

## APPENDIX

# VEA - Personalizing the journey towards enhanced asthma self-management

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# Appendix 1

## What is asthma?

### 1.1 Asthma in numbers

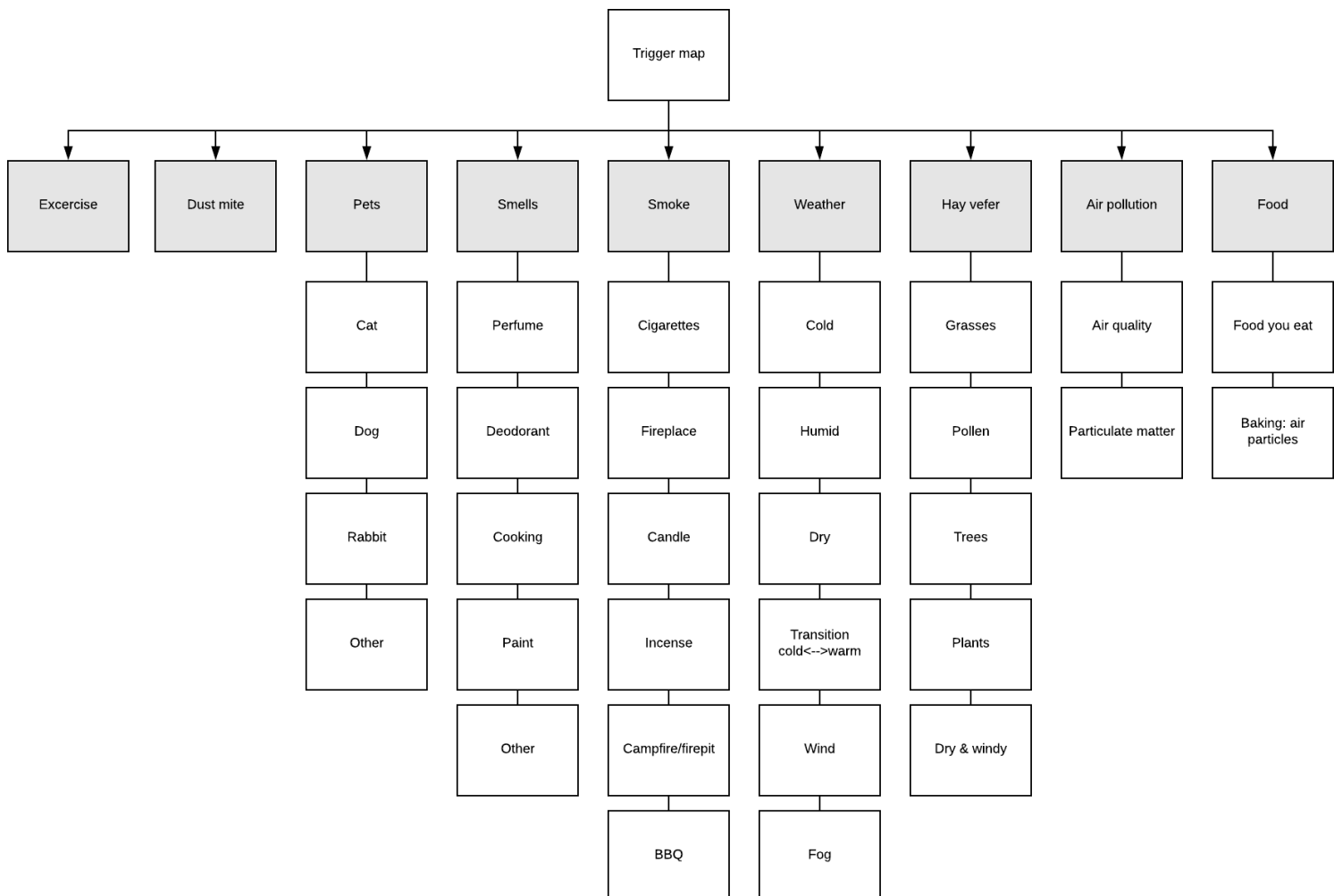
The WHO has estimated that yearly 15 million disability adjusted life-years are lost due to asthma, representing 1% of the global disease burden (Bateman et al., 2008). Worldwide 250.000 people die of asthma exacerbations yearly (long ziekten feiten en cijfers, 2013), making asthma accountable for one in every 250 deaths worldwide (Masoli et al., 2004). The yearly costs of asthma in 2007 in the US was estimated at 56 billion us dollars and in Europe 19.3 billion euro (Asthma and Allergy Foundation of America, n.d.), (Braido, 2013).

Although the costs to control asthma as perceived by patients and society seem high, the costs of

not treating asthma are considerably higher. With the cost in controlled asthma estimated to be €509 and the costs in uncontrolled asthma ranging up to €2281 per person yearly (Braido, 2013), (Bateman et al., 2008). According to GINA the substantial burden of asthma can be dramatically reduced through combined efforts of patients health care organizations and governments towards improving asthma control (Bateman et al., 2008).

### 1.2 Trigger diagram

The list below gives an overview of the triggers that were identified using longfonds.nl



# Appendix 2

## Self-management

### 2.1 Required skills in self-management

Lorig and Holman state that to manage the three self-management tasks, six core skills are required from the patient. A description of each task can be read below.

#### Problem-solving

Rather than teaching patients the solution to their problems, self-management focusses on teaching patients problem-solving skills. They learn to identify problems, to come up with a possible solution, to consult others and to implement and evaluate the results.

#### Decision making

Decision making can be seen as a part of problem-solving skills, but it is also a skill in itself. It is the ability to make daily decisions based on the changing conditions of the disease.

#### Resource utilization

It is important for patients to not only know where to find information but also to learn or be told how to utilize this information.

#### Formation of patient-provider partnership

In the shift towards collaborative care, the formation of a partnership between caregiver and patient becomes a major aspect of self-management. To be able to form this partnership patients should be thought how to recognize trends in the disease how to report these, and how to discuss them with the caregiver.

#### Taking action

By means of short-term action planning patients can learn how to change behavior. According to the self-efficacy theory people should be thought how to set achievable goals that encourage them to take action.

#### Self-tailoring

Self-tailoring is the skill to apply the different self-management behaviors to oneself as appropriate for their own situation.

#### Conclusion

Enhancing self-management skills

The six self-management skills; problem solving, decision making, resource utilization, formation of patient-provider partnership, taking action and self-tailoring, are essential for effective self-management. The final design should support the development as well as the execution of these skills.

## 2.2 Self-management tasks in asthma

Medical management according to Longfonds consists of three main tasks. The first task is taking the medication as prescribed. As described earlier an asthma patient often uses a combination of medicines. Often a patient needs to take a puff every morning and evening and sometimes during the day in case of certain activities or an exacerbation. They need to make sure that they stick to the medication schedule and that they take their medications with them if they go out the door.

The second task is the correct use of the inhaler. Medicines are often taken by means of an inhaler. Correct inhaler technique is important because only then the right amount of medication ends up in the lungs. There are many different inhalers and each inhaler requires a different technique. For some inhalers the techniques are quite complex and some patients even have to use several different inhalers. The patient can find these online at [inhalatorgebruik.com](http://inhalatorgebruik.com).

The third task that falls under medical self-management is dealing well with exacerbations. When getting an exacerbation it is important for the patient to stay calm and take the reliever medications.

Besides the medical management of asthma there are also a lot of tasks that fall under the behavioral management. There are many often

patient specific behaviors that an asthma patient needs to perform. They will be described below shortly.

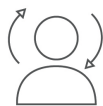
First of all the patient needs to ensure a good relationship with the caregiving team. It is important that the patient is open and honest and provides them with the right information about their life, adherence, activity, eating patterns etcetera. It is important for asthma patients to live a healthy life and have as little risk as possible to be susceptible to for example a cold. This entails that the patient needs to do enough physical activity. Longfonds advises at least 5 days a week 30 minutes of physical activity. When doing sports some asthma patients need to be more careful than others. Asthma patients need to take care of a healthy diet. The need to get enough sleep and make sure to manage their energy levels during the day. If a patient smokes it is very important that they stop as smoke irritates the lungs and impedes the functionality of medicines.

Asthma patients can be allergic or sensitive to a number of different irritants, the patient should learn what these are for him or herself and try to avoid these irritants as much as possible. Lastly asthma patients should try to help others in their surroundings to understand their condition and they need to be understanding that others might not understand them.



Medical management

Medicine intake  
Inhaler technique  
Management of exacerbations



Behavior management

Patient doctor relationship  
Practice sports  
Energy management  
Manage food  
Optimise Sleep  
Stop smoking  
Avoid irritants  
*Dust mite*  
*Pets*  
*Smells*  
*Smoke*  
*Weather*  
*Hay fever*  
*Air pollution*  
*Food*



Emotional management

Acceptance  
Coping  
*Understanding for others*  
*Get understanding from others*



# Appendix 3

## Market research

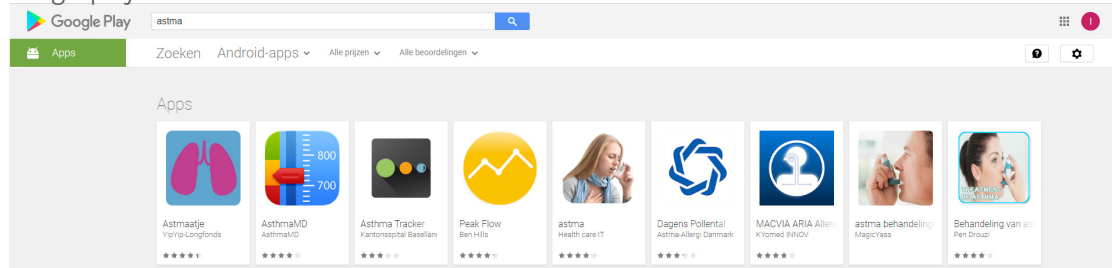
### 3.1 market research mobile health applications

#### 3.1.1 Search results

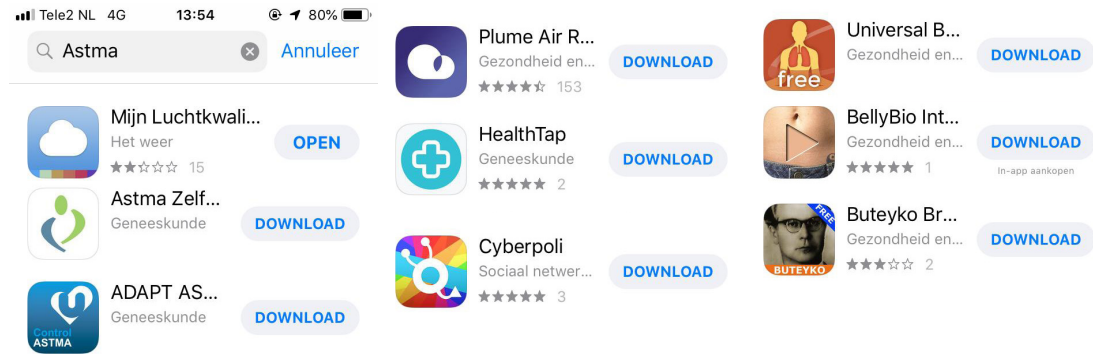
To find out what current apps already provide and to indicate possible market gaps some asthma self-management apps were compared. A search was performed using the two most commonly used app platforms: "Google play"

and "App store". The input for the search was the keyword "astma" in Dutch. The first 9 apps that came up in each of the platforms can be seen below. Inclusion criteria for the research were: app has to be for adults, app has to be related to self-management or self-monitoring. Apps that were excluded were breathing exercise apps, apps for children, apps that stopped existing over the course of the research and apps that were in other languages than Dutch or English.

Google play results for "astma"

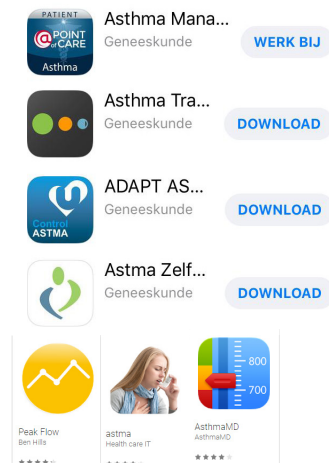


App store results for "astma"

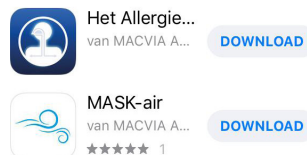


The following apps were included in the research:

#### Asthma self-management apps:



#### Allergy tracking apps





#### Air conditions apps




### 3.1.2 Excluded apps and exclusion criteria:


#### Breathing Exercises apps

 **Buteyko Br...**  
Gezondheid en... [DOWNLOAD](#)


 **Universal B...**  
Gezondheid en... [DOWNLOAD](#)


 **BellyBio Int...**  
Gezondheid en... [DOWNLOAD](#)  
★★★★★ 1  
In-app aankopen


#### Not for Dutch market

  
Dagens Pollental  
Asthma-Allergi Danmark  
★★★★★


#### Apps for children


 **Cyberpoli**  
Sociaal netwer... [DOWNLOAD](#)  
★★★★★ 3


 **Astmaatje**  
YipYip-Longfonds  
★★★★★

 **Asthma Dodge**  
Martin Rees  
★★★★★


#### Excluded - apps do not exist anymore

 **astma behandling**  
MagicYass

 **Behandeling van**  
Pen Drouzi  
★★★★★

 **MACVIA ARIA**  
Allergi  
Kromed INNOV  
★★★★★

#### GP chat

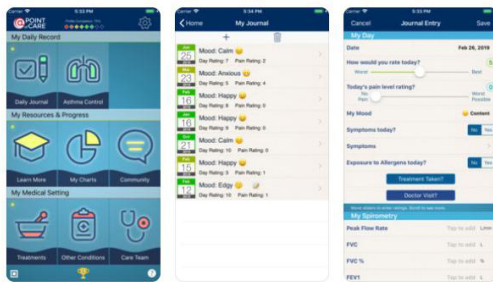
 **HealthTap**  
Geneeskunde [DOWNLOAD](#)  
★★★★★ 2

### 3.1.3 An impression of the researched apps

App name: Asthma Manager

Key words: Information & tracking asthma

Comment: UI is not easy to understand, technical uninviting look

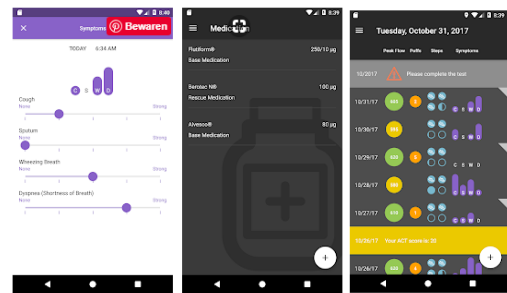


App name: Asthma Tracker

Installations: 1000

Key words:

Comment:



App name: Adapt Astma

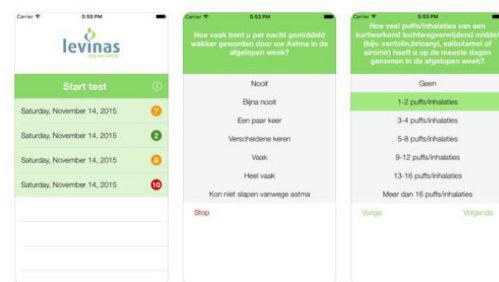
Key words: Status Asthma & allergies

Comment:



