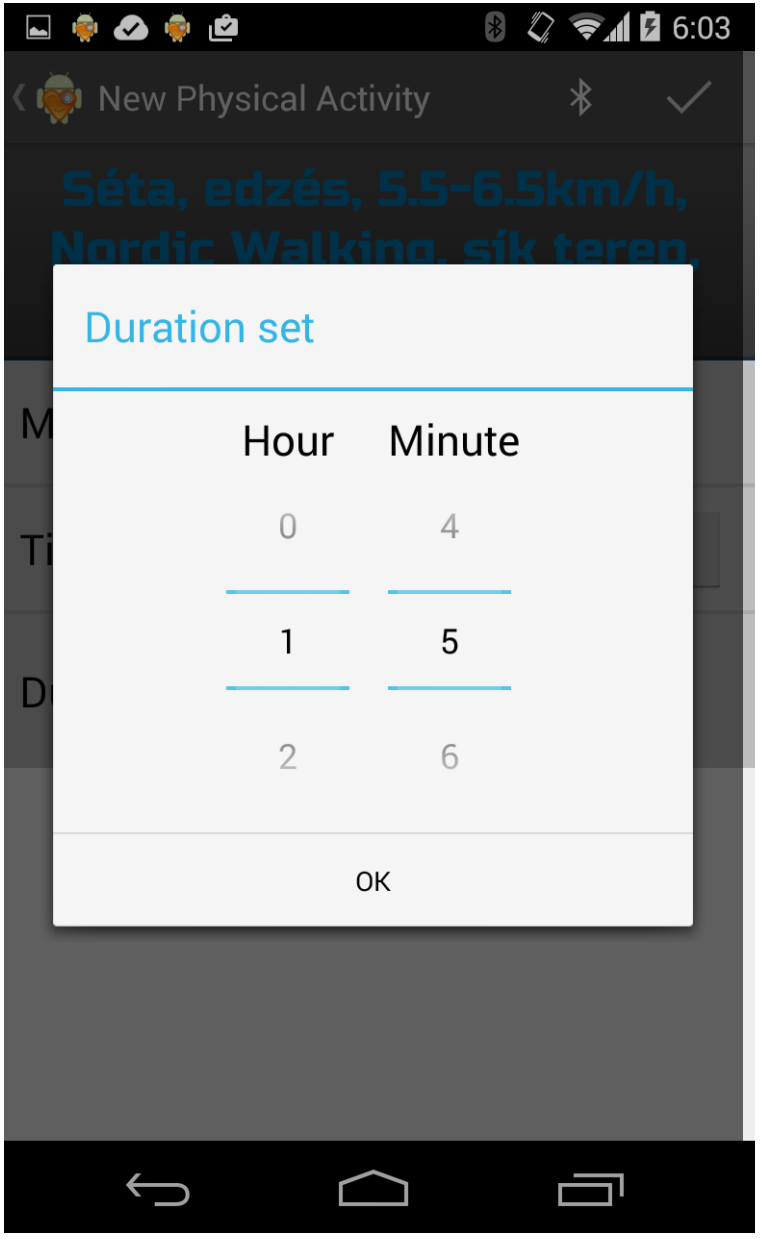
Evaluation of proportionality of the diet



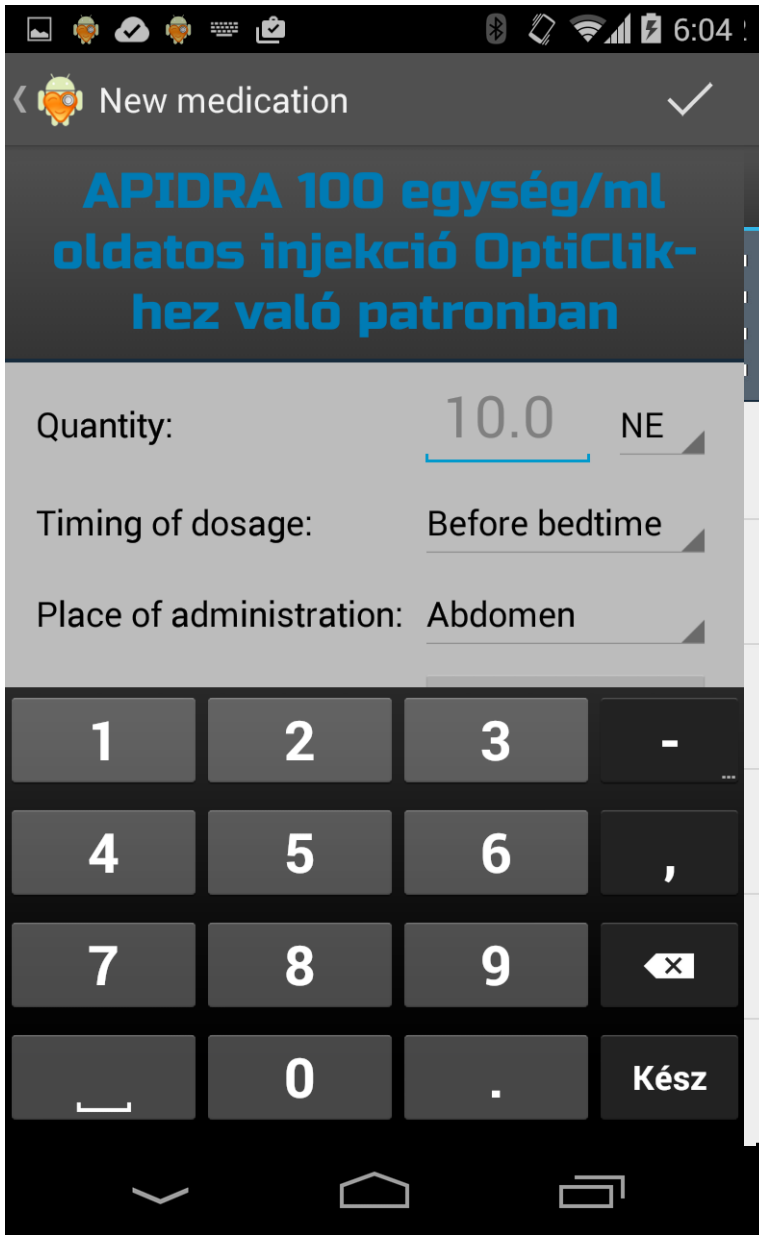


Logging of Physical Activity





Logging of Drug Intake



Phases of preclinical evaluation

- **Phase I**
  - **The completeness of the Lavinia database**
- **Phase II**
  - **The validity of the Lavinia database**
- **Phase III**
  - **The time expenditure of the mobile logging procedure**

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Method - Phase I

- Assessing the database support for a menu of a rehabilitation institute
- Two experts entered
  5 manually designed,
  22 days long menus

330 meals

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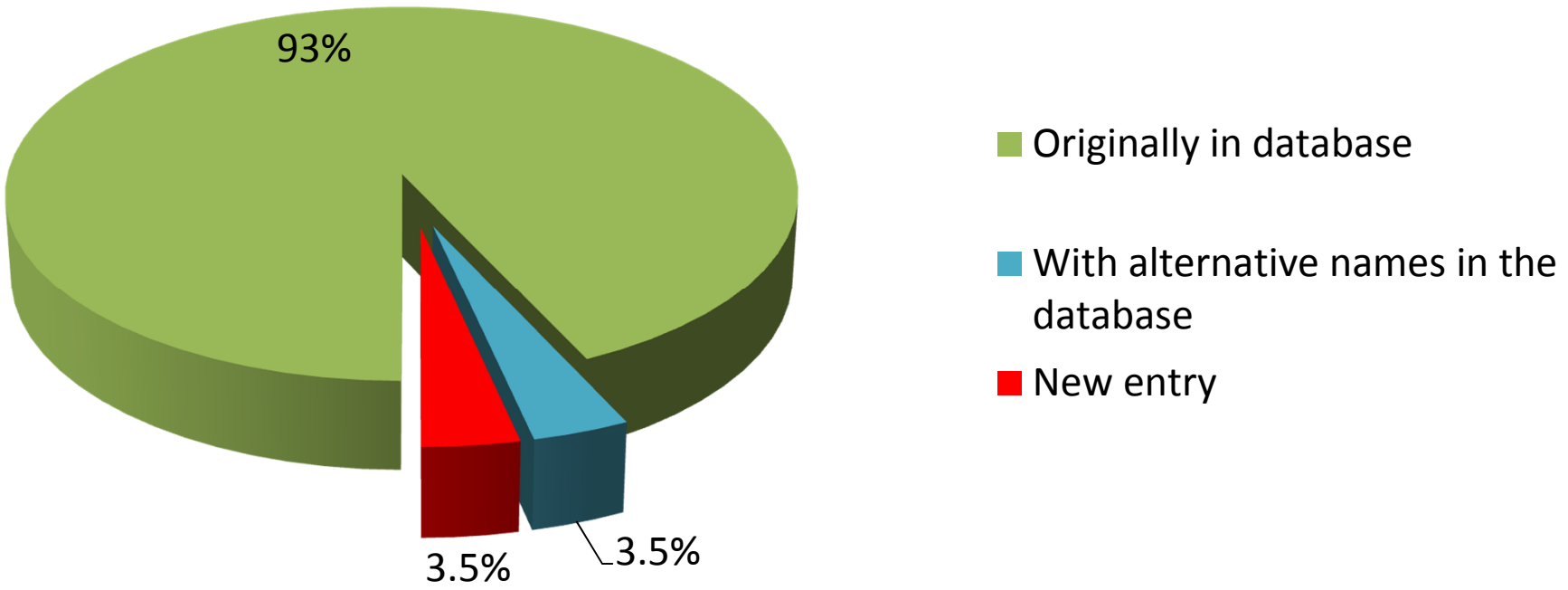
Results- Phase I

641 units of basic foods



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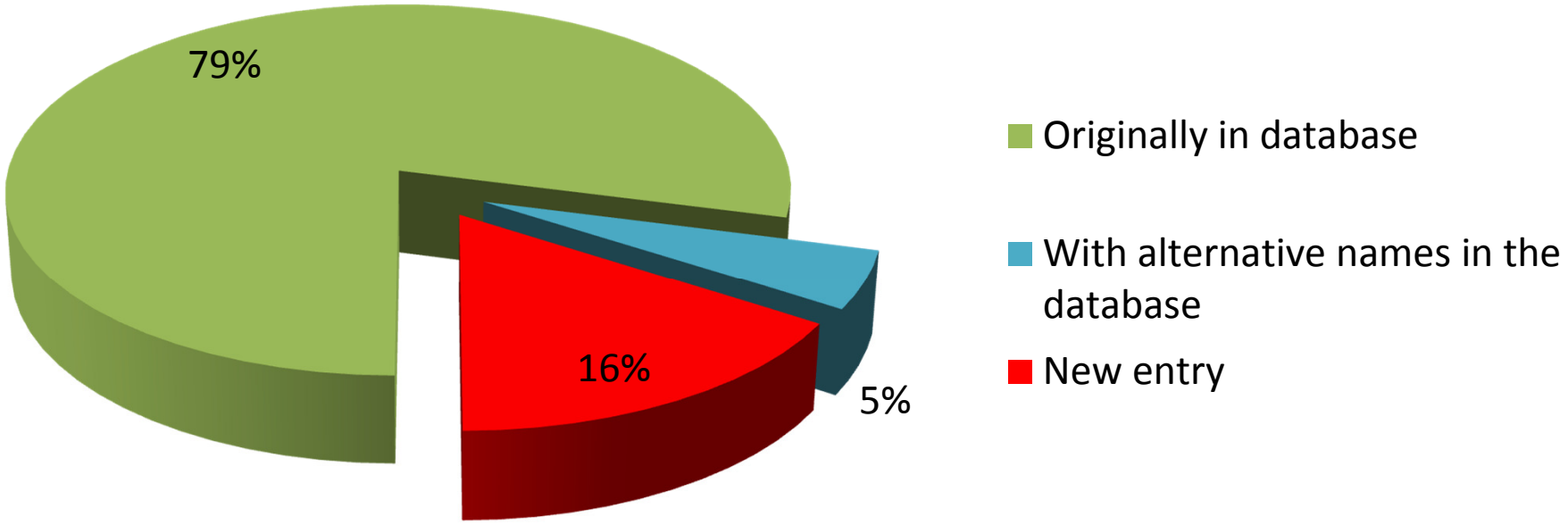
Results- Phase I

538 units of dishes



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Conclusions - Phase I

- **The chance of finding an item is around 90%.**
- **Although for such a dietary logging application the food and dish search list can be infinitively expanded, we must spare the user's time, so this ratio can be considered highly acceptable.**

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Method - Phase II

- Evaluation of differences of nutrient contents in Food Composition Databases (FCDBs)
  - Reference: Commercial database used for dietary calculations for inpatients at the Cardiac Rehabilitation Center of the Millitary Hospital, Balatonfüred, Hungary
- Step 1.
  - Normalisation of the serving units of the items to match the units in the Lavinia system

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Method - Phase II

- 2.) Two dieticians compared the carbohydrates, protein and fat contents of the databases labelling each differing case with consensus as due to
  - 1) natural FCDB differences,
  - 2) user search error, or
  - 3) FCDB or system error.
- 3.) For the first group of cases, we then selected those items that had a nutrient content above 10 g.
- 4.) Differences were expressed as absolute (g) as well as relative values (percentage of amount in the Lavinia system).

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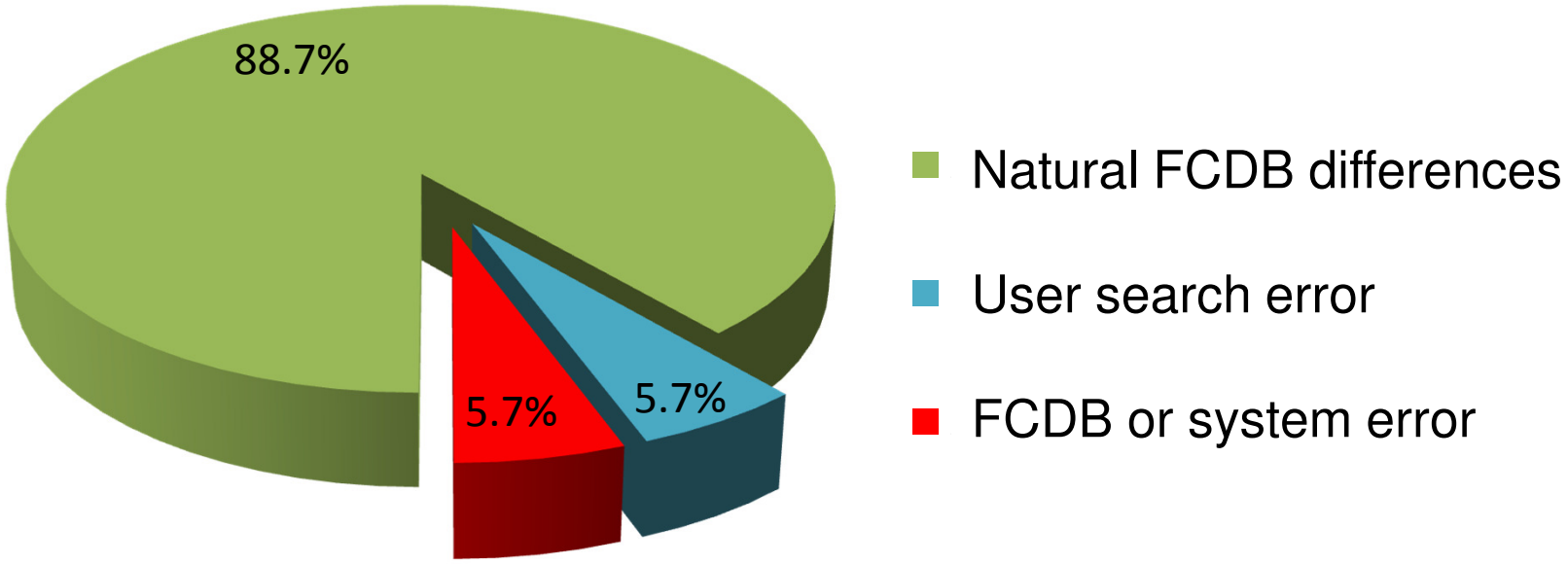
Results- Phase II