App name: Asthma zelfcheck

Key words: Asthma control test

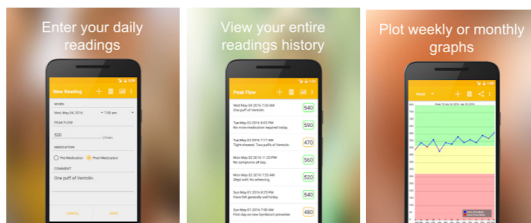


App name: peak flow

Installations: 10000

Key words:

Comment:

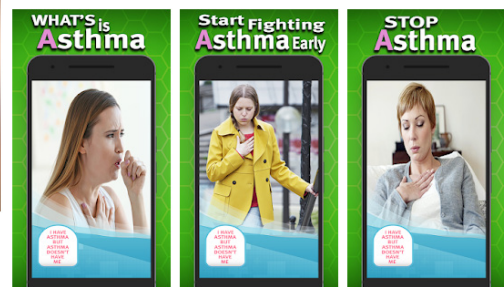


App name: astma

Installations: 1000

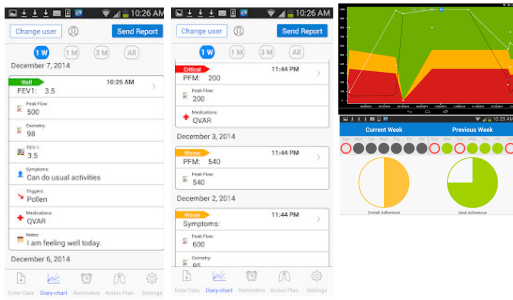
Key words:

Comment:



App name: AsthmaMD  
 Installations: 10.000  
 Key words:

Comment:

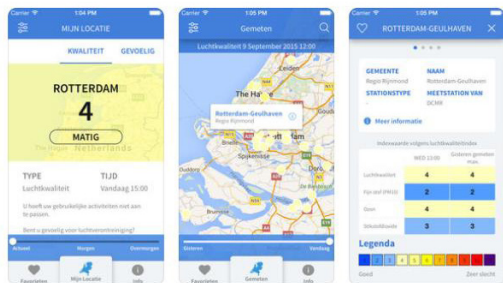


App name: MACVIA ARIA Allergie Dagboek  
 Installations: 10.000  
 Key words: Tracking allergies  
 Comment:

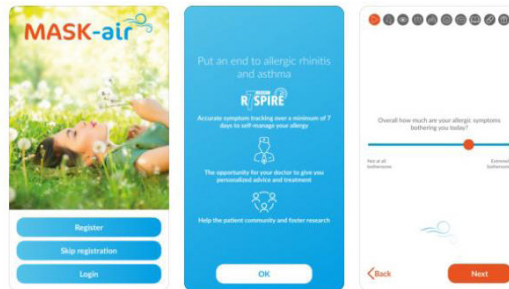


App name: Mijn Luchtkwaliteit  
 Key words: Luchtkwaliteit

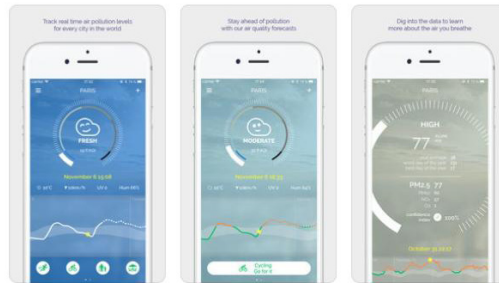
Comment:



App name: MASK-air  
 Installations:  
 Key words: Tracking allergies  
 Comment:



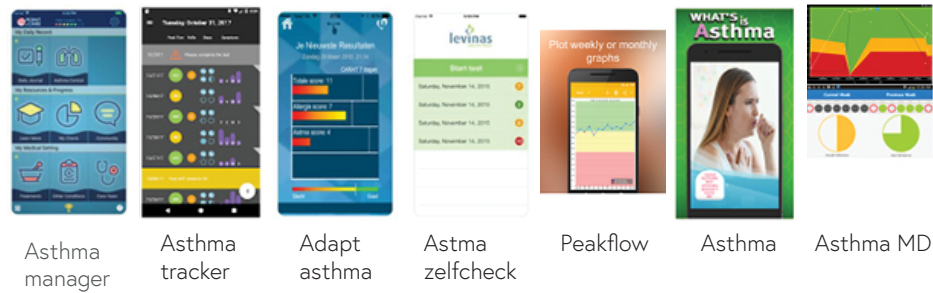
App name: Plume Air Report  
 Key words: Air quality  
 Comment:



### 3.1.4. Results

Several criteria that are believed to be important for self-management apps were set up. The criteria were divided under three main criteria: Self-management, knowledge, and patient experience. In the figure below the results can be found.

It is important to note that some criteria such as easy to understand or aesthetically pleasing are based on my personal opinion as an industrial designer, and some readers might perceive these different. Below the most important findings are visually displayed.



| Self-management         |   |   |   |   |   |   |   |
|-------------------------|---|---|---|---|---|---|---|
| Trends                  | ● | ● | ● | ● | ● | ● | ● |
| Action setting          | ● | ● | ● | ● | ● | ● | ● |
| Knowledge               |   |   |   |   |   |   |   |
| Knowledge               | ● | ● | ● | ● | ● | ● | ● |
| Personalized            | ● | ● | ● | ● | ● | ● | ● |
| Visually presented      | ● |   |   |   |   |   | ● |
| Self-monitoring         |   |   |   |   |   |   |   |
| ACQ                     | ● | ● | ● | ● | ● | ● | ● |
| Adherence               | ● | ● | ● | ● | ● | ● | ● |
| Reminders               | ● | ● | ● | ● | ● | ● | ● |
| Other complaints        | ● | ● | ● | ● | ● | ● | ● |
| Trends                  | ● | ● | ● | ● | ● | ● | ● |
| Patient experience      |   |   |   |   |   |   |   |
| Aesthetically pleasing  | ● | ● | ● | ● | ● | ● | ● |
| Understandable graphics | ● | ● | ● | ● | ● | ● | ● |
| Efficiency              | ● | ● | ● | ● | ● | ● | ● |
| Gamification            | ● | ● | ● | ● | ● | ● | ● |

● Yes

● To some extent

● No

### 3.2 Market research smart inhalers

The table below provides a visual overview of the results. The devices that are currently seen mostly track medication adherence and wirelessly communicate these to mobile applications. Some of these applications connect the data to the location, weather and/or air conditions to provide insight in measurable triggers. A shortcoming here is that the discovery of non-measurable triggers is not supported, such as the presence of pets or dust mites (orange).

Another major shortcoming is that patients often need to manually log information which costs a lot of time and effort, which patients are often not willing to invest. At least the smart additions cannot provide any feedback on inhalation technique, intake of medicines and usage of the device.



Propeller



Turbu+



MyAirCoach

| Features Inhaler     |   |   |   |
|----------------------|---|---|---|
| Track Adherence      | ● | ● | ● |
| Inhalation Technique | ● | ● | ● |
| Connection Phone     | ● | ● | ● |
| Dose Counting        | ● | ● | ● |
| Features App         |   |   |   |
| Reminders            | ● | ● | ● |
| ACQ                  | ● | ● | ● |
| Self-monitoring      | ● | ● | ● |
| Adherence            | ● | ● | ● |
| Trends               | ● | ● | ● |
| Triggers             | ● | ● | ● |

Track adherence - whether it tracks the intake of medication  
 InhalationTechnique - feedback on inhaler technique  
 Connection Phone - wireless connection to a phone  
 Dose Counting - feedback on whether the user inhaled all of the medicine

Reminders - can the user set reminders for medication  
 ACQ - can the user track level of asthma control  
 Self-monitoring - can the user self-monitor complaints  
 Adherence - is adherence shown  
 Trends - does the app provide insights by showing relations between adherence and ACQ  
 Triggers - to what extent is the user supported in the discovery of triggers

● Yes      ● To some extent      ● No



### 3.3 Market analysis traditional care

#### Traditional care

Traditionally asthma is treated through inhaled medication and sometimes with medicines in the form of pills. Today the inhaled medication is the main source of treatment for asthma patients. There are numerous different inhalers, which in turn can contain different medicines.

The inhalers on the market can be divided into three main categories based on their working principle, see the figure in the next page. Each category has been researched and compared below.

#### Method

For finding and categorizing the different inhalers the Dutch website [www.inhalatorgebruik.nl](http://www.inhalatorgebruik.nl) has been used. In order to compare the different inhalers and their usability five categories of comparison were used: working principle, preparing for first time use, technique required, ease of inhaling and size. It is important to note that since the inhalers each work very different the results are not quantified in numbers but described in word.

#### pMDI – Breath actuated

pMDI's deliver the drug to the lungs via inhalation.

The breath actuated pMDI comes ready to use. Use of the device does not require a complicated technique, when using a breath actuated MDI it is important to inhale deeply and calmly in order to get all the medicine out of the device (Bass, 2018). At last the device has a manageable size.

In the figure some examples of Breath Actuated MDI's can be seen.

#### pMDI – non-breath actuated

Non-breath actuated MDI's use a propellant to deliver the drug to the lungs.

The non-breath actuated pMDI is very easy to prepare for use, the canister needs to be inserted and after 3 test sprays the device is

ready for first time use. Using the inhaler does require a rather complex technique. Users should actuate the inhaler by pressing it and at the same time inhale at a proper pace. It is estimated that only 8% of the users of this kind of inhaler can perform the right coordination of actions.

To overcome the need for good technique the Non-Breath actuated MDI is usually prescribed with a volume spacer (Haugney et al., 2008). This way the drug gets spread in the volume spacer and patients can inhale the drug more easily and the timing is less crucial. A problem, however, is that using a spacer is patients least preferred way of inhaling and user research has shown that none of the patients actually use the device due to its large size.

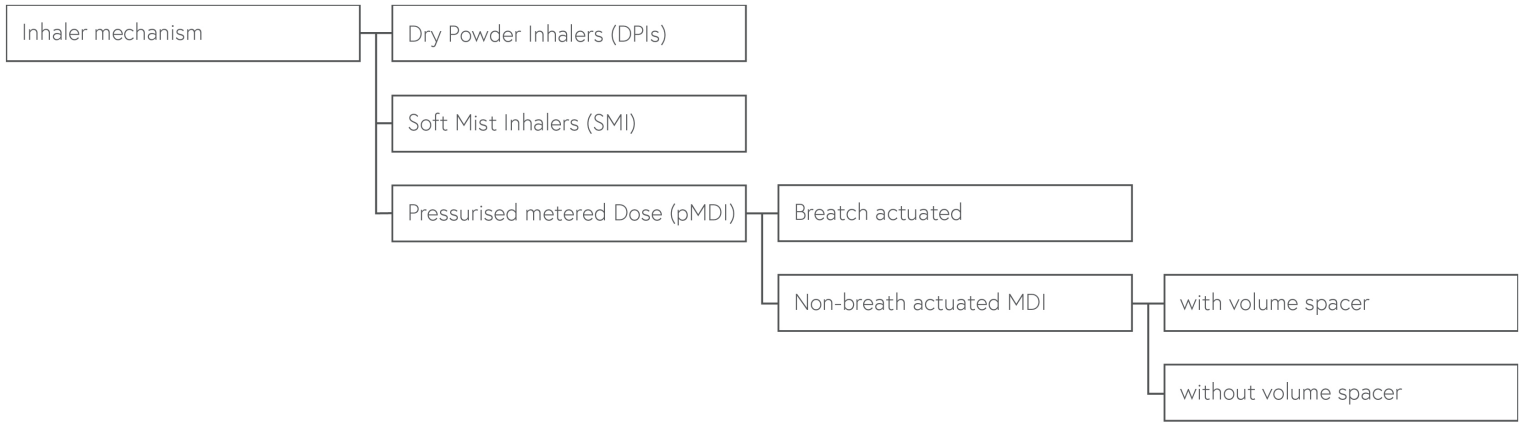
#### Dry powder inhaler

Dry Powder Inhalers work by means of manually loading the drug, this is done by either loading a single dose capsule that is pierced or by the device metering a dose upon activation (G.Waller and P.Sampson, 2018). After activation, the drug can be actuated by means of deep forceful inhalation. The advantage of this type of inhaler is that they overcome the need to both coordinate activation and breathing at the same time (Javadzadeh and Yaqoubi, 2017), the technique is thus easier to perform. A slight problem with these devices is that when feeling stuffy, it is difficult to inhale forcefully and thus difficult to inhale the medicine. On average these devices are slightly bigger than the pMDI's but still easy to carry.

#### Soft mist inhaler

The Respimat (see figure on next page) is a soft mist inhaler. The device contains liquid medicine which is converted into a mist that can be inhaled by the user (Ponen, 2019). A problem pointed out in the user





Pressurized metered dose - Breath Actuated (inhalatorgebruik.nl)



A selection of the 20 non-breath actuated metered dose inhalers (inhalatorgebruik.nl)



Volume spacers that can be used in combination with pMDI's (inhalatorgebruik.nl)



Dry Powder Inhalers (inhalatorgebruik.nl)



Soft mist inhaler (inhalatorgebruik.nl)

### 3.4 Additional research inhaler

#### Unintentional non-adherence - inability

Because the inhaler technique is so important it is advised that users do not use more than one different type of inhaler at a time. It is advised that even over time patients should not switch between inhalers as they might revert back to old using habits, causing them to inhale wrongly. These points were also pointed during interviews with caregivers, however, during the user research, it was uncovered that often the opposite happens, with some users having had up to 9 different inhalers.

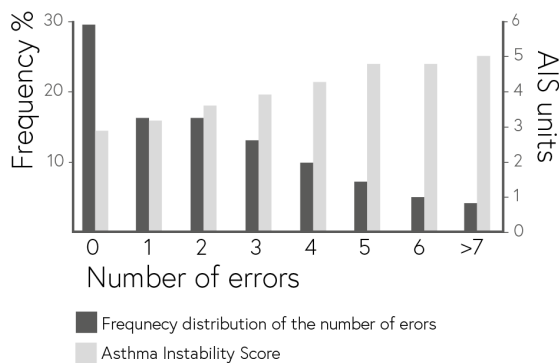
A good demonstrator of the problems with inhalers is the use of MDI's (see table below). Only 8% of the patients are able to perform the

right breathing with good coordination when using their MDI. The need for good technique can be overcome by using a spacer, however using a spacer is the least favorite way of inhaling by patients (Haugney et al, 2008). During the user research, this problem also came forward, there were a few patients using MDI's and from their explanation it could be concluded that they do not use their inhaler correctly and based on their personal beliefs they were convinced that a spacer would be unnecessary.

#### Aerodynamics

Earlier versions of the concept direction also involved looking at the redesign of the inhaler. Even though the inhaler is out of scope it was decided to include all research findings and ideation into the appendix of this report upon special request by CAHAG. It was agreed to do so because CAHAG believes that the research might provide useful insights for the pharmacists in the workgroup.

During the brainstorm sessions several ideas came up for improvement of the pMDI inhaler. To verify and iterate upon these concepts three experts were consulted. Two experts on aerodynamics and fluid dynamics were consulted: F.Hu and A.Roseillier and one expert on mechanical engineering, E.Garner, was consulted. The sketches on the following page demonstrate some concepts that resulted from these conversations and the propositions done by the consulted experts.