194 items



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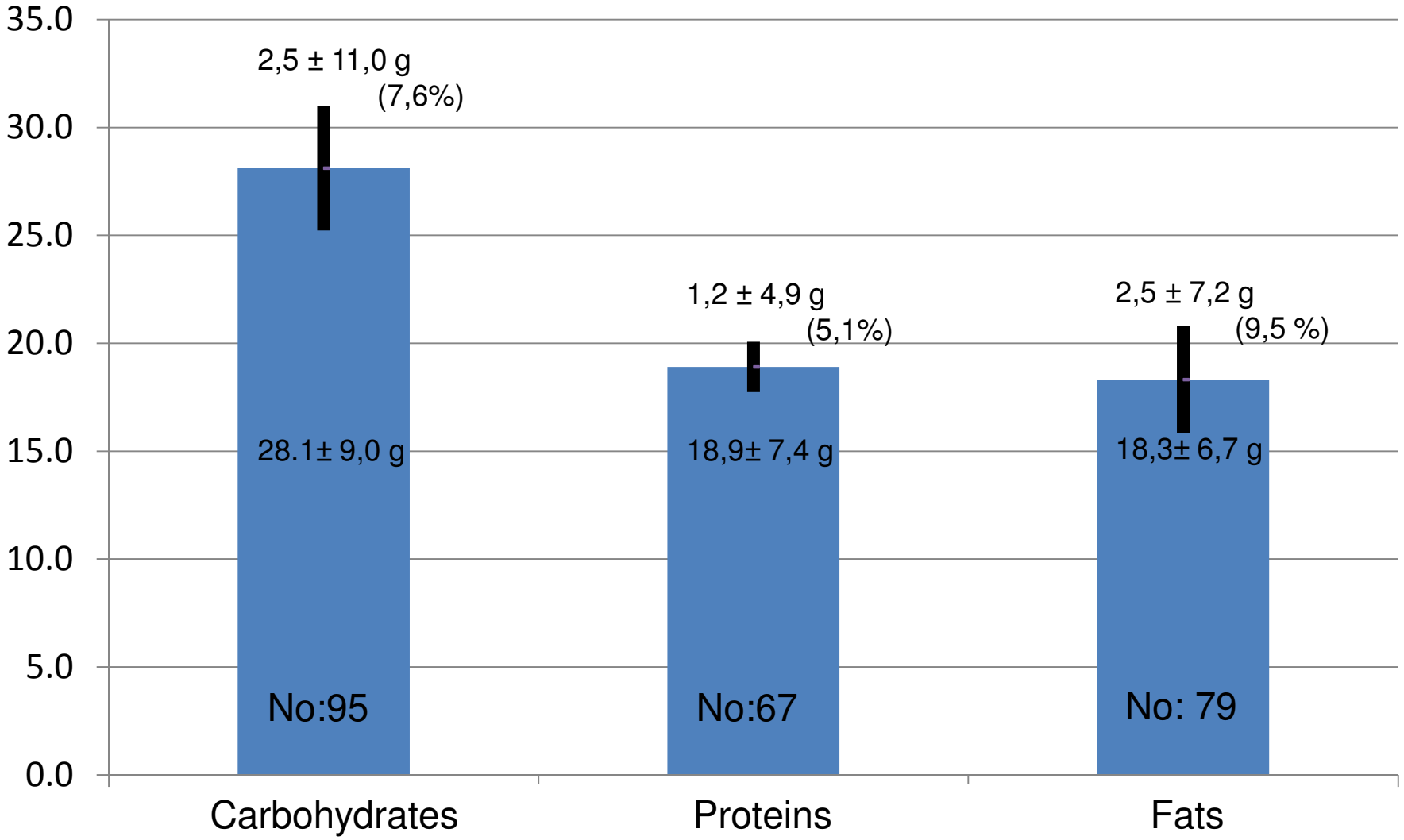
Results- Phase II



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Conclusion- Phase II

- This phase analysed the inevitable differences and errors in food composition databases, an often overlooked issue in dietary analysis.
- There are other types of errors that occur in nutritional logging, but the proper management of this error is imperative when building a complex logging system

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Method – Phase III

Measuring the logging time expenditure

- Five volunteers, familiar with android phones but new to Lavinia's set based food search system.
  - 3 to 5 minutes introduction to the operation of the Lavinia user interface.
  - Entering the 22 day long menu listing of the Cardiac Rehabilitation Center with three main meals for every day.
  - The activity of the test subjects was tracked using hidden time stamp logging from the beginning of any new item entry to the completion of the process.
  - The users were allowed to change from the set based search method to the keyword based search at any time

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Method – Phase III

- 330 meals
  - 1179 dish or food items
  - 194 different items

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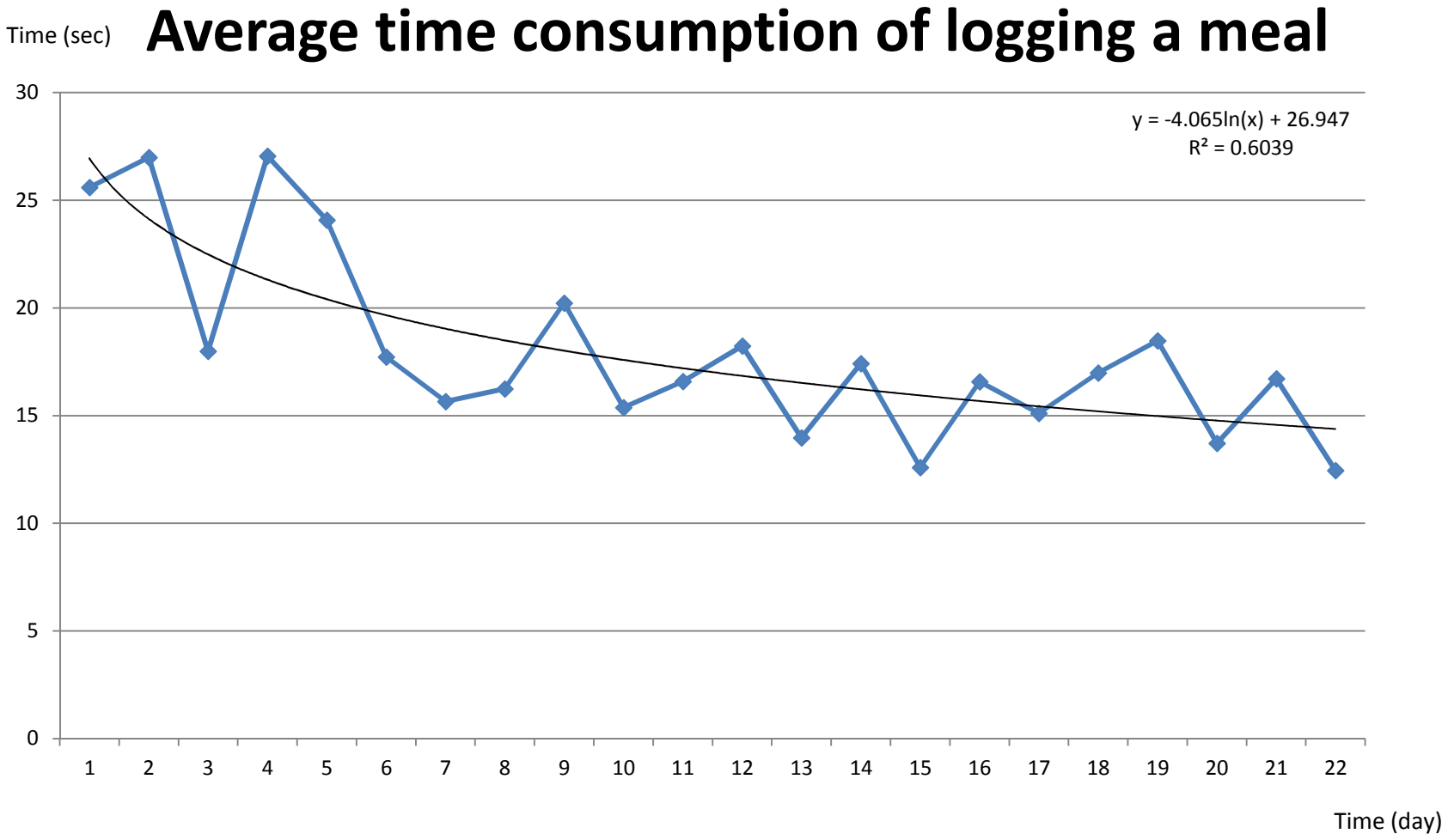
Results– Phase III