Number of errors in inhalation technique in relation to asthma instability score (Haugney et al., 2008)



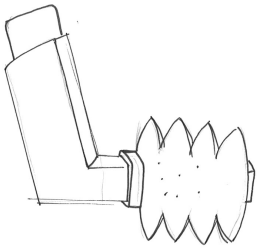
MDI (inhalatorgebruik.nl)



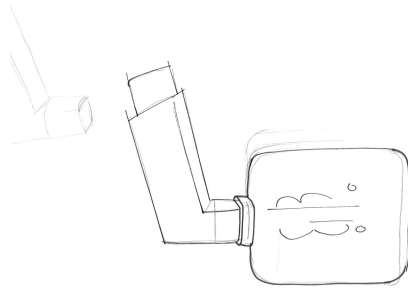
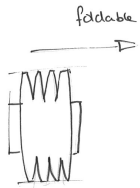
MDI should be used in combination with a spacer (inhalatorgebruik.nl)

# Ideation Inhaler

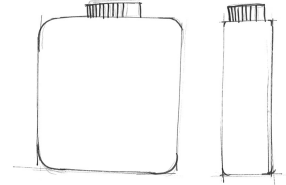
text



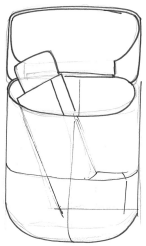
add-on  
to slow down  
spray



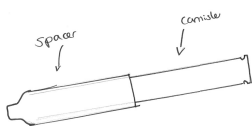
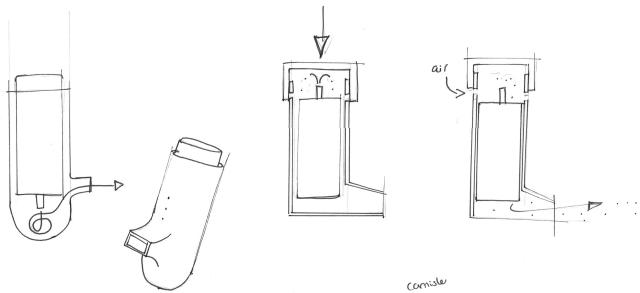
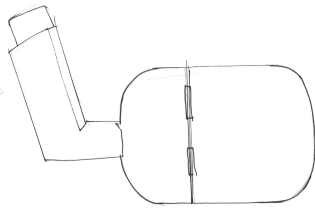
sprays  
medicine in  
on the go packaging



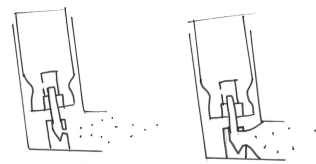
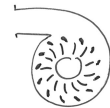
shake before  
use



inhaler placed  
inside spacer



turbine to slow down  
spray



increase area  
↳ makes it slower

curved walls: diffuses



- might get stuck  
to the walls

# Appendix 4

## Patient perspective

### 4.1 Focus group - Method

#### Method

In order to get a deep understanding of the user perspective qualitative research by means of a focus group was conducted. For the setup of this research the context mapping method as described by Froukje Sleswijk and colleagues was used (Visser et al., 2005).

#### Research objectives

Before setting up the focus group eight research questions were determined. These questions are listed below.

1. What does the process of diagnosis till asthma control consist of?
2. How do patients experience the process after the diagnosis?
3. Where do patients get information from?
4. What beliefs and knowledge do patients have related to their medicines?
5. What role does self-management play in the lives of asthma patients?
6. How do people perceive and interact with their inhaler?
7. What role does the general practitioner play in the patient's treatment and self-management?
8. Do asthma patients themselves have suggestions for improvement of asthma treatment?

To find participants three methods were used. (1) several calls on social media were placed (Facebook and Facebook groups for asthma patients) this yielded one participant. (2) Through consulting employees of NeLL which one participant was found. (3) By word of mouth, and through WhatsApp groups colleagues and friends were asked if they knew any possible participants, this yielded three of the participants. (4) a message on longforum.nl, and (5) posters in supermarkets and elevators did not result in any participants.

In total 16 willing participants were found. The final participants were selected on: severity of asthma, recency of diagnosis and age. Only two participants matched the target group perfectly, others matched some of the criteria. The table below provides an overview of the participants.

#### Participants

| Participant | Age | Asthma diagnosis | Asthma severity   | Asthma control      | Type of asthma                           |
|-------------|-----|------------------|-------------------|---------------------|--|
| 1           | 62  | 2017             | Mild intermittent | Partly controlled   | Non-allergic, exercise induced           |
| 2           | 28  | February 2015    | Severe            | partly uncontrolled | Allergic, non-allergic, exercise induced |
| 3           | 26  | May 2013         | Mild intermittent | Controlled          | Non-allergic, exercise induced           |
| 4           | 24  | 2001             | Mild intermittent | Controlled          | Allergic, non-allergic, exercise induced |
| 5           | 26  | Birth            | Severe            | Partly uncontrolled | Allergic, non-allergic, exercise induced |

### Methods used preparation

To prepare the participants for the focus group and to get some more in-depth information about the participants a sensitizing booklet was created (Appendix 4.2). This booklet contained five tasks that needed to be completed, spread over five days. This booklet was sent out to the participants a week before the session.

One day before each session the booklets were retrieved and studied. Notes were made on aspects that seemed interesting and questions were created to gain more in-depth insights during the session.

### Methods used in the session

The session itself consisted of a context mapping session (Visser et al., 2005). Two of the sessions were held at the TU Delft and one session was held in a private space in the public library of Amsterdam.

For the session two different assignments were created. The first assignment was to map out the process of diagnosis from first complaints till stability of asthma. Several stimuli were created in the form of icons that could be pasted on a timeline. These icons can be found in appendix 4.2.

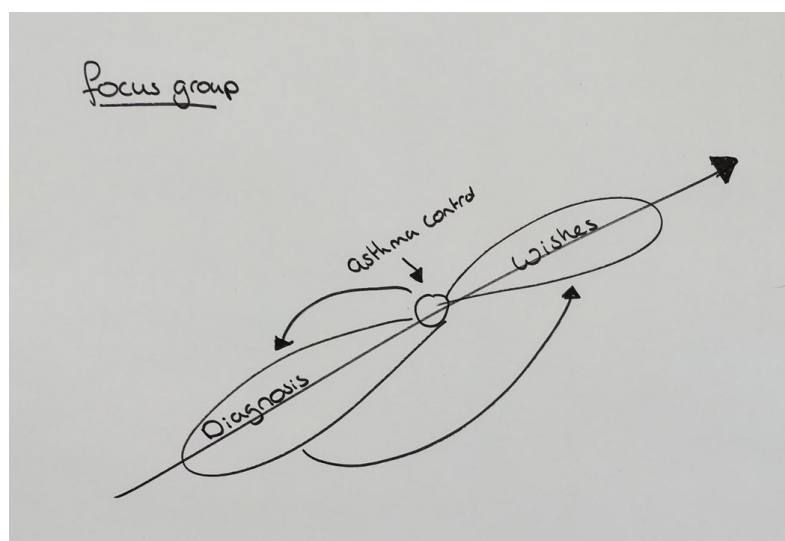
After the first assignment was completed the results were presented by the participants, questions were asked by the researcher and

discussions emerged.

In part two of the research participants had to make a mindmap about three different topics; inhalers, medicines and information. A template for each mindmap was created, supported with icons, words and questions on an A3 sheet. Per topic the results were presented by the participants and questions by the researcher lead to discussions. See appendix 4.2 for the mindmap templates.

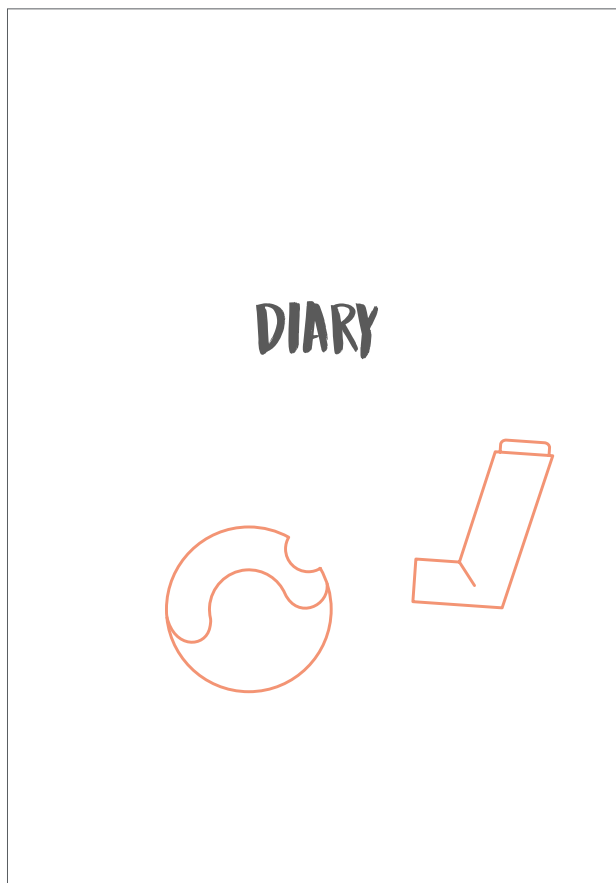
Each session was video- and audio-recorded. Right after each session the recordings were analyzed, and quotes related to the topics information, medication, inhaler, doctor, booklet, app, idea, diagnosis and other, were written down and clustered. Each of the quotes related to these topics has been typed out and can be found in appendix 4.4.

Apparatus can be found in appendix 4.2.



## 4.2 Focus group apparatus

Sensitizing booklet



### THANK YOU FOR PARTICIPATING!

#### What are we going to do:

This booklet will be your diary for the upcoming 5 days. Every day you can answer a few short questions. This is in order to prepare for the session that we will be doing, so we can dive deeper into the different topics then. It is important that you answer honestly and there is no wrong or right answers. You can use all the space to write draw or do anything else you would like to do.

#### Why are we doing this?

The goal of this booklet and the focus group is to think about how you live with asthma and how you perceived the road from diagnosis until where you are now. With this information we can see how we can improve on this process for future patients and how we can give them the right support.

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### TELL ME SOMETHING ABOUT YOURSELF

Name:

Age:

Occupation:

I have asthma since:

These are the medications that I use:

This is what I do in my spare time:

This is the phone I use:

Living situation:

## DAY 1

Could you describe in your own words what asthma is?  
You might think about: What causes it, what do you feel, what happens in the lungs, what are the medications for?

How did asthma change your life?

## DAY 2

Can you give a description of the following statements:

This is how my asthma feels this week:

This is how my asthma feels when it is going well:

This is what it feels like when it is not going well with my asthma:

At the moment my asthma is/isn't in control because:

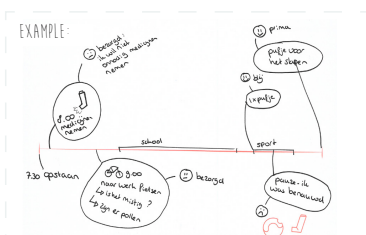
## DAY 3

Could you keep track today of what a typical day with asthma looks like for you?

1. Describe your day, write down or draw the different activities of today, think of getting up, what is your morning ritual, how do you get to different places etc.

2. Could you circle the moments that you are concerned or occupied with things related to asthma. Think of the moments you take your medications, moments you felt a bit stuffy, etc. write these moments down and circle them.

3. Note how you felt at these moments by means of drawing smileys. (or use the smileys provided)



## DAG 4 – DIAGNOSIS

Could you describe the process of the diagnosis and the time after?  
Some questions are set up to help you, but you can give them your own interpretation.



Could you describe how the diagnosis was made?  
Did you have to come back over time? Who did you talk to?

Which information did you get from the GP/lung doctor/....

Were you satisfied with the information that you got?

Was there information that you would like to have but did not (sufficiently) get??

Three things that I liked about the process of the diagnosis are:

- 
- 
- 

Three things that I did not like about the process of the diagnosis are:

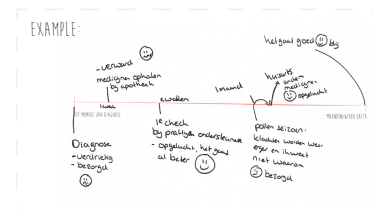
- 
- 
- 

## DAY 4 – SHORTLY AFTER DIAGNOSIS

Do you want to describe how you felt at different moments after the diagnosis?

1. Mark important moments or happenings for you at the timeline and describe them.

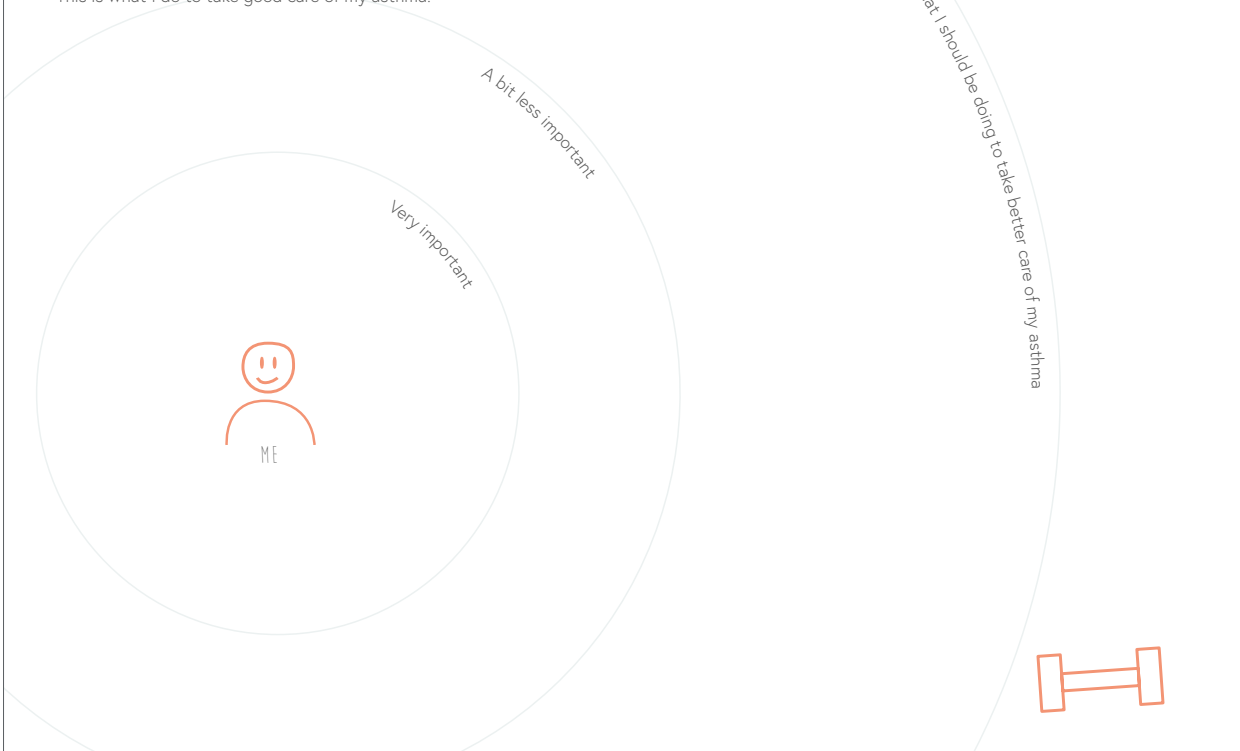
2. Describe how you felt at this moment using a smiley or a word.