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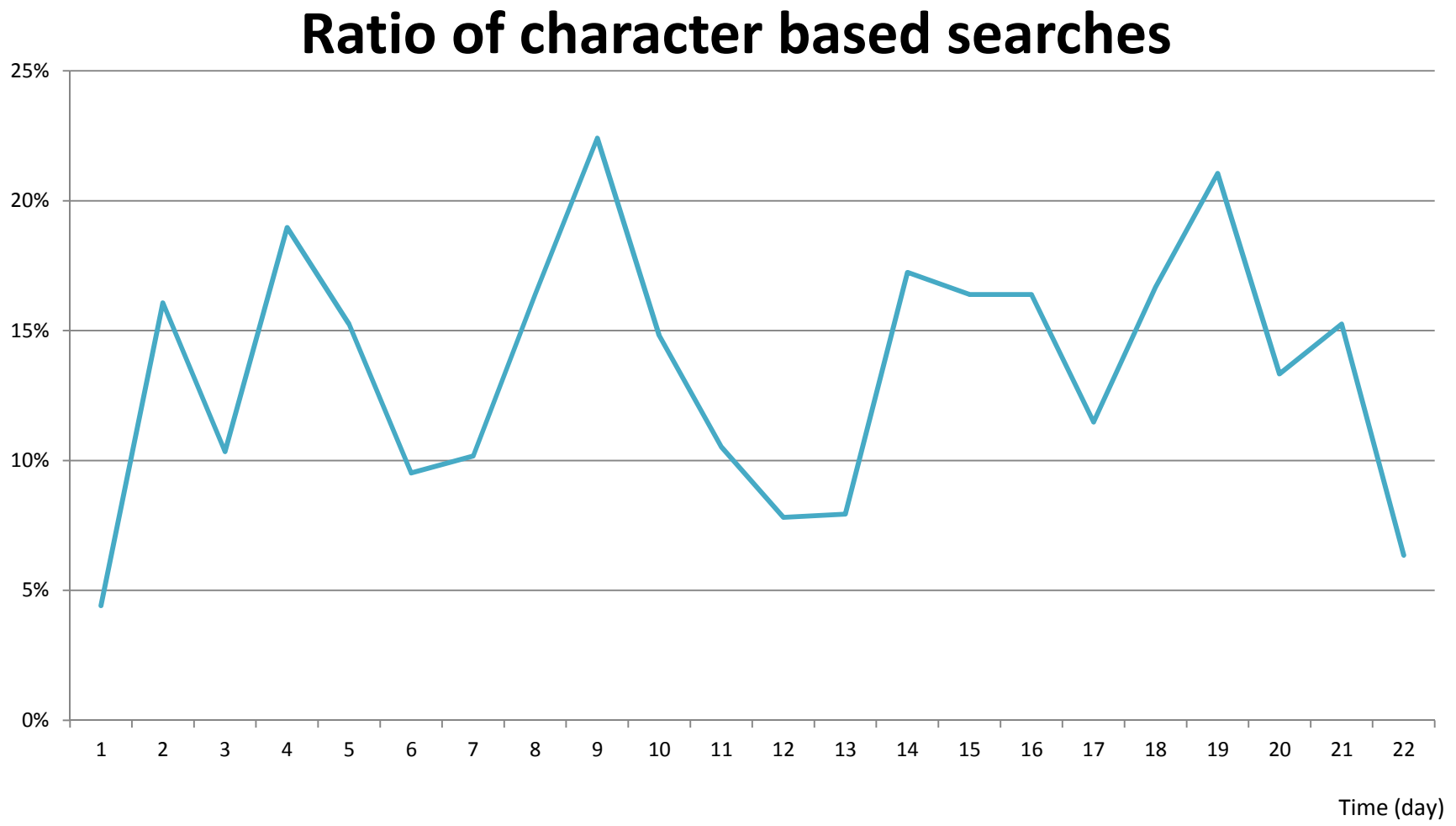
Results– Phase III



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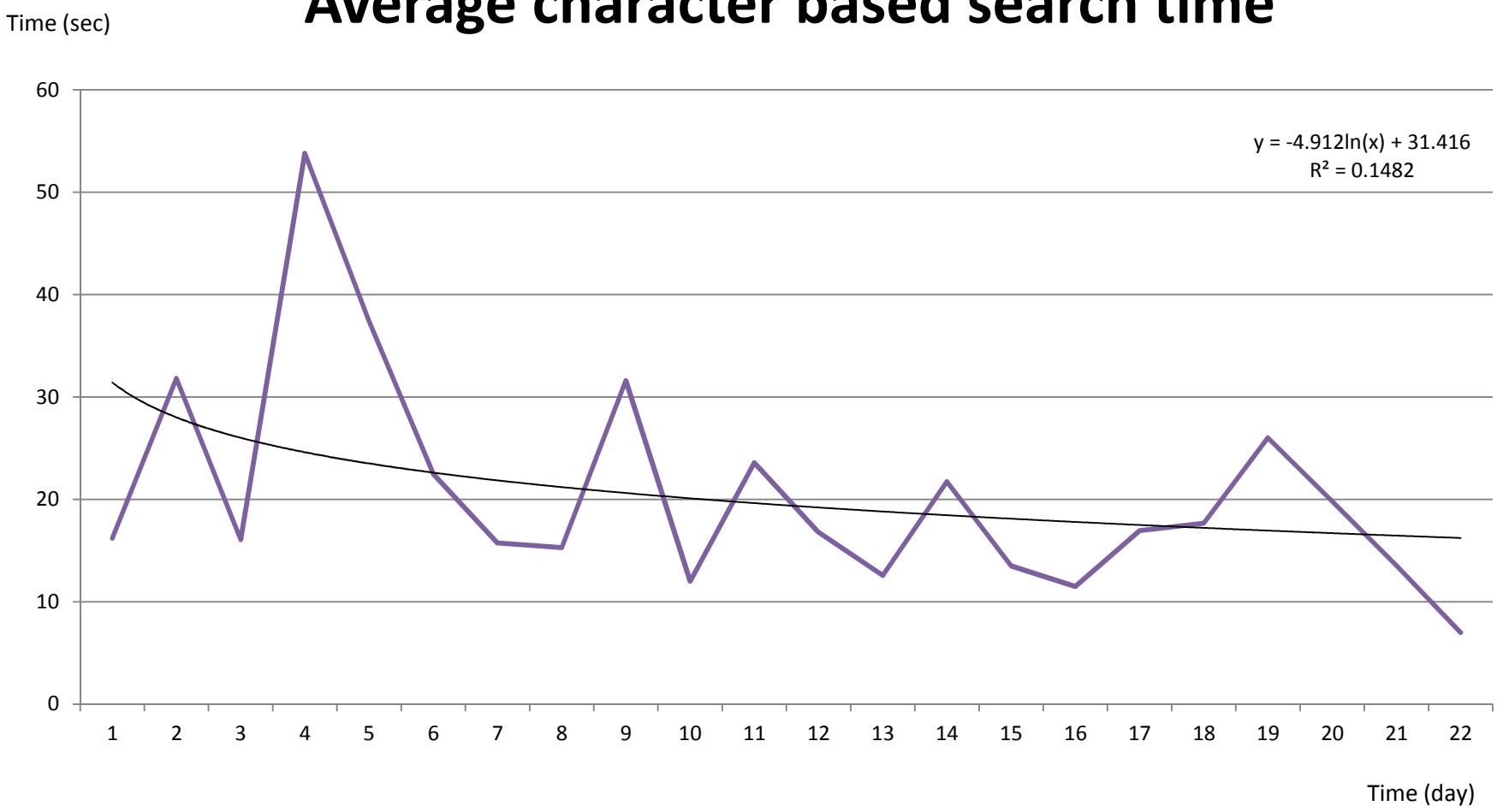
Results– Phase III

Average character based search time



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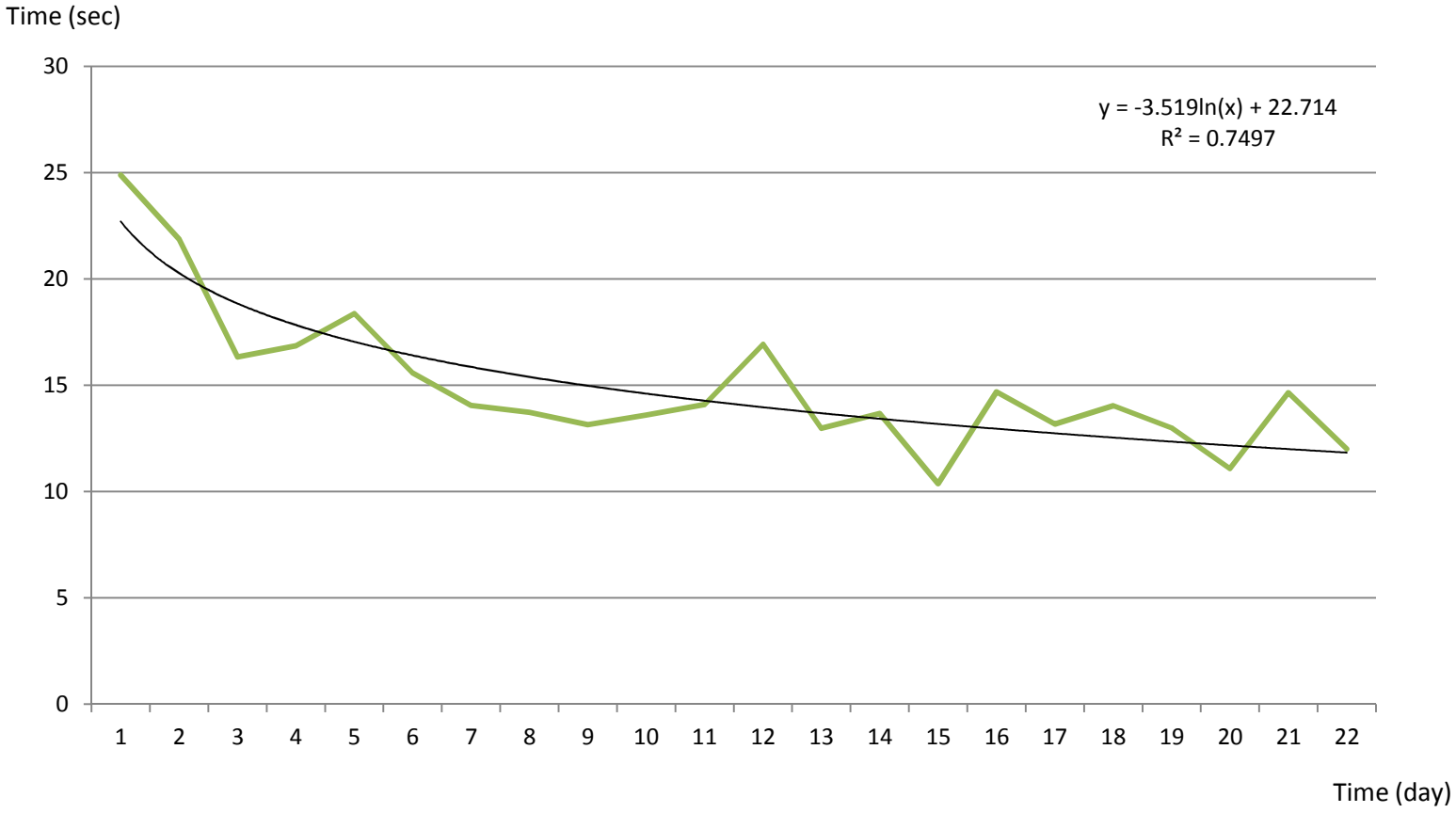
Results– Phase III

Average set based search time



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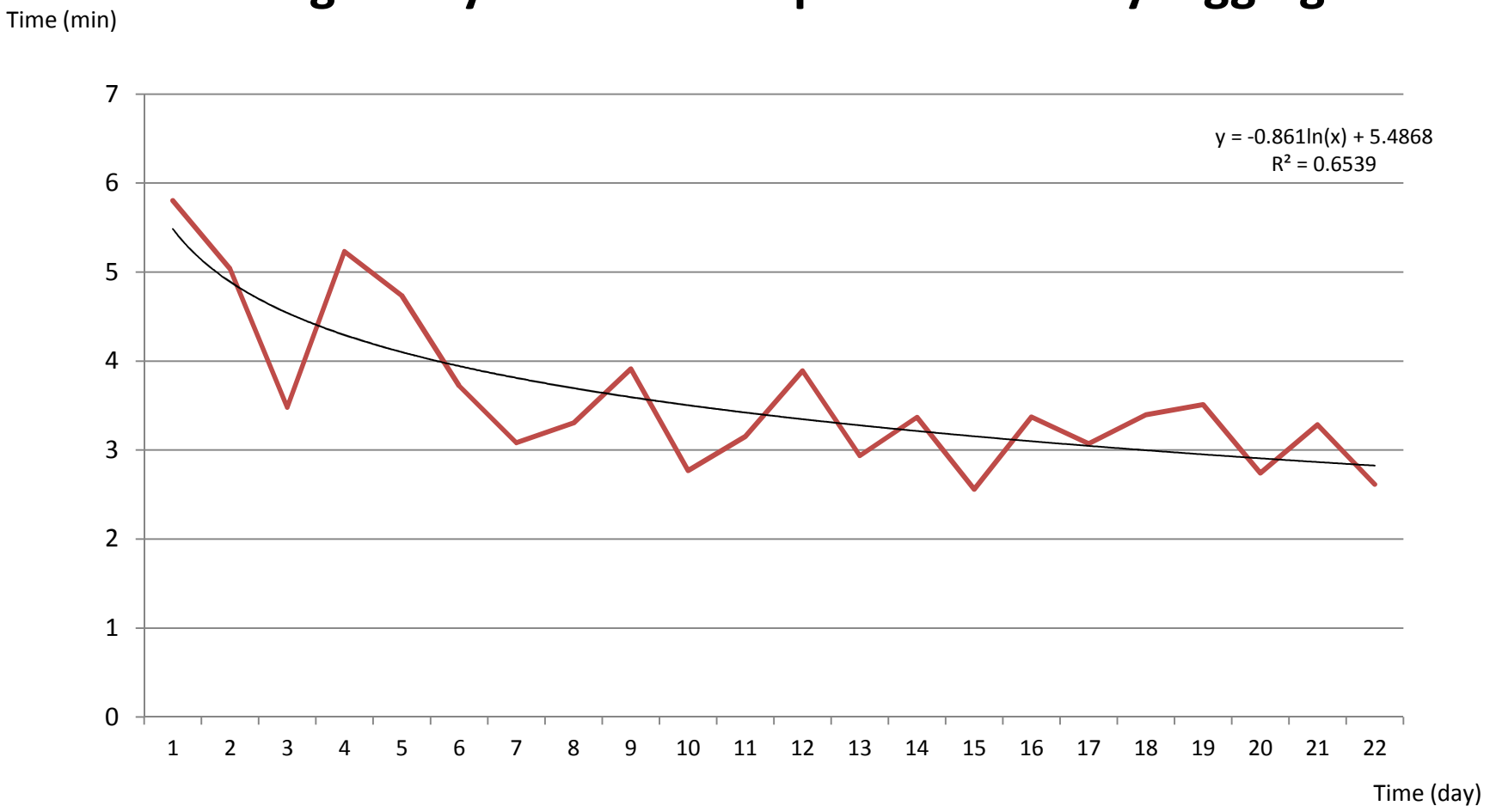
Results– Phase III

Average daily time consumption of dietary logging



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Conclusions – Phase III

- The set based dietary logging application is a viable system to generate a nutrition mirror for the users.
- The daily total time consumption of dietary logging is highly acceptable.
- Users probably need more practice to reduce the extra effort connected with keyword based search.

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Phases of clinical evaluation

- **Phase I**
  - **Applicability of logging for typical patients of a cardiac rehabilitation center** (closed)
- **Phase II**
  - **Evaluation of the utilisation of external sensors (activity/weight scales)** (running)
- **Phase III**
  - **Prediction of blood glucose evolution** (planned for 2015)

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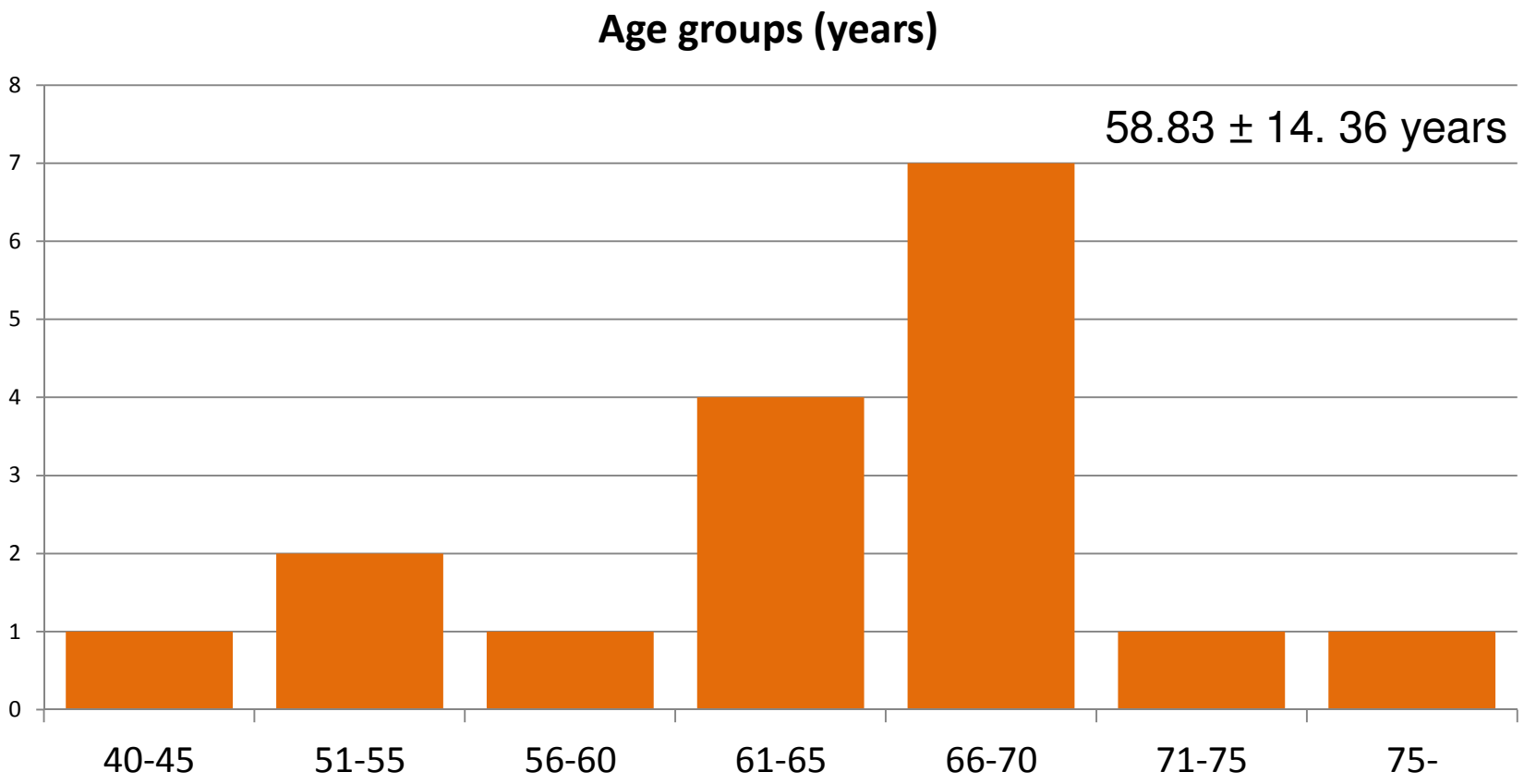
Clinical Study Patient Population