## DAY 5 SELF-MANAGEMENT

This is what I do to take good care of my asthma:



## NOTES

You can leave any notes or comments here:



### 4.3 Focus group apparatus

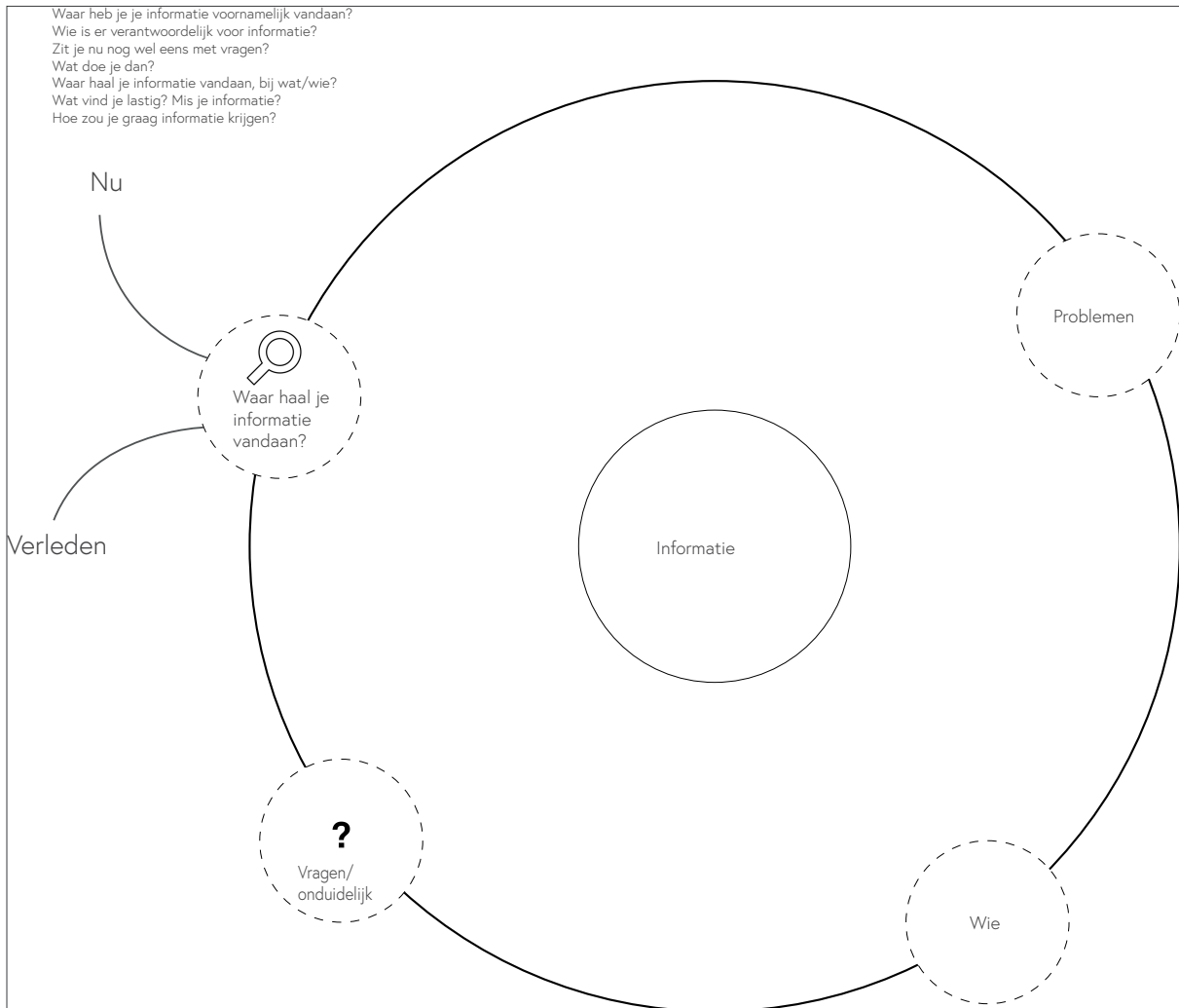
Input for assignment 1; creating timeline of diagnosis

**Verzorgers**

**Locaties**

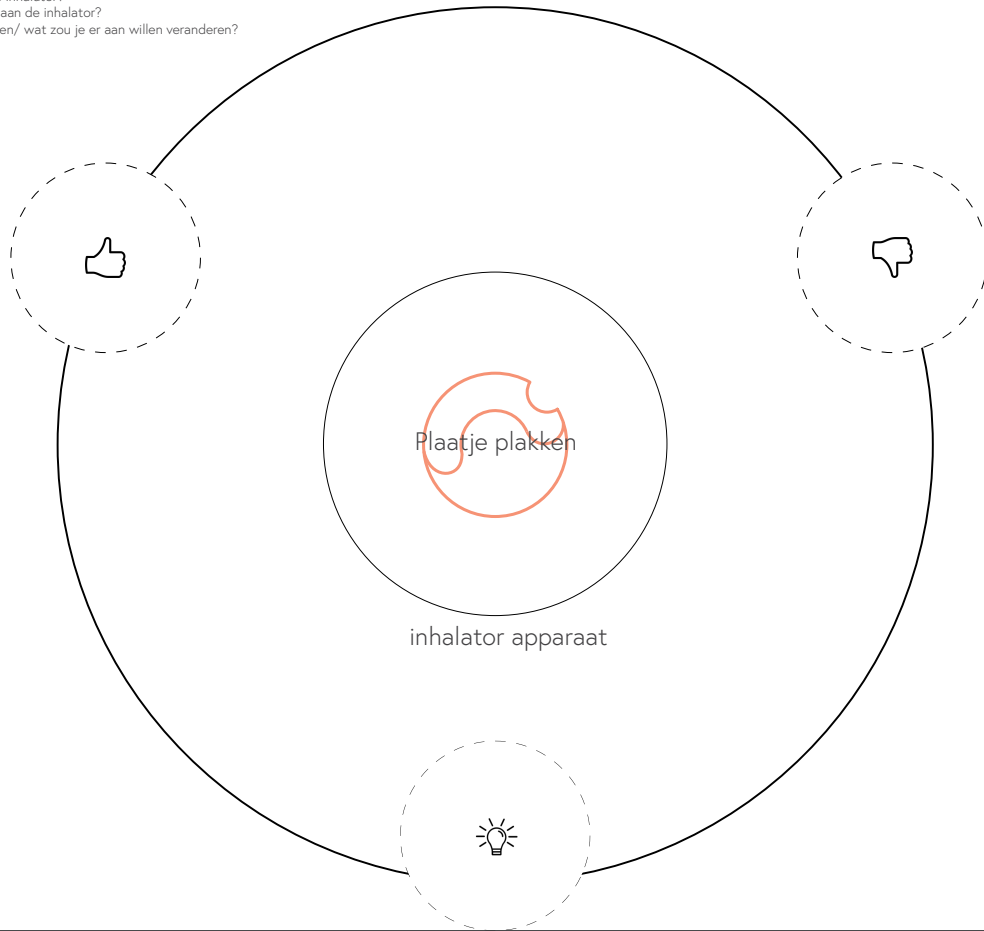
**Besproken**

Input for assignment 2; Mindmaps, each mindmap was printed on A3



Werkt de inhalator zoals je wilt?  
 Snap je hoe de inhalator werkt?  
 Wat vind je van hoe de inhalator er uit ziet?  
 Wat vind je positief/fijn/goed aan de inhalator?  
 Wat vind je negatief/niet fijn/ slecht aan de inhalator?  
 Wat zou je graag op de inhalator willen / wat zou je er aan willen veranderen?

text



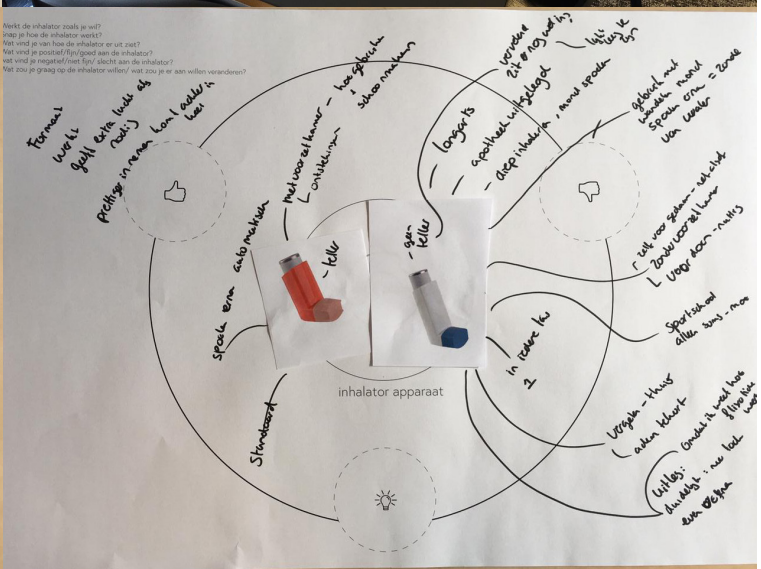
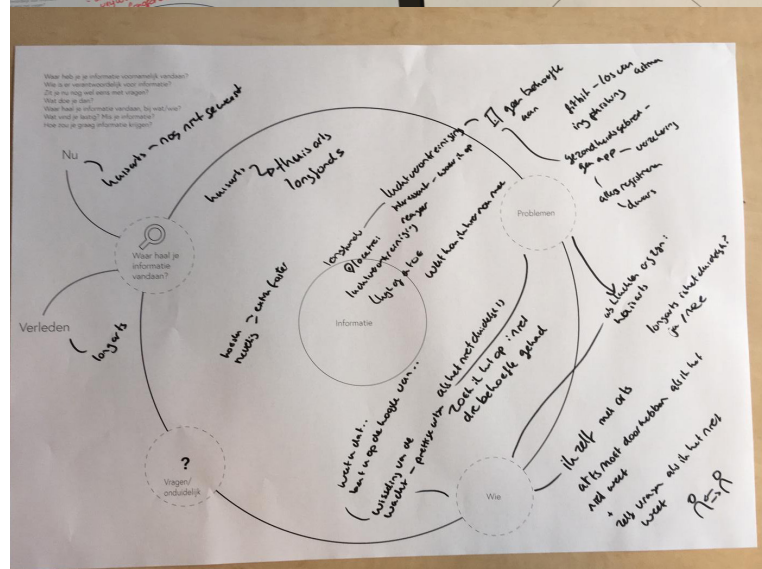
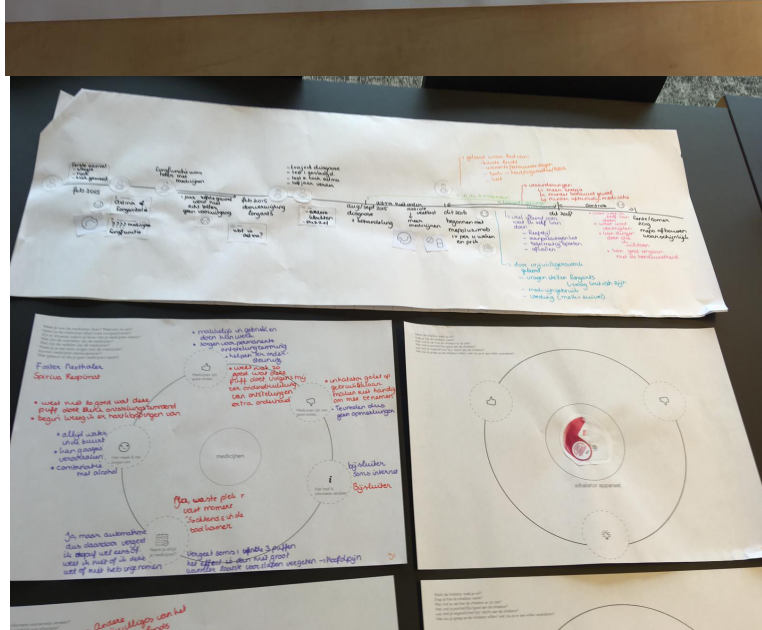
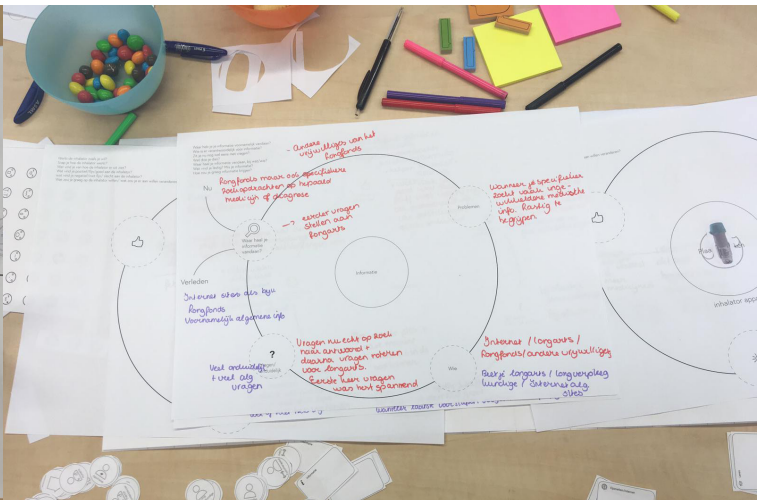
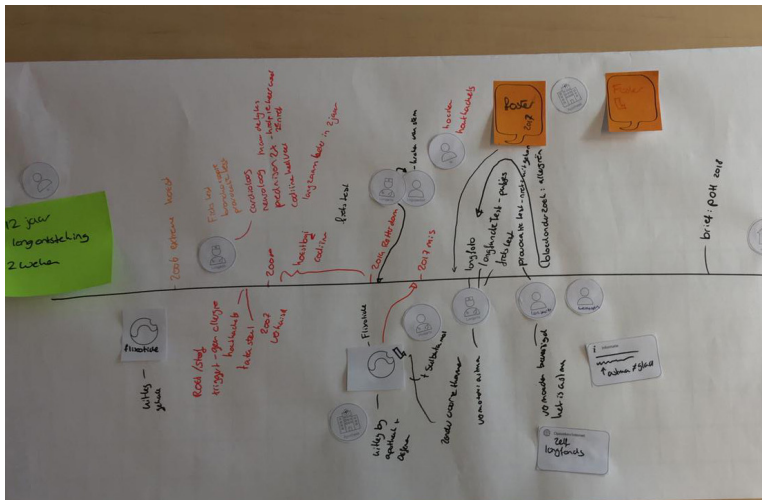
Weet je wat de medicijnen doen? Waarvoor ze zijn?  
 Neem je de medicijnen altijd zoals voorgeschreven?  
 Zijn er situaties waarin je liever niet je medicijnen neemt?  
 Wat zijn de voordelen van de medicijnen?  
 Wat zijn de nadelen van de medicijnen?  
 Maak je je wel eens zorgen over de medicijnen?  
 Kunnen medicijnen astma genezen?  
 Wat gebeurt er als je geen medicijnen neemt?