- 17 patients (9 men / 8 women)



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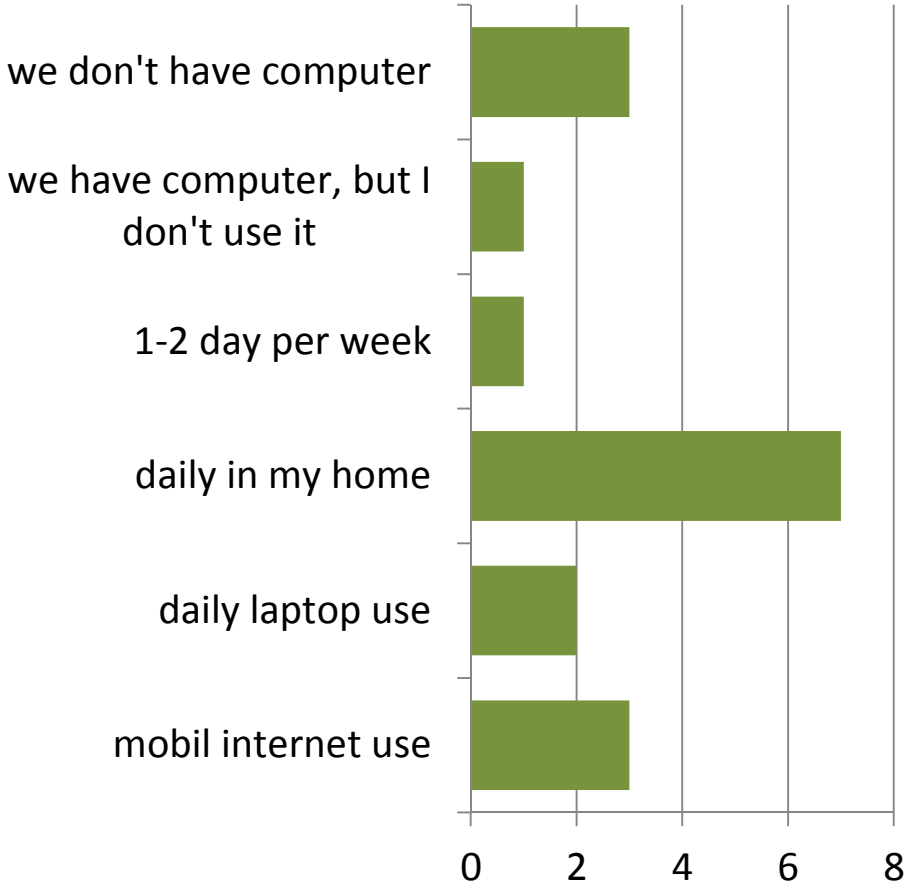
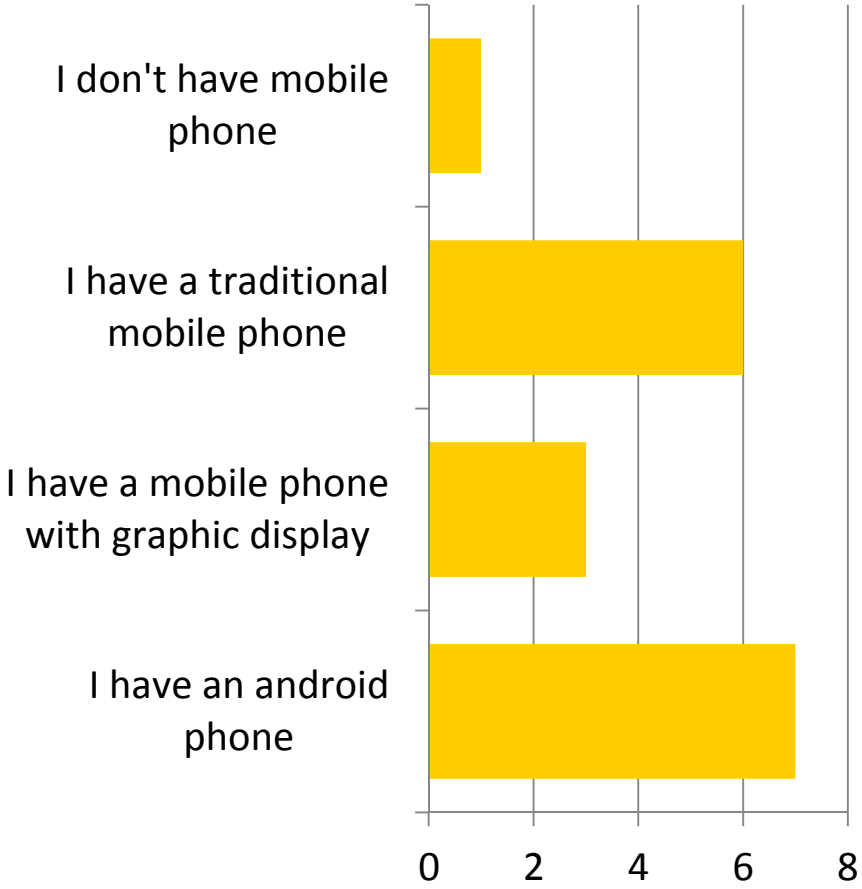
Clinical Study Patient Population

Earlier computer utilisation



Earlier mobile phone utilisation



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Clinical Study Method

- We asked the patients to log the menu served at the hospital
  - We allowed them to log other extra, individually purchased items
- Evaluation
  - Ratio of missing items
  - Ratio of extra items
  - Accuracy of weight estimation
  - Time consumption of logging
    - Calculated based on hidden time stamping

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Results

- Recorded items
  - Total 3416 (100%)
    - Menu 2109 (61,7%)
    - Extra 1299 (38,0%)
    - Double entry 8 (0,2%)
  - Missing 518 (15,1%)

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Results (2019 Menu items)

Total	2019	(100%)
– Correct name / weight	1365	(64.7%)
– Correct name Incorrect weight	535	(25.4%)
– Incorrect name	203	(9.6%)
– Group logged only	6	(0.3%)

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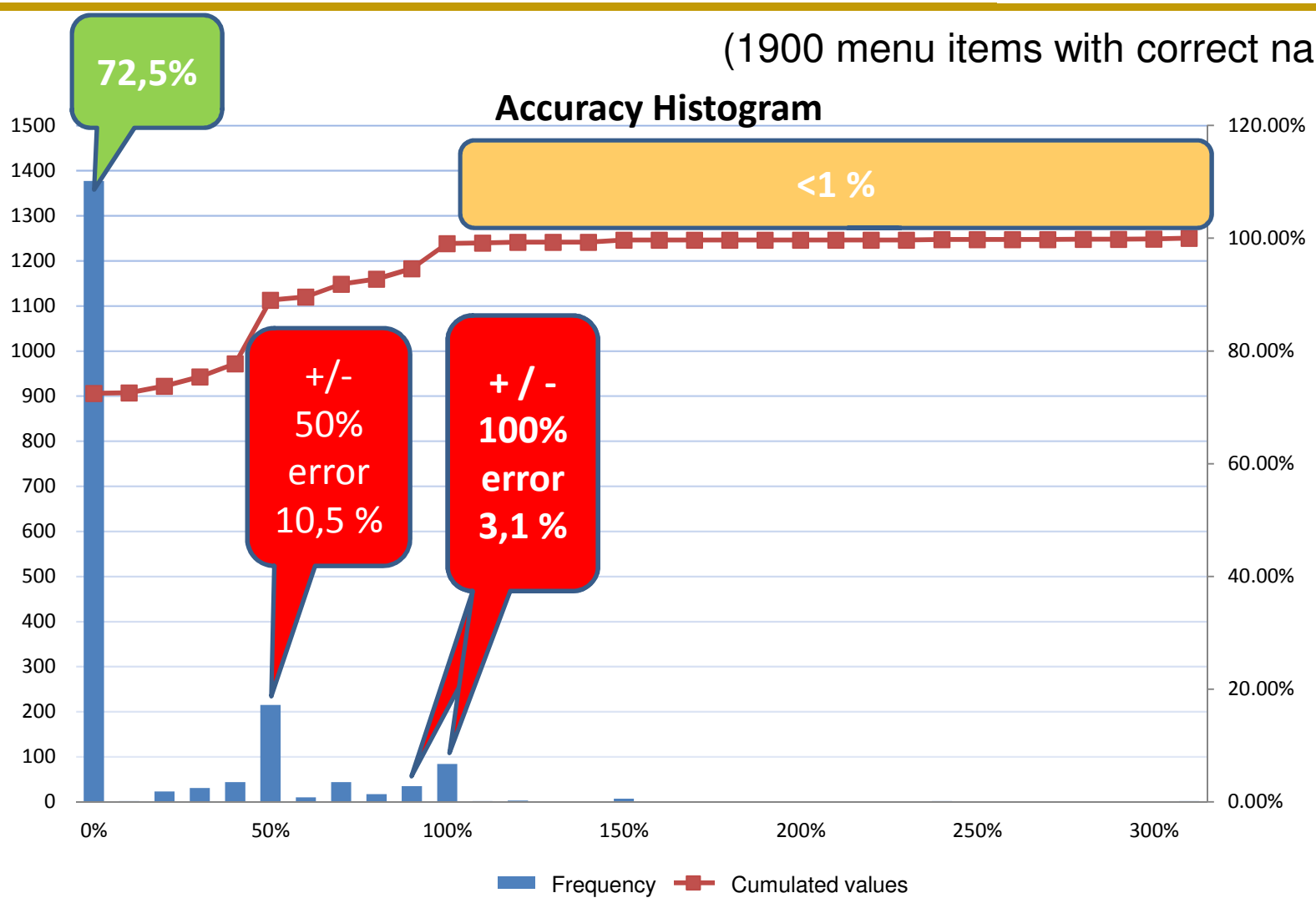
Weight estimation errors

(1900 menu items with correct names)



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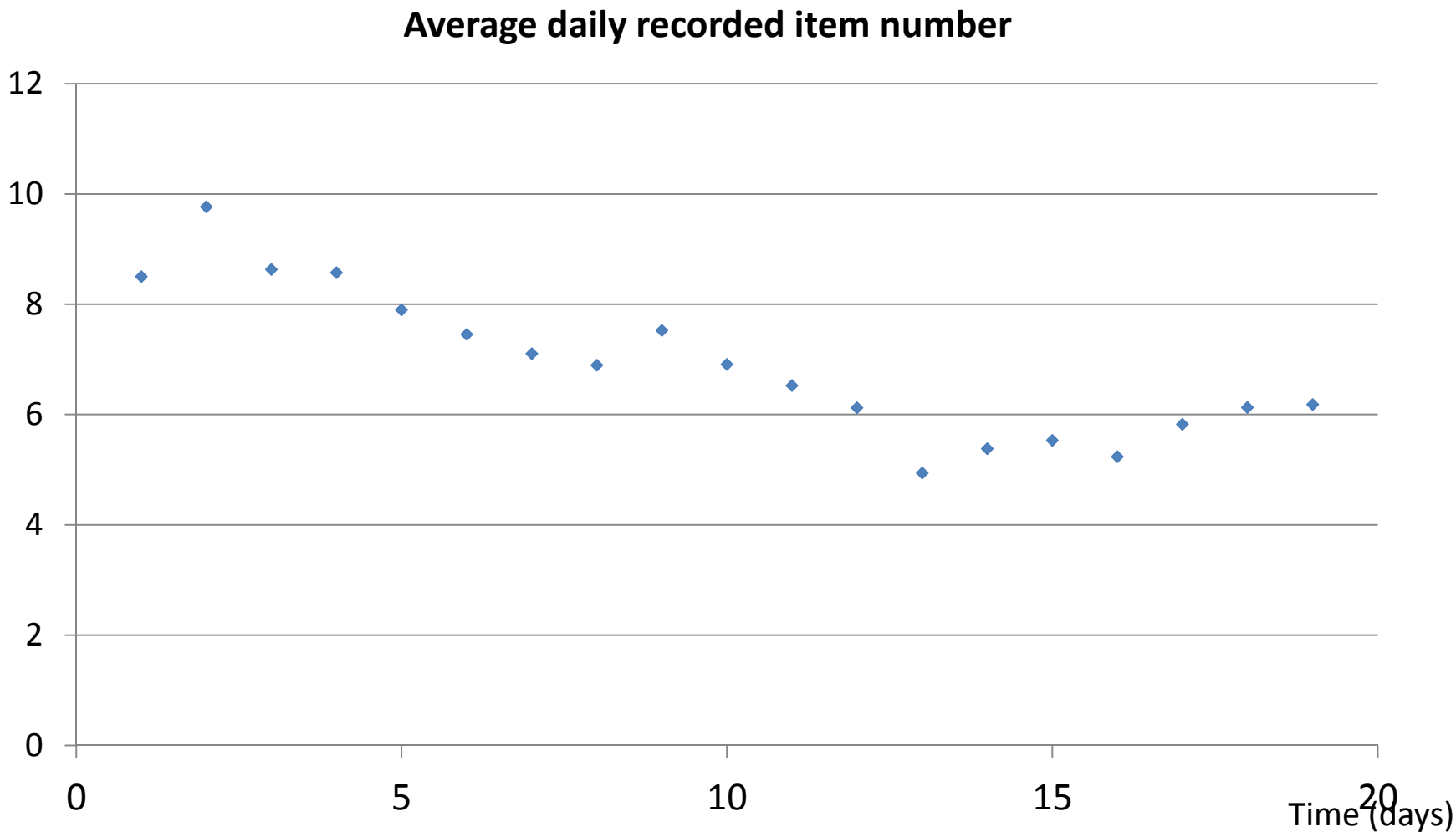
Results Time consumption



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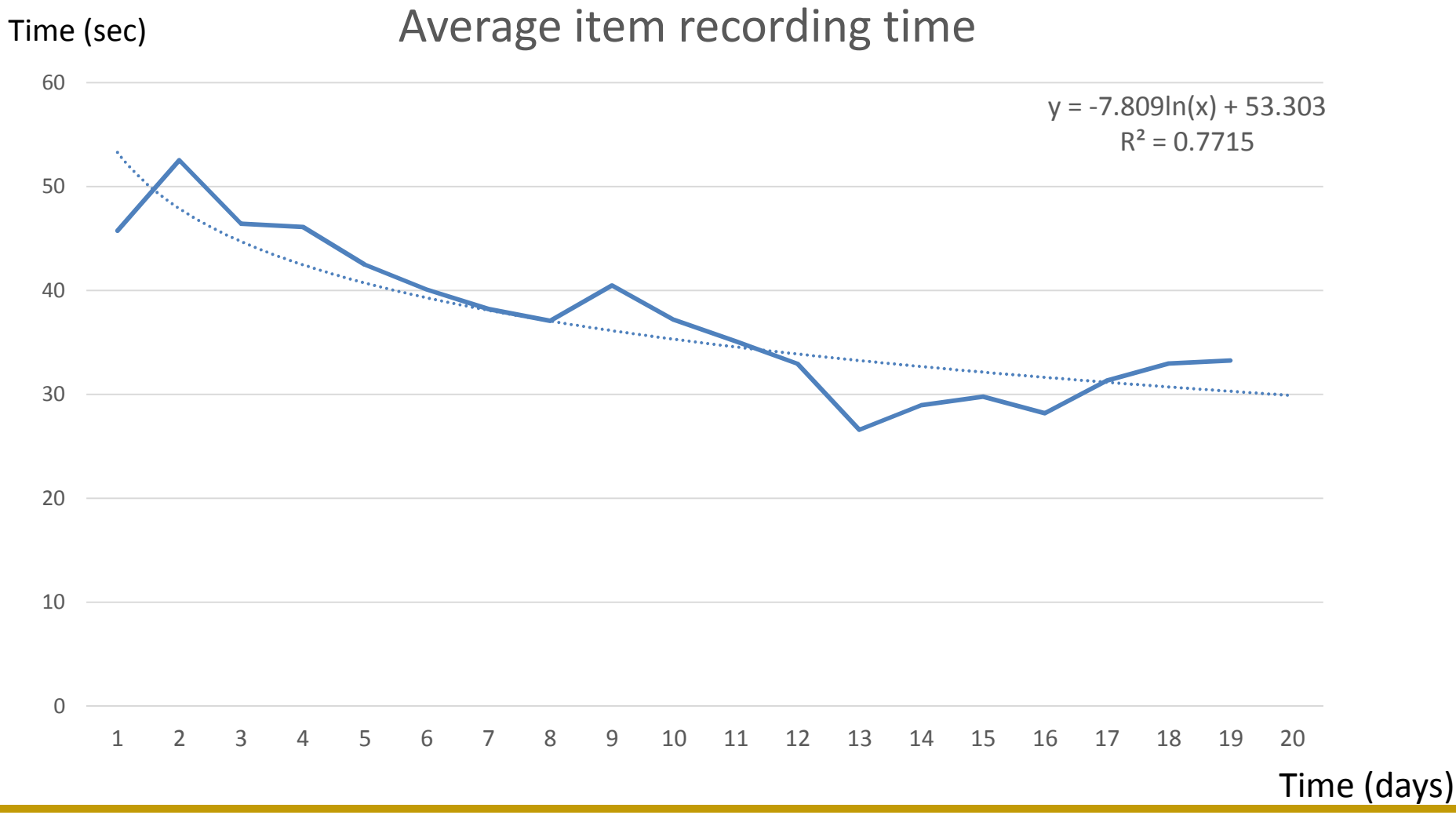
Results Time consumption