## 4.4 Focus group pictures

Some pictures of the sessions and the results of the sessions







## 4.5 Focus group results per topic

### Inhoud

|  |    |
|--|----|
| Information .....  | 2  |
| Unknowingly passive after diagnosis .....                        | 2  |
| Learned to become more active participants in the treatment..... | 3  |
| Responsibility for information.....                              | 3  |
| Information I wanted .....                                       | 3  |
| Internet.....  | 3  |
| It is such a given .....   | 3  |
| Stop telling me what to do .....                                 | 4  |
| Specific knowledge – where to find it .....                      | 4  |
| Specific knowledge – is found per accident .....                 | 5  |
| Information sources .....  | 5  |
| Other: .....   | 6  |
| Doctor.....  | 7  |
| Patients do not see the need to see a doctor .....               | 7  |
| Medicines .....  | 8  |
| Opinions of others matter .....                                  | 8  |
| Worries related to medicine .....                                | 8  |
| Rinsing the mouth .....  | 9  |
| Patients want to know when to change dosing .....                | 9  |
| Dislike dependency.....  | 9  |
| Other: .....   | 9  |
| Non adherence .....  | 10 |
| Denial:.....   | 10 |
| Lack of understanding .....                                      | 10 |
| Stopping does not have immediate negative consequences.....      | 10 |
| Lack of positive feedback when taking medicine.....              | 10 |
| I just stop .....  | 11 |
| I stop because it goes well.....                                 | 11 |
| Importance of routine .....                                      | 11 |
| Other: .....   | 11 |
| Inhaler .....  | 12 |
| Shape & size .....   | 12 |
| Looks.....   | 13 |



|                                  |    |
|----------------------------------|----|
| Part of your identity .....      | 13 |
| Medical kit .....                | 13 |
| Ritual.....                      | 13 |
| Not trustworthy.....             | 14 |
| Inhalation technique .....       | 14 |
| Spacer .....                     | 15 |
| Lack of feedback when empty..... | 15 |
| Feedback .....                   | 15 |
| Other .....                      | 16 |
| Notes .....                      | 16 |
| Influence of asthma on life..... | 17 |
| Accept current situation.....    | 17 |

Participants:

| Participants | Gender | Astma since |
|--------------|--------|-------------|
| P I          | Male   | 2013        |
| P II         | Female | 2015        |
| P III        | Female | 2017        |
| P IV         | Female | 2009        |
| P V          | Female | 199?        |

## Information

### Unknowingly passive after diagnosis

P II - Ik denk dat je zelf verantwoordelijk bent, maar aan de andere kant zou het fijn zijn om het soms aangereikt te krijgen of dat er meer uitgelegd word.

P II - In het begin was ik heel passief, ok onbewust, daar kun je dan niet zo veel aan doen.

P II – (over wie er verantwoordelijk is voor informatie) Ik, maar had in het begin wel wat meer handvatten gewild.

P I – Ja in het begin was ik ook wel passief

P II – Nu ik langer astma heb kan ik specifiekere informatie opzoeken, in het begin kon ik dat nog niet.

P II – Het duurde lang voordat ik meer vragen durfde te stellen aan de longarts

**Conclusion:** people are unaware and for that reason passive. They need to be stimulated more in the beginning of the process to ask questions and to do research. P II tries to explain that the doctor should stimulate more responsibility of the patient

## Learned to become more active participants in the treatment

P II - Vragen stellen aan de longarts is best spannend

P II – Ik ben nu kritischer en durf meer te vragen

P II – Kritische vragen stellen is best eng, mag dat? Kom ik misschien dom over?

P II – Nu zoek ik mijn vragen actief op op het internet en noteer ik ze voor als ik naar de longarts ga. De eerste keer vragen stellen was best spannend.

P II – Gaande weg heb ik geleerd meer vragen te stellen aan de longarts

P II – Het duurde lang voordat ik meer vragen durfde te stellen aan de longarts

## Responsibility for information

P III – Ik ben verantwoordelijk

P III – Het is een samenwerking wel, de arts moet checken of je alles weet en ik moet vragen wat ik niet weet

P IV – The doctor is responsible for the information

P IV – Information is the responsibility of the GP

P IV – It's the specialists responsibility. The ones that are going to take care of you getting the medicine are fully responsible for making sure you understood why you are taking the medicine, what for and what happens when you take it.

P IV- Why would you give someone medicine if they don't know why they use it and therefore there is a chance that they won't, if they don't see the need to.

P IV – The first responsibility is for the doctor and then the GP should check

## Information I wanted

P I – Hoe te werken met deze aandoening

P I – Gevolgen voor medische keuringen

P I – Ik kreeg niet genoeg informatie over hoe met astma om te gaan

P II – Ik kreeg niet genoeg informatie over wat ik makkelijk aan kan passen in mijn leven

P II – Ik had wel meer informatie gewild over wat ik moet doen of juist laten in mijn leven

## Internet

P I, P II and P III state they never got referred to the internet by her doctor.

P IV and P V did not mention any doctor referring them to the internet.

## It is such a given

P IV – From a discussion it becomes clear that P IV is so used to having asthma that she does not recognize some complaints related to asthma, she thinks they are just normal and every person has them, for example in the past she felt like a belt was squeezing her ribs.

P IV – Today I learned, when talking to my mom, that what I associate with crying, a throat that feels like it is squeezed might also be related to asthma.

P IV – You get diagnosed really young and at some point you don't really question it anymore, its just a given.

P IV – I would be interested in knowing more, but I'm not going to google it

P IV- I never took the effort to look it up myself. I'm sure I could have

P IV – I'm still interested just haven't looked it up because it is such a given at this point, its such a normal part of me

P IV – It's almost like looking up "how does a part of the body take up a vitamin". I don't know, im kind of interested but I'm not going to research it, there is no reason. I just know vitamin is good for me so I take it.

P IV – There is not much of a reason to do research, I am already taking medicine

### Stop telling me what to do

P V – Information gets repeated often (she says so many times)

P V – I get it, stop telling me over and over

P V – Hearing all the information very thorough one time was enough

P V – The GP would drop hints to what asthma is, and it would be a bit like "eyeroll"

P V – It's also weird and annoying, they see you have had asthma for s many years, they know, and still they give this information. Its like "oh she almost died, I have to say something about it"

P V – (about the repeated explanation of what asthma is) It's super frustrating and annoying

P V – I have been through it my whole life and o got to know my body and what triggers it, stop telling me.

P V – It made me feel different and frustrated. Why do I have this?

P IV - With more severe asthma that could lead to death I think they feel more responsible or more urgency to give information.

P IV – I wish I had that explanation (about the very thorough explanation session P V got aged 8)

**Conclusion:** P V has very severe asthma and almost every year she has an exacerbation that makes her end up in the hospital. It seems like because she has such a severe form of asthma she gets repeated information over and over. Where others feel like they get too little information.

### Specific knowledge – where to find it

P I – Specifieke kennis over het duiken is moeilijk te vinden

P II – Specifieke zoekopdrachten leiden naar medische informatie die moeilijk te begrijpen is

P II – Op het longfonds.nl vind je voornamelijk algemene informatie

P II – Nu ik langer astma heb kan ik specifiekere informatie opzoeken, in het begin kon ik dat nog niet.

P II – Algemene informatie kun je overal wel vinden, maar als je specifiekere gaat zoeken kom je op ingewikkelde stukken terecht die moeilijk te begrijpen zijn. (geeft uitleg dat ze op de universiteit heeft gestudeerd en prima Engels kan lezen) ... dan denk ik als ik het al niet kan begrijpen dan is dat voor iemand die wat minder opleiding heeft gehad helemaal niet te doen (P I stemt in)

P II – Er komen veel onbegrijpelijke stukken voorbij

**Conclusion:** It seems to be very difficult to find more specific information about asthma.

### Specific knowledge – is found per accident

P I – Ik had me in eerste instantie niet gerealiseerd dat duiken en astma gevaarlijk is en eigenlijk niet mag (kwam er achter toen hij geweigerd werd het water in te gaan)

P I – (was afgekeurd voor het duiken) Ik heb toen van een vriend geleerd over de medische keuringen

P II – Ik bewaar mn inhaler in de badkamer... ik heb laatst van iemand gehoord dat dat eigenlijk niet goed is; maar ik doe het toch

P II – Door vrijwilligers werk heb ik meer geleerd over mijn astma.

P II – Laatst toen was ik weer bij een bijeenkomst en vroeg iemand wat wil je drinken? Toen zei ik doe mij maar een glas melk, en toen was het “oh drink jij dat dan?” want daar krijg je dus blijkbaar extra slijm van

P II – Dat van die prikken heb ik daar ook weer gehoord, en toen ben ik dat dus gaan vragen

P II – Ik heb veel geleerd van andere vrijwilligers bij het longfonds

**Conclusion:** it seems to be very difficult to find more specific information about asthma. A lot of more specific information and recommendations are found per accident by talking to other people. However for example P I in the beginning did not want to talk about his asthma with others, which makes it very difficult in the beginning after diagnosis to get to know the disease better. After consulting a POH she agrees that more specific information is difficult to find and this information should be provided by the doctor. Through talking to a patient and getting to know them better they can give the right advises, for example about diving or other professions that might have influence on a patient's condition.

### Information sources

#### Internet:

P I – longfonds, Wikipedia, for a, google

P II – longfonds, specifieke medische stukken, internet, specifieke zoekopdracht

P III – longfonds

P IV – internet

P V - internet

### **People**

P I – Huisarts, duikarts

P II – Longarts een beetje

P III – Longarts (passief, ik luister naar wat hij zegt), apotheek (over het gebruik van de inhaler maar dat vind ze overbodig)

P IV – GP

P V – GP, specialists, from the hospital after an attack

### **Inhalers:**

P II – Bijsluiter, maar anderen lezen die niet braaf volgens haar

P III - Bijsluiter

P I - Bijsluiter

### **Other:**

P II: Heeft wantrouwen in haar huisarts omdat hij aan het begin de verkeerde diagnose heeft gesteld.

P V – Going to the doctor made it even more like I had a problem.

P V – When I was a teenager I just refused to go

P IV – It was not explained to me how the lungs work and what was happening

P IV – I still don't know what exactly asthma is and what happens in the body

P IV – I still don't really know how it works

P IV – I never got any visuals or explanation to what is happening, what is asthma'

P IV – They should have shown me the effect for example with visuals (refers to an example with smokers lungs, that it is very clear to understand when showing a normal lung and a black lung that the black lung is not healthy, she wants those kind of visual illustrations)

P II- Ze hebben mij nooit uitgelegd wat astma precies is. Waarschijnlijk ook omdat als ze er dan naar vragen je zegt dat je het wel weet, maar dat is nooit honderd procent zo.

P I – Ik ben tegenwoordig niet zo heel onderzoekend

P I – (waar haal je je informatie vandaan) nu, nergens eigenlijk

P I – Ik heb geen vragen of onduidelijkheid, ik heb een methode die werkt als ik me er aan houd

P II – Veel is onduidelijk

P II – Na de diagnose was het een groot leerproces van hoe om te gaan met astma (dingen waar ze naar verwijst op de tijdlijn: kat, sporten, rook, BBQ, warm/koud, sport weer)

## Doctor

### Patients do not see the need to see a doctor

P III – Ik moet een keer in de 6 maanden naar de huisarts, ik vind dat niet zo nodig. Als er klachten zijn dan ga ik wel naar de huisarts.

P III – Waarom zou ik daarheen gaan als het goed gaat

P III – Ik ga wel als ze me oproepen, dan ga ik niet moeilijk doen, maar ik ga niet zelf een afspraak inplannen

P III – Ik moet nu verder bij de huisarts, maar daar ben ik nog niet geweest. Informatie hoef ik niet zo

P V – I stopped seeing specialists, they were not helping

P V – I haven't seen a specialist since I was 15 (10 years)

P V – I'm not going to go to a doctor just for them to give me a regimen, there is no point

P V – The doctor every time would give me a regimen. Like, take this every morning, that that every evening, take this take that, it's always the same.

P V -I get the treatment, you are not going to solve my life

P V – Doctors can't really do anything besides prescribing medicines that help you feel better. They cannot take it away

P V – In the hospital every year I end up seeing a specialist and its always the same, I know the treatment, I can literally spell it out. I can do it, I know it

P IV – My asthma has never been so serious that I was forced to see a specialist. I have been coincidentally quite recently to the GP, but before that I have not been for years

P V – It is a little embarrassing, "ok you are unable to have control & other people do not lose that control"

## Medicines

### Opinions of others matter

P I – In de kleedkamer zeggen ze dan “doping is delen”

P I – In de sportwereld heerst een taboe op salbutamol

P I - Ik doe het met het sporten juist niet in het geheim, het is toch al overduidelijk als je je medicijnen mee zou nemen naar de wc. En geheimzinnig doen wekt alleen maar vragen op

P V – I would never do it in front of my colleagues

P V - At work when I have my asthma thing I would take my medicine and go to the bathroom and take it

P V – One of my colleagues one day just did it in front on all of my colleagues, and it was almost like weirdly shocking.. and then everyone started asking questions and then I was like, oh that’s why I don’t do it

P V – I remember being teased about it, people going like pffff

P II – Ik heb er geen moeite mee om in de buurt van anderen mijn medicijnen te nemen

P II – Als ik op het werk bij mensen zit die ik minder goed ken loop ik even weg (flexplekken)

P IV – My siblings would repeat it after me

P IV – I would do it in my own room just to avoid the whole imitation thing

P IV – Even now when doing it in front of my boyfriend he always tries to make me laugh, which is actually super bad

### Worries related to medicine

P I – Kan het wel alle klachten verlichten

P V – There is no cure

P V – Having to take them forever

P V – Worried that the medicine is not enough

P V – Asthma is not a disease with a solution it’s a disease with just treatment for it

P V – What is the long term solution?

P II – In het begin kreeg ik er hartkloppingen van

P II – In de bijsluiter staat dat je als je alcohol wil drinken je dit met je huisarts moet overleggen, maar die wuifde het een beetje zo weg van ajoh dat kan gewoon. En dan denk ik waarom staat het er dan in? Want op de een of andere manier kan ik toch niet heel goed tegen alcohol.

P II – Wat doet dit medicijn?

P V – What was unclear for me always was long term solutions

## Rinsing the mouth

P III - Dat spoelen is wel onhandig. Vooral als ik dan aan het wandelen ben, dan denk ik, dat is zonde van mijn water

P II – Je moet wel spoelen anders krijg je gaatjes, maar dan moet je dus zorgen dat er altijd water in de buurt is.

P V – There is this whole thing about it, you need to take it out, then take it and then rinse your mouth.

## Patients want to know when to change dosing

P I – Het zou fijn zijn om te weten wanneer je minder medicijnen nodig hebt

P II- Het zou fijn zijn om te weten wanneer het handig is om extra medicijnen te nemen

**Conclusion:** the norm for the treatment of asthma patients states that the treating healthcare provider should make an action plan with the patient. This plan describes what the patients should do in certain circumstances and when to take extra medicine. But reality shows that only 20% of asthma patients actually get this plan from their healthcare provider

## Dislike dependency

P V- Medicines create dependency

P IV – That’s just it. Suddenly you have to depend on medicine every day

P I – Ik vind het niet fijn om afhankelijk te zijn.

P V – I do not always take medicines, I do not like the dependency

## Other:

P I – Ik ben nu bezig met een eigen experiment om te kijken of dat werkt. Dan neem ik ochtends eerst m’n luchtweg verwijder, en dan een half uur daarna m’n ontstekingsremmer. Dan denk ik misschien komt het dan dieper in de longen

P II – Ik ben altijd een beetje benauwd (onderzoeker vraagt of ze dan niet naar de dosering van haar medicijnen wil laten kijken) ik wil niet meer medicijnen. (waarom?) Dat heeft geen zin. Volgens mij zit ik wel op m’n max.

P IV – It feels like you are putting dust or sand in your body

P V – Medicines make you feel secure

P V – Medicines let you live like others



## Non adherence

### Denial:

P I: Na een maand kwam ik in een ontkenningsfase, ik nam weinig medicijnen en wilde gewoon alles doen, ademen ging zwaar.

P I – Tien maanden na de diagnose ging ik minder medicijnen nemen. Ik wilde niet toegeven aan de ziekte

### Lack of understanding

P IV - I could not understand what was happening they did not explain it

P IV – Knowing what happens and why. For me that would have prevented me from stopping so often

P IV -Not understanding why I take medicine lead to me not taking it properly

P IV – And then because my mom told me I so I would take the medicine again, but still not understanding why

P IV – The doctor gave me some very general information regarding medicine, but not what it does in the body

P III – Werking is iets van ontstekingsremmend, geen idee hoe dat werkt in de longen

P II – weet niet hoe het werkt

### Stopping does not have immediate negative consequences

P I – Meestal gebeurt er niks als ik dit niet neem

P IV – You don't want to take medicine in your body when you feel like you don't need to, that's why I would quit

P IV – I would stop... what would happen was nothing serious immediately, but after a while I would feel like a belt was tightening around me ribs, but I would not directly relate it to asthma.

P V- It goes very slowly, you don't take it for months and you'll be fine, and then suddenly you are not fine.

P IV – If you don't take it you don't immediately feel it. There is not much of an incentive/much of a plus

### Lack of positive feedback when taking medicine

P V – Sometimes I'm just fed up with it. Its not like "I have allergies oh I sneeze so much, now I take a pill and I'm not sneezing so much anymore"

P V – You feel better but you don't feel perfect

P V – It's not like if I take it perfectly I will feel perfect, you don't get that feedback, you don't get the guarantee

### I just stop

P I – Er zijn periodes waarbij ik het niet gebruik

P IV – Sometimes I would go without medicine for months and I would just accept the pain in my chest. To me that felt better than taking medicine every day.

P IV – When I was young I would not take it for months

P IV- at some point I was just so sick of taking medicine I just stopped

P V – I don't even thing fuck this. I don't even think, I just stop. Its not even a process in my hear like ohh.. I'm going to quit for this amount of time... I just don't think and before you know it ts like a month and then something happens and I'm like.. oh I should take t, and then I take it again.

P V – It's easy to get lazy with it, like oh him fine..

P III – Het ging goed, toen heb ik zelf minder medicijnen genomen, ja en dat heb ik geweten, toen ging het natuurlijk fout.

P III – Ik denk dat ik in het voorjaar wel weer ga stoppen

P III – Nee zomaar stoppen dat doe ik nu niet meer

### I stop because it goes well

P I – Ik vergeet ze te nemen omdat het goed gaat

P IV – Why would you take medicine if you feel fine

### Importance of routine

P II – Voor de ene inhaler heb ik een vaste plek in de badkamer en ik neem ze in de ochtend en de avond na het tandenpetsen die vergeet ik nooit.

P II – Voor de ander heb ik geen vaste routine, die neem ik ergens op de dag. Die vergeet is soms, of het is moeilijk te herinneren of ik hem nou heb genomen of niet.

P II – Het is automatisme. Ik vergeet het soms of ik vergeet of ik ze heb genomen

P III – In de ochtend en de avond dat vergeet ik niet. Wel vergeet ik soms de reliever voor het sporten

### Other:

P I: Na twee weken was ik de medicijnen zat, ik ging minderen

## Inhaler

A= spray

B= discus

C= respimat

D=turbuhaler

## Shape & size

P V – What the fuck, why does it have to be like this(A)

P V – As a teenager you don't always have a handbag, s I'd always have to stuff it in my jean pocket (A)

P V – It is **so** noticeable this shape and it would always stick out (A)

P V – The spray is an awkward shape that you can't fit anywhere seamlessly(A)

P V – The entryway could be straight. And then it could be small. Amazing. And then it would be like carrying a lipstick. (A)

P V – Why are there corners on the tube when the cannister is round? It could look just like a lipstick (A)

P V – Can't this be straight, there is no reason for it to bend.(A)

P IV – There is no need for the awkward corner (a)

P V – It could be half the size, instead 50 doses instead of 100, awesome

P IV – They could make an additional portable one

P V – This is actually a nicer one, it is smaller like a little mini (Flixotide dosisaerosol)

P V – The discus could have been better if it was a smaller discus, but it is so big, its bigger than the spray (B)

P V – The discus is like a nice compact shape but its like twice as big as the spray (B)

P V – Also it is round so it doesn't fit in any square pouch. (B)

P IV- Its large and takes a lot of space in the bag (B)

P IV – Make it smaller if possible (B)

P IV – A huge part of my toiletries bag is just plastic things (B)

P IV – I wonder how much of it is actually useful (B)

P II – Fijn & makkelijk mee te nemen. (B)

P V – I always had to have this side pouch and all my friends did not have to have this side pouch.

**Can't they make it better.** (A, B)

P V – As a teenager I was so annoyed, over and over again I was thinking, why can't they redesign the shape of this (A, B)

P V – On a girls jeans this looks ridiculous (A, B)

P V – It's so annoying, just the shape of a product can make such a difference in people's life (A, B)

### Looks

P IV – It just screams medicine

P IV – As soon as you take it out people will see "ok you need medicine", "you are sick", "you are a patient"

P IV – When you look at the design, when you see this you immediately see it is medicine, everything about it, the color, the letters, the numbers, the font

P V – I hate this color (purple)

P IV – It's completely purple, nothing has this color.

### Part of your identity

P IV – This becomes something like a wallet or a phone case, you have it all the time, its something you identify with.

P IV – It becomes a part of you and just the fact that everyone has the same thing. If you could personalize it, it would be so much better

### Medical kit

P V – I'm walking around with this pouch in which most girls have their makeup. Its just like this little medical kit

P V – I always take it and its super annoying I can never go out empty handed

P V – I don't want a bag this big at the club

P V - I carry three inhalers which is ridiculous, plus allergy medicine, plus an EpiPen

### Ritual

P V Has a new kind of medicine which is a sticker that you can put on your body, it feeds the medicine into her bloodstream and she does not use any additional inhalers. (patch)

P IV – (about patch) The ritual of taking is reduced, you don't have to bring anything, you don't have to take a physical object

P V – (about patch) It is more like a solution, you don't want to have to think about taking medicine all the time

P IV – (about patch) It is more discrete

P V – (about patch) There is this whole thing about it; taking t out, taking it, then rinsing your mouth, and that's completely reduced with this. You almost forget about it

P V- (about patch) It's the same reason why girls take these implants for birth control, you don't want to have to take the pill every day.

P IV – The ritual is so awkward (talking about exaggerated breathing needed to inhale medicine)

P II – Gebruiksklaar maken duurt lang, ik zie mezelf dat niet doen als ik benauwd ben (C)

P II – Gebruiksklaar maken is veel gedoe, eerst laten vernevelen totdat je zo'n wolkje ziet, en dan moet je hem nog 3 keer laten spuiten voordat je hem daadwerkelijk kan gebruiken. Ik zie mezelf dat niet even op m'n werk doen zo, dat vind ik echt helemaal niks (c)

P II – Het is irritant om hem gebruiksklaar te maken

### Not trustworthy

P II – Hij is niet betrouwbaar; je kan hem niet gelijk gebruiken, en je kan ook niet zien wanneer hij precies op is (c)

P II – Als je benauwd bent is hij lastig in te nemen (B)

P I – Als je benauwd bent is hij lastig in te nemen (B)

### Inhalation technique

P V – If you don't take it right 50% of the medicine gets lost. (A)

P V – This is my emergency one, so I don't want to use it with as spacer, a spacer makes it go slow, and I need it immediately (A)

P III – Je moet krachtig inhaleren, ik denk dat ik krachtig genoeg inhaleer blijkbaar want ik voel hem meteen achter in mijn keel schieten (A)

P III – Deze vind ik fijn want die schiet achter in mijn keel. Daar hoort het denk ik dan. Die andere blijft een beetje in mijn mond hangen dat vind ik niet fijn. (A)

P III – Dat zal allemaal wel hetzelfde werken (A)

P III – Dan denk ik kom op geeft me dat ding, dat is toch duidelijk er zit een handleiding bij

P III – Dat is toch duidelijk, werkt gewoon hetzelfde als dat andere apparaat

## Spacer

P III – Voorzetkamer is niet nodig

P III – Voorzetkamer is tegen ontstekingen in de mond, maar het schiet zonder voorzetkamer toch achter in de keel

P III – Die voorzetkamer moet je elke keer schoonmaken, dat is zo'n gedoe

P III – Ik zou de voorzetkamer niet mee nemen dat neemt veel te veel ruimte, dat ga ik niet helemaal meeslepen

P III – Ik vind de voorzetkamer niet gemakkelijker

P III – Ze hebben hem bij de apotheek een keer voorgedaan zonder, en de andere keer met voorzetkamer

P III – Ik heb nu niet het gevoel dat ik vinder stof binnen krijg ofzo

P V – I never use the spacer

P V – The spacer makes it go slower, but now it is my emergency one, so I want it like direct, fast.

## Lack of feedback when empty

P II – Ik weet niet wanneer hij leeg is (C) (niet betrouwbaar)

P III – Een teller is fijn

P III – Je voelt het wel hoor als hij leeg is

P III – Nee trouwens deze heeft geen teller, dat vind ik vervelend dat ie dat niet heeft

P IV – I don't really look at the counter, I often notice it too late

P IV – When I was in Norway I discovered the counter was at 0 and that I actually took an empty one

P IV – Sometimes I run out and I'm not able to get a new one in time, then I go for a few days without

## Feedback

P V – The powder gives feedback (b)

P V – I went back to my doctor and said it is not working. He said it does work, but I don't feel anything (D)

P V – It doesn't have the powder and then I don't know if I have done anything. It gives no feedback (D0)

P I – Het is lastig om de goede ademintensiteit te vinden (B)

P III – Ik heb nu niet het gevoel dat ik vinder stof binnen krijg ofzo (A zonder spacer)

P III – Ik vind het prettig innemen, het schiet gelijk achter in mijn keel (A)

P III – Ik vind hem niet fijn, hij blijft in mijn mond hangen

P I – Ik probeer nu zelf een betere positie te vinden, ik merk dat als ik m'n kin iets meer omhoog doe dan komt het toch wat meer in m'n keel in plaats van op m'n tong

## Other

P II – Het is wel echt een ding waar je even over na moet denken (c)

P II – Hij is niet betrouwbaar; je kan hem niet gelijk gebruiken, en je kan ook niet zien wanneer hij precies op is (c)

P I – Ze zijn gelukkig redelijk robuust

P II – Meenemen is onhandig (C)

P V – It is more discrete, I can hold it completely in my hand (A)

P V – The type of medication is a little embarrassing

P I – Met het herhaal recept kreeg ik opeens een andere, toen zeiden ze bij deze moet je alleen krachtiger inhaleren. Maar die andere vind ik fijner

P II – Bij de apotheek kreeg ik toen een andere inhaler en toen zeiden ze ja dat werk gewoon het zelfde als die andere

P V – Its gross, you spend a year putting your mouth on that thing

P V – I have one with lipstick on it

## Notes

No-one has ever looked up the inhalation techniques online, they also state never to have been referred to [inhaloatorgebruik.nl](http://inhaloatorgebruik.nl)

According to guidelines it is advised that healthcare providers describe only one type of inhaler to a patient. The participants in this research had between 1 and 9 different inhalers.

P III has had three different inhalers

P II has had three different inhalers

P I has had three different inhalers

P V has had nine different inhalers

P IV has had only one type of inhaler.

Also when visiting the pharmacist many participants got the inhalers without explanation. Sometimes the pharmacist gave a different inhaler and patients do not want to start a discussion, so they randomly switch to a new inhaler

## Influence of asthma on life

P IV – Het heft mijn leven afgeremd

P IV - Je voelt je permanent patiënt, je bent afhankelijk van dagelijks medicijnen

P I – Als mijn astma slecht is voel ik me zwak

P I – Voor dat ik astma had kon ik oneindig rennen, nu ben ik kortademig na een trap op te lopen soms

P I – Als mijn astma goed is voel ik me onoverwinnelijk

P IV – I got the medicine and I had to use it. You suddenly become a permanent patient

P V – Medicines make you feel different

P V – That is what is most frustrating in the whole process, is that you are left in this permanent situation

P V – I was often disappointed by a lot of treatments. They told me if you are 18 it will go, or this will make it better, try this. It is a lot of things and treatment and promises and hopes that are not true.

## Accept current situation

P III – Hoesten hoort erbij. Soms hoor ik mezelf piepen

P III – Ik hoor mezelf piepen

P III – Mijn astma is nu goed onder controle

P IV – It lingers at a level that is acceptable but never really good.

P IV – I did change my behavior and for example I would cycle a little slow

P IV – I just adapted to my lungs

P II – Ik ben altijd een beetje kortademig

P II – Mijn astma is goed onder controle

### Additional

### insights:

#### Action plan

Another problem pointed out by the participants is that they would like to develop an understanding of when they can or should change their medication. Officially GP's should develop an asthma action plan (ACT) with their patients, this plan consists of different "risk zones". On this plan, a patient can check in which zone they are and whether they should increase their medication. Only 20% of the GP's use this tool (F. Braido, 2013), even worse, none of the research participants have ever received this action plan.

Additionally, I would like to argue that the use of ACT's is a bit outdated as they are filled out on paper. Besides that the ACT only focuses on the negative: when you are doing bad you should increase the medication. It is known that asthma is a changing disease and the symptoms can vary over time. It would be beneficial for asthma patient's self-management if the ACQ would empower them to self-tailor their treatment.

*It would be nice to know when you should take extra medicine -P2*

*"It would be nice to know when you can take fewer medicines" -P1*

#### Stigmatizing effect of medication

Like already pointed out in literature most patients do not feel comfortable with the type of medication that they use. They feel like there is a stigma of illness around it.