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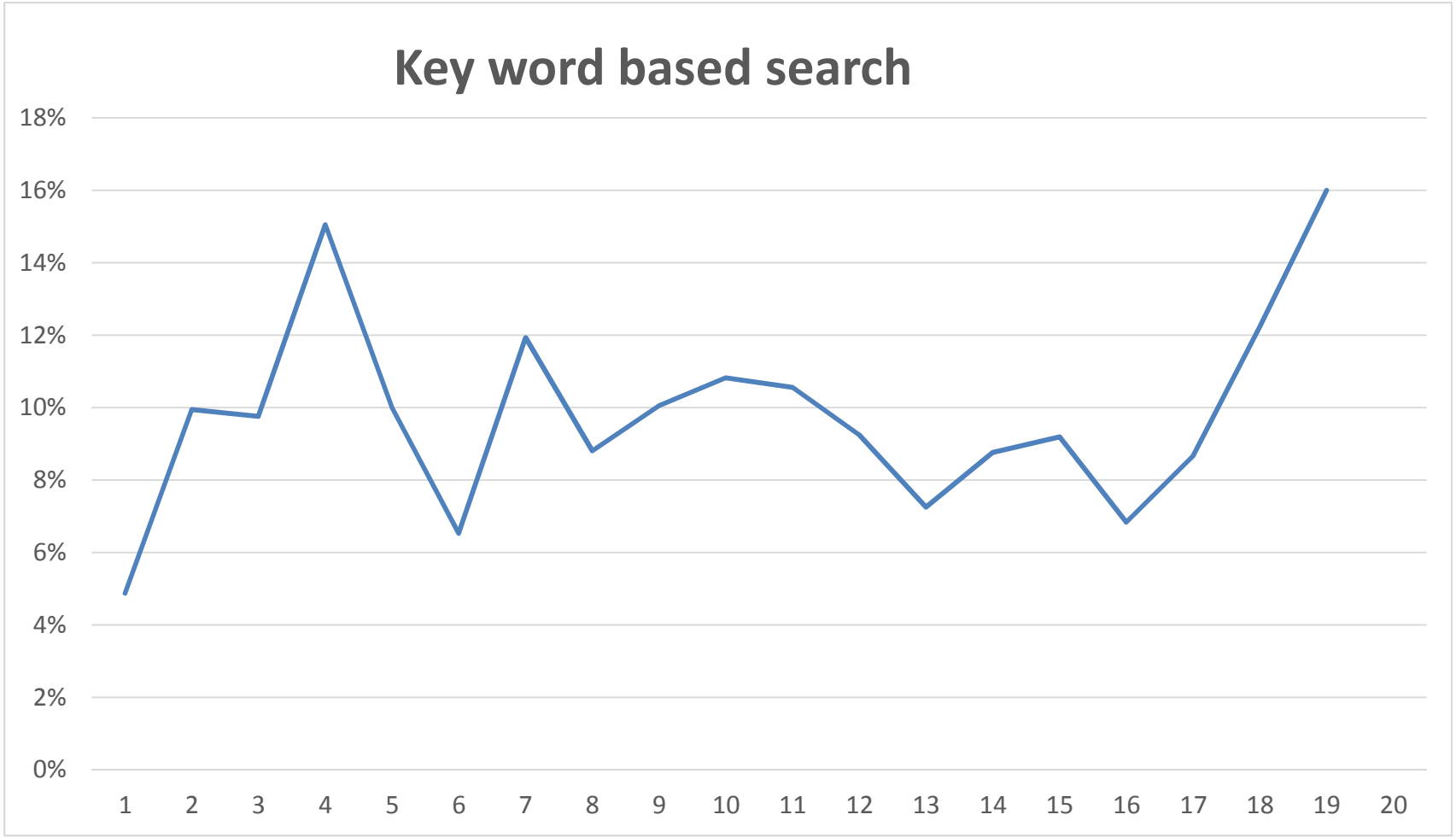
Results Time consumption



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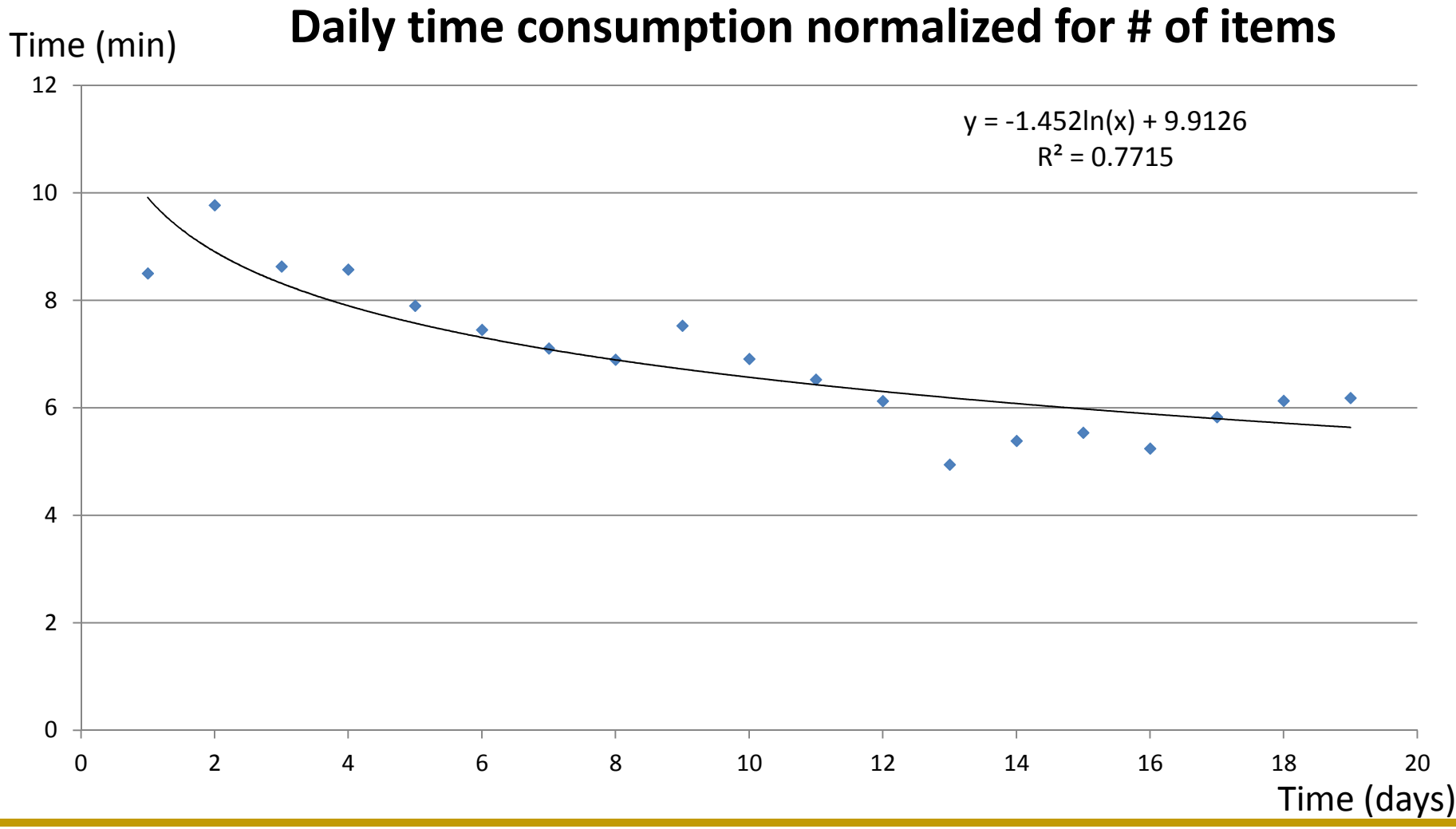
Results Time consumption of logging



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Conclusions – Clinical Phase I

- The set based dietary logging application is a viable system also for inpatients of a rehabilitation institute
- Information delivered by such an application is relevant for our patients
- We should deal with the weight estimation error
- The use of a simple dish weight scale in the introduction period can be a solution

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Many thanks for your attention

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