*I would never do it in front of my colleagues -P5*

*It just screams medicine As soon as you take it out people will see ok you need medicine , you are sick , you are a patient -P4*

*when you see this you immediately see it is medicine, everything about it, the color, the letters, the numbers, the font -P4*

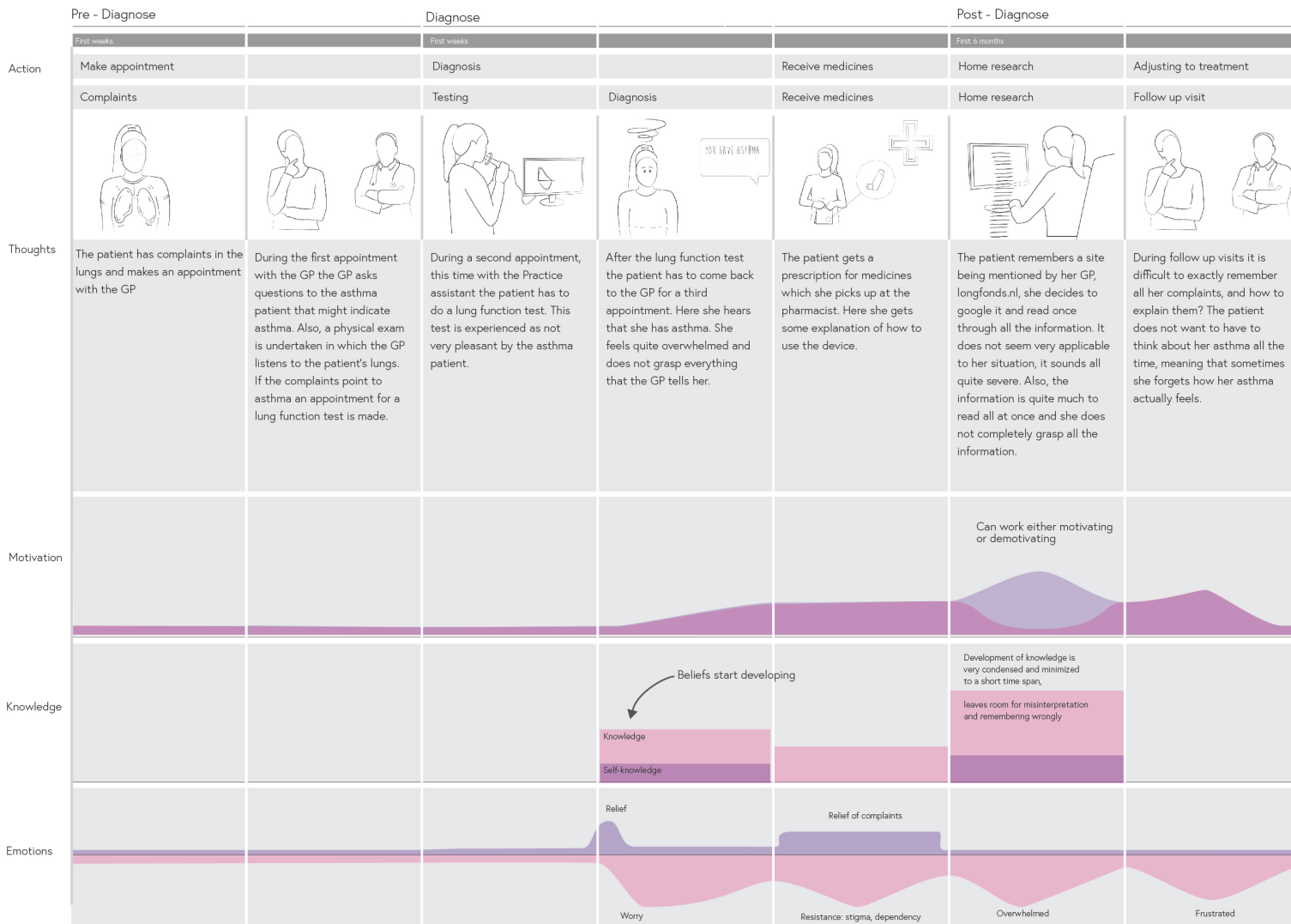
*This becomes something like a wallet or a phone case, you have it all the time, its something you identify with. -P4*





## 4.6 Current patient journey

Patient journey



|  |   |   |  | After 6 months   |  |  |
|--|---|---|--|--|--|--|
|  |   | Stabilisation   |  | Everyday life  |  |  |
| Finding triggers   | Accidental discoveries                            | Motivation dip  |  |  | Forgetfulness  |  |
|  |   |   |  |  |  |  |
| During an exacerbation there are often several things that could have triggered the complaints. There are so many different triggers and each time there are different triggers, the patient has difficulty making relations between her complaints and possible triggers. | \$\$\$\$\$  | After a couple of weeks the complaints start to stabilize, and the asthma patient decided to take less medicine, she does not like to be dependent on medicines when she does not feel like she needs them. | For a while the patient feels completely fine, she feels like she can do without her medicines. She does not notice that slowly she starts to develop some complaints, instead she adjusts her daily routines a bit. | All of a sudden, the asthma patient experiences a strong worsening in condition. She starts taking her medicine again but does not really see the relation between her complaints and her non-adherence, after all she felt just fine all that time. | After some months the therapy becomes a bit of a habit, the patient does not really think much about her medication and forgets to take her medication, or she even forgets whether she actually took it or not. |  |
|  |   | Stabilization of complaints, patients doubt the need of medicines   |  | Sudden worsening of condition increases motivation   |  |  |
|  | Accidental discoveries lead to self-knowledge<br> |   |  |  |  |  |
|  | Achievement<br>                                   |   |  |  |  |  |
| Frustrated   | Resistance, "and what now?"                       | Denial trying to forget "illness"   |  | Frustrated   |  |  |

# 4.7 Envisioned patient journey

## Patient journey - Using the app

|            | Pre - Diagnose   |   | Diagnose  |   |  | Post - Diagnose  |   |  |
|------------|--|---|---|---|--|--|---|--|
|            | First weeks  | First weeks   |   |   | First 6 months   |  |   |  |
| Action     | Make appointment   | Diagnosis   |   |   | Receive medicines  | Learning process   | Adjusting to treatment  |  |
|            | Complaints   | Testing   | Diagnosis   | Physical reminder   | Receive medicines  | Download app   | On-boarding   | Attitude   |
| Thoughts   |  |   |   |   |  |  |   |  |
| Thoughts   | The patient has complaints in the lungs and makes an appointment with the GP | During a second appointment, this time with the Practice assistant the patient has to do a lung function test. This test is experienced as not very pleasant by the asthma patient. | After the lung function test the patient has to come back to the GP for a third appointment. Here she hears that she has asthma. She feels quite overwhelmed and does not grasp everything that the GP tells her. | After she has heard the diagnosis the GP gives her a post-it note with the link to an app. The tells her that the app will help her to take good care of herself. | The patient gets a prescription for medicines which she picks up at the pharmacist. Here she gets some explanation of how to use the device. | At home the post-it reminds the patient to download the app, all she has to do is scan the QR code.                          | After downloading the app, the app introduces the asthma patient to the goal of the app. It tells her exactly what is expected from her and how she will be supported. Also, she has to fill out a questionnaire which will adjust the app to her personal needs. |  |
| Needs      |  |   | As a recently diagnosed asthma patient I want to know about the available tools so I can apply them   |   |  | As an asthma patient I want to know what this tool is for so I don't have to put in useless effort                           | As a curious asthma patient I want to make sure I got all the information I need so I can take good care of myself<br><br>As a passive asthma patient I want to be taken by the hand, so I don't have to take charge myself                                       | As an asthma patient I want to put in as little effort as possible<br><br>As a sceptic asthma patient I don't want to be taken by the hand, so I don't want to take charge myself<br><br>As a sceptic asthma patient I don't want to be taken by the hand, so I don't want to take charge myself<br><br>As an experienced asthma patient I want to be taken by the hand, so I don't want to take charge myself<br><br>As an experienced asthma patient I want to be taken by the hand, so I don't want to take charge myself |
| Functions  |  |   | GP recommends the app   | Post-it block   |  |  | On-boarding: explain goal of the app<br><br>On-boarding comforting: Don't worry we will provide you with all the information (Curious)<br><br>On-boarding raise awareness: You are in charge (but we will support you)(Passive)                                   | High frequency interactions<br><br>Informational<br>Provide feedback<br><br>Feedback<br>feedback<br>performance  |
| Motivation |  |   |   |   | Can work either motivating or demotivating   |  |   |  |
| Knowledge  |  |   | Knowledge<br>Self-knowledge   |   |  | Development of knowledge is spread over time and repeated to prevent forgetfulness, misinterpretation or remembering wrongly |   |  |
| Emotions   |  |   | Relief<br>Worry   |   | Relief of complaints<br>Resistance: stigma, dependency   |  | Motivation<br>Scepticism  |  |

|  |   |  |  |   |  | Everyday life  |
|--|---|--|--|---|--|--|
|  | Chose goal  | Learning the Basics  | Discovering triggers   | Adherence & ACQ   | Visit the GP   |  |
|  |   |  |  |   |  |  |
|  | In the app the patient can choose between different goals she wants to work on: learning the basics, discovering triggers and even tracking her progress and medicine intake. | The first goal that the patient chooses is to learn the basics. Through animations and visuals she learns what asthma exactly is. The GP also told her but because she was so overwhelmed she did not remember everything clearly. Now everything is under her thumb one click away. | After learning the basics, the patient understands that knowing what triggers are is very important for her treatment. She decides that she wants to learn what her triggers are and sets this as her next goal. | Once she is well on her way the patient decides to start on the next goal, tracking her asthma control. She connects her smart inhaler and her medicine intake is automatically tracked by the app. Together with the filled-out asthma control questionnaires she can now easily obtain insight in how she is progressing. | During her follow-up visits the tool helps her to remember her complaints. Together with insights on the patients' ACQ and adherence the GP can now make a good estimation about how well the treatment is adjusted to the patients' needs and he can give concrete advice to the patient. |  |
| As a curious asthma patient I am willing to put in a daily effort so I get used to my diagnosis                                    | As a curious asthma patient I want to read very specific information so I can implement it into my treatment  | As an asthma patient I want to know what happens in the lungs so I know why I take medicines   | As an asthma patient I want to know what my triggers are   | As an asthma patient I want to log my data efficiently so I can save time & effort  | As an asthma patient I want to be in charge over the data that share with my GP, so I don't feel like I'm being checked  | As an asthma patient I want a tool that looks nice, so I don't feel stigmatised as a patient                             |
| As a sceptic I want to see proof, I don't want to read some  | As an expert I want to decide for myself what I find useful & when I want to work on a goal   |  | As an asthma patient I want advice on avoiding or dealing with my triggers   | As an asthma patient I want to get insight in my asthma so I get a sense of how I am improving  | As a GP I want to know what is going on in my patient's life, so I can give relevant input to the treatment  | As a sceptic I want a tool that is discrete, so I don't have to feel embarrassed when I use it                           |
| As a sceptic I want to read hard to get insight in progress so I don't get disappointed anymore                                    | As a sceptic I want to feel in charge, so I don't have to invest effort in something I do not believe in  |  |  | As a sceptic/expert I want factual data about myself so I know exactly what is going on   |  | As an asthma patient I want to be treated like a person and not like a patient who is told what to do                    |
| As an expert I need factual information on my performance so I can be confident I'm not that much of an expert                     | As a passive I want all the tools laid out for me, so I can just do what I'm being told   |  |  |   |  | As an asthma patient for a few months now I don't want to be bothered with reminders everyday so I can just live my life |
| As an asthma patient I don't want to be reminded of my diagnosis all the time, so I don't want to feel like a patient all the time | As a curious asthma patient I want to get handles to better manage my disease   |  |  |   |  | As an asthma patient for a few months now I want to have a set routine so I can focus on my daily life around that       |
| Frequency of interaction in the beginning  | Information: provide option to read specific information  | Goal: learn the basics   | Goal: Discover triggers  | Connect to smart inhaler  | Data: ask user's consent to share data with GP   | Aesthetics   |
| Information for expert: facts  | Goals: curious & sceptic patients can choose what goals to work on  | Information: -what is asthma & what happens in the lungs -Medicine: what, why & how -Follow up goals: Explain topic of the goal, why are they important  | Goal: how to avoid your triggers   | Goal: track adherence & ACQ & show relations between medicine intake and asthma control   | GP interface: Design an interface for the GP   | Discrete   |
| Information: provide factual information on patient's own performance (data)(Expert)   | Goals: provide tools to act on the information  |  |  | Provide feedback: collect data, provide feedback & facts on performance   |  | Tone of voice  |
|  |   |  |  | Insight in functionality of medicines   |  | decrease frequency of interaction  |
|  |   |  |  |   |  | Goal: help build routine   |
|  |   |  | Guided discoveries lead to self-knowledge  | Tracking leads to self-knowledge  |  |  |
|  | Autonomy  |  | Achievement  | Purpose   |  |  |
|  |   |  |  |   |  |  |
|  | I don't want to do all this   |  |  |   |  |  |

# Appendix 5

## Healthcare provider perspective

### 5.1 Interview questions

#### Diagnosis

- Can you tell something about how the diagnosis happens?
  - o Who does the diagnosis?
  - o How does the patient hear the diagnosis?
  - o What are the first follow-up steps?
- Action plan – do you create an action plan?
- Treatment plan – how do you decide how much medication they need, is this discussed together?
- Device
  - o How do you decide which device to use?
  - o How and when is the device explained?

#### Self-management

- How does the patient get more information on the disease?
- How does the patient learn about self-management behaviors?
  - o Example follow up question:
    - How does a patient learn about exercising more?
    - How does a patient learn to avoid irritation?
- What are reasons for a lack of self-management?

#### Asthma control

- Are there many people who do not have asthma control?
  - o Are they aware of this usually?
  - o What do they do about it themselves?
  - o How do you help them?

#### Support on the long term

- How often does a patient visit?
- What do you need to know from them then at these visits?
- What would you like to have support with during these visits?
  - o Do you want to know if they take their medication?
  - o Do you want to know the patient's level of control?
- What shortcomings do you see in the patients' self-management?

#### Self-management perspective of the GP

- What do you see as self-management?
  - o What are parts that are important?
- How do you help patients to obtain better self-management?
- Do you set any goals besides the medication intake together?
- What bottlenecks are there when helping them – what would you need from the tool?

#### Tool:

- What could the tool help patients with?
- What could the tool help you with?

#### Participant characteristics

| Participant | Profession           | Interview method  |
|-------------|----------------------|---|
| GP1         | General practitioner | Semi structured face-to-face interview + practice visit |
| GP2         | General practitioner | Semi-structured phone interview                         |

## 5.2.1 Healthcare provider perspective, transcript 1

This is a rough transcription of the interview with GP1.

### Diagnose

Question: How does the diagnosis happen?

First the client comes to the practice with complaints then we ask questions about things such as: coughing, feeling stuffy, family with asthma, allergies, rash. these questions can all point towards asthma.

We also ask about smoking that is more pointing towards COPD

If the complaints are there since a short time we think more of a lung infection or an infection of the higher airways.

Then we send them to the Practice assistant for a lung function test that takes about 30 minutes.

### Lung function test

There they will ask far more questions. With the lung function test we can only say something about the lung function, if the lungs are being used maximally.

People have to breathe in as far as possible breathe out as hard as possible as fast as possible and as long as possible. And this needs to be repeated a few times.

Then we give them medication that opens the airways. If it improves than that indicates asthma. But the improvement needs to be at least 12% to be able to set the diagnosis.

### Diagnosis

Then the patient must come back another time to the GP, because they should hear the diagnosis from their GP. This consult is called the "scharnier" consult, and we have double the time. This is a crucial consult in which a lot must happen to make the patient immediately the owner or partial owner of the sickness. And this is where I think it goes still wrong quite often.

For most GPs it is very easy of course to say so you have asthma and here is the medication and then its done.

However, I have the tendency to do not even talk about the medication yet. These people often have complaints for a few years, so they can wait a bit. So, I'm more explaining that they have a disease that is chronic. But whether you will have complaints is in your control for a big part. And you can have a normal life expectancy. So, you put a big responsibility upon the patient. There is a big group of GPs who do not do that.

And that's why we need your tool, so people immediately get your tool with information that is relevant for them specifically and that the immediately get motivated to "aan de slag gaan".

And that is in short the diagnosis.

### Question by the researcher

The content of the consult the "scharnier" consult is highly dependent on the person and how they are dealing with the news and for example if they need to change their lifestyle. Its dependent on the specific lifestyle and what will help them most.

**There is a lot of websites that explain self-management, do you also tell the patient this information?**

No not in that first consult. I usually point out the existence of "thuisarts.nl" and ask them to read the information there. And I explain them that they will quite regularly visit the practice assistant. Two weeks later there is another consult with the practice assistant (PA). The PA always has 30 minutes for a consult and this person will see what the patient wants to talk about and he/she will discuss thuisarts and longfonds.

### Longaanval plan

Do you set up a "behandelplan" like how often and when they should take the medication?

Yes. So when we prescribe a medicine we also explain, how often they should take it, why, what it is needed for.

And we make a "longaanval plan".

So we try to identify why they get stuffy, how their exacerbations started. Some people find it really difficult to describe the feeling of stuffy. So, they will say they have been taking the bus for two weeks. Oh, but you usually bike right? Yes, but it did not go so well, I take the bus, I'm tired. And that is what we call "stuffy", but people are very reluctant if they don't know why they need to take medication, and they first think of, I can also take the bus.

So that ...how do I recognize my own decline in condition that is very important to talk with them about and to write down or in you app. Because if you know, oh yeah this is how it starts with me. Then you will recognize it sooner. And if you are at the step that you are not really stuffy yet but you recognize the symptoms then they know they can take extra medication.

The longaanval plan is for bad episodes.

Question: And the regular medication do you record for the patient somewhere when to take it?

No, we have it in our file. And on the box it has an instruction on how to use it. But because the instruction varies in time patients can never check when they are stuffy oh how often should I take this. I fear that not all doctors make a longaanval plan.

...Chatter...

COPD is a constant disease. But with asthma its always varying and if it goes a bit worse, you don't immediately have an asthma attack, there are gradations in it. When do I have an attack and when is my asthma not in control, and that is difficult to say for doctors and for patients it's also very difficult to feel. What we do know is that some people don't worsen at all in condition and then all of a sudden have an exacerbation and end up in the hospital. But luckily this is very rare.

### **Correct use of medication**

Do people use their medication correct and is the use explained to them? Can you explain this procedure?

This differs per practice but usually the practice does not do the explanation. It is however more and more common that the practice together with the patient selects which device they use. So, you look together what they look like and choose the one of which the patient and the POH think they will get the medication in in the right way.

Because there is such a huge number of inhalers no POH has all the inhalers in their office to practice. Also, then they get dirty so that's just impossible.

Together you look and then you prescribe something.

Many GPs and regions have a "formularium" so GP's hospitals and pharmacies have said to only give out about 10 of the total offer. Then it gets clearer.

So how does it go. You prescribe something. Then they go to the pharmacy and the pharmacy does the inhalation instruction. And two weeks later they come back, and they have to show how they use it.

What appears to work best is if both instructor and patient have device and then use it together.

### **Not using mediation**

There is a group that can temporarily stop medication, for example the people that are only allergic to pollen. That is only a very small group

...Chatter...

### **Uncontrolled asthma after diagnosis**

There is a very clear standard. As long as your asthma is not in control you should visit the POH every 6 - 12 weeks. And do you not get it in control then they have to be sent to the second line. And every visit you check: do you use your medication, do you use it in the correct way, are you in touch with irritants, is there something else that could give complaints, you should always think is it only asthma or are there maybe other diseases. For this you have 6-9 months, and did you try everything, maximum medication ect. then don't accept it and send them to the 2nd line. Patients usually accept it, but that is not ok

### **Are there any shortcomings in the information that you get from patients?**

People are quite fast not completely honest. Especially if you ask a yes/no questions. You should invite people to explain.

### **Misuse of medication**

Old people often don't even click it in, people spray it in the air, people hear things about steam and they do weird stuff.

### **Are there things you need in the tool?**



Do we necessarily need feedback, because our system communicates really bad. And it takes years before it is fixed and approved.

I think we are making something that puts responsibility at the patient. I don't want all kinds of messages of the patient or alarms that the patient is not doing well. The patient should get these and then we can sit together and discuss how this goes how that goes etc.

#### **What are those things that you would like to see then how they are going?**

Smoking, medication does not run out, so they don't use it, how they inhale, exercise those kind of things.

What I would like. Is if the patient is working with the tool and that they get the message your asthma is not in control, this this this is important for you, try it... and otherwise go to POH or GP. The patient is not allowed to accept that the asthma is not in control.

Seeing if their medication is being taken.

#### **Example of a patient...**

He did not know what asthma is, did not want to take medication, and he's an educated person. How is that possible that someone does not know anything?

When they are a child it is well monitored and have had the instructions through their parents. In the teenage years they are doing well. And then the complaints come back. They once used those medications so over the phone they just order new medications, which is quite bad, and they come and visit the GP if it is going really bad.

There is a group for which the lungs always do not work 100%. That's because the medication has not been set well. And those people don't notice it because they have always had those lungs. And he is one of those.

#### **About exercise...**

Online instructions on exercise are not very specific.

#### **Self-management tool**

What should be in the app to help the patients?

A bit of physiology. Explanation why do you take certain medicines and what do the different medicines do. That taking a medicine once does not help, it's a long-term disease.

In the communication with doctors, that people know what asthma control is, what is meant with that and that they know that they have their asthma in control or not. That would be the basis and then maybe more general information that people can find more about, smoking, exercise.

People should really stop with smoking, smoking is that bad that I think we don't even need to treat you, then the smoke only gets deeper into the lungs.

A bit about pregnancy would also be good. For asthma people have the tension to stop with the medicines. However, for a baby it's better that you use medicines and that the asthma is in control than that you do not use medication and the asthma is not in control. The child will grow less, the placenta is in a bad condition, early birth etc. etc.

#### **Do you have any idea why patients do not take their medication correctly?**

I think most of the blame is on the care givers, that they have never really explained what their exact disease means. That the patient does not know what they are doing and thus are doing it wrong. I do not believe that there are people that do not do it right on purpose.

Because asthma is different for every person and the way medication should be taken as well. I really think it is the job of the care giver to make clear to patients to make things negotiable, it's really working together.

People try not to be thinking about their disease too much, if things are good they are good, and if things are bad they usually do not notice it or remember since when they have their complaints.

#### **About the medication prescription**

GP tries to predict how the disease will go. plan the medication in a way that they do not have to change device, because it is really hard to learn how to inhale with different devices at the same time or to switch devices after a while.

## 5.2.2 Healthcare provider perspective, transcript 2

### Diagnose:

Patiënt komt bij de huisarts met klachten (...omschrijving klachten). De huisarts probeert deze klachten verder uit te diepen. Vraagt naar klachten als kind en eventuele allergieën. Fysiek onderzoek: luisteren naar de longen.

Patiënt wordt doorverwezen naar de POH, op een volgende afspraak en daar wordt een verdere inventarisatie van klachten gedaan en een longfunctie onderzoek. En eigenlijk hoort daar ook een laboratoriumonderzoek bij, maar dat kan niet zomaar, dan moet de patiënt bloed laten prikken.

De patiënt kan de uitslag een ander moment ophalen bij de huisarts, en de huisarts is degene die de diagnose stelt. (...uitleg complicaties bij het vaststellen van astma)

### Labonderzoek, gebeurt dat regelmatig?

Ik ken geen getallen ik denk meestal, maar zeker niet altijd, ook al raad de NAG standaard dat wel aan.

### Stappen na de diagnose:

Vaak hebben mensen al eerder medicijnen gehad. Meestal is de 1e stap om medicijnen mee te geven, zoals salbutamol. Eerst wordt de diagnose gesteld en dan is het vooral belangrijk dat de patiënt het snapt. Ik verwijs vaak naar thuisarts en ook wel longfonds.nl.

Tijdens dit consult leg ik ook wel uit wat we eraan gaan doen. Dan vertel ik dat astma een chronische ziekte is, dat de longen snel geprikkeld zijn en dat we dat wel kunnen voorkomen, en dat daar dan medicijnen voor nodig zijn.

### Medicijnen:

Er zijn voor astma misschien wel 100 puffers, in onze regio hebben we een formularium. De huisarts probeert in samenspraak met de patiënt te kijken welke inhalator goed bij hen past en wat de patiënt prefereert (iets wat makkelijk in te nemen is versus iets wat makkelijk mee te nemen is).

De uitleg over hoe de medicijnen werken legt de huisarts uit en hoe ze moeten inhaleren dat legt de apotheek uit. Het is ook belangrijk dat mensen snappen waarom ze medicijnen nemen.

### Actieplan:

Is er wel maar daar doet de huisarts zelf niets mee, dat zou de praktijkondersteuner moeten doen.

Vraag: Is het gebruikelijk om dat actieplan op te stellen?

Nou... (Twijfel) ik denk dat dat veel te weinig gebeurt. Ik vind dat dat een vast onderdeel moet zijn van patiënt begeleiding.

### Astma controle

Het verbaast me niks dat patiënten denken dat astma onder controle is maar toch gewoon klachten hebben, dus dat ze regelmatig hun puffer nog wel nodig hebben, terwijl je eigenlijk pas goed onder controle bent als je dat niet nodig hebt. Dat ze zich dat niet realiseren van zichzelf. Het komt vaak voor dat mensen zeggen nou zo ernstig is het bij mij allemaal niet, dus het zal wel onder controle zijn bij mij en dat ze dan toch gewoon met klachten door blijven lopen. Het zou gaaf zijn als we een tool hebben dat mensen uitlokt tot het te gebruiken of dat mensen uitlokt tot gedragsverandering

### Zelfmanagement

Vraag: Krijgt de patiënt informatie over zelfmanagement?

Bij het longfonds kun je astma & bewegen astma & medicijnen lezen. En je kan een actieplan meegeven.

Vraag: Denkt u dat mensen ook op deze sites kijken?

Dat week ik niet, eigenlijk als je echt een goede POH zou hebben dan zou je zeggen kijk eens op die site, en maak een lijstje van de vragen die je hebt voor de volgende keer. Of je kijkt samen naar de site, zoals je ook samen naar de site inhalatorgebruik kunt gaan.

Vraag: Waarom denkt u dat mensen toch niet aan zelfmanagement doen?

Nou ik denk door een onderschatting van de klachten... Ik denk dat er indianenverhalen gaan over therapie, de onderhoudstherapie van astma zijn inhalatiecorticosteroiden. Daar zijn toch wel misvattingen over, dat het hormonen zijn dus het is slecht voor je, "tis gif", hoe minder je nodig hebt hoe beter. Dus ik denk veel misvattingen over medicatie. Verder misschien ook wel tijdsgebrek of

lastig... Of mensen komen niet naar de huisarts want ze kunnen geen vrij nemen van werk.

Vraag: Zou het helpen om mensen meer inzicht te geven, zodat ze echt begrijpen wat er gebeurt?

Nou ik denk het wel, het is ook bewezen dat als je mensen goed uitlegt wat nou de werking is van medicijnen dat de adherence ook verhoogt. Dus goede uitleg, goede informatie dat help echt. Dat is onder andere dus herhalen en ook de patiënt vragen goh leg mij nou eens uit wat er aan de hand is, dus dat de patiënt ook echt begrijpt wat astma is.

Vraag: Zijn er bij u in de praktijk veel mensen die hun astma onder controle hebben?

(Uitleg van 4 niveaus van controle) Echt goede astma controle dat is een minderheid, ik weet geen getallen uit mijn hoofd. De meerderheid heeft gedeeltelijke controle en dat is dan ook al best wel goed. Sommige mensen zie je ook heel lang niet, bij de apotheek komen ze dan nog wel om hun medicijnen op te halen, eigenlijk zou je ze dan daar moeten onderscheppen en checken of ze hun astma onder controle hebben.

Vraag: Wat zou u kunnen helpen, wat moet u van astmapatiënten weten?

Nou hoe het gaat. Er zijn gevalideerde vragenlijsten voor ACQ, ACT... en die vragen gebruik ik wel. Of de astmapatiënt moet die dan invullen. Thuis doen mensen dat 3 dagen en dan hebben ze er geen zin meer in. Ik denk dat als mensen hun signalen herkennen en merken wanneer het niet goed gaat met ze dat dat wel werkt.

Vraag: Doet u iets met apps?

Nee

#### **Over de app & level of engagement van de huisarts**

Alleen tijdens consult versus tussendoor gegevens sturen losgekoppeld van bezoek: Dat laatste zou fijn zijn dus los van een bezoek en misschien dat het zelfs een consult kan voorkomen. Of bij vragen, of bij signalen dat de controle niet goed is, dat we daar een signaal van krijgen. Als het goed gaat met de patiënt dat hoeven wij niet elke dag te zien.

#### **Over smart inhalatoren:**

Op die manier zou je ook de therapietrouw kunnen bijhouden, het zou mooi zijn als dat erin zit.

ACT zou erin kunnen zitten en misschien een stappenteller. Want bewegen is ook goed bij astma, dat is misschien ook wel iets wat mooi zou zijn.

Ik vind het allerbelangrijkste, weet een patiënt wat ie moet doen als ie klachten krijgt. Want astma is een ziekte die op en neer gaat. Iemand kan vandaag goed zijn en morgen klachten krijgen. Dan is het mooi als zo'n app je op dat moment verder helpt.

### 5.3 Rough insights GP interviews

#### Problems seen for the asthma patient

Conversations with GPs gave several insights on what problems asthma patients encountered. Below these are elaborated upon.

#### Triggers

Due to the fact that feeling stuffy is difficult to describe and recognize to patients, it is even harder to point out triggers. This also relates to earlier findings of patients not being able to express their level of asthma control

#### Acceptance uncontrolled asthma

Several times it was pointed out that patients are used to living with complaints and find it difficult to describe and recognize feeling stuffy. Besides that due to the fact that they are used to complaints they sometimes do not see the need for improvement and they accept their condition.

#### Role of medication

Several times the importance for explaining asthma, its chronicity and the reason for taking medicines was mentioned. The GPs stress that it is really important to ensure patients understand why they take medicine. It should be explained what the different medicines do. That taking a medicine once does not help.

#### Problems of the GP

Interestingly GPs that were consulted did not point out many problems or shortcomings for themselves related to the treatment of asthma patients. They did point out some difficulties, but each had their own tools to overcome these.

*"People are quite fast not completely honest. Especially if you ask a yes/no question. The GP should invite patients to explain things and situations in order to find out what is really going on."*

It is likely that this result of the fact that all of the GPs that were consulted are members of CAHAG. This means that they have a special affinity with asthma and that most of their practices have extra good arrangements for asthma care. They did point out however some shortcomings they see from other GPs who do not have special affinity with asthma.

#### Not explaining well

*"I think most of the blame is on the care givers, that they have never really explained what their exact disease means. That the patient does not know what they are doing and thus are doing it wrong. I do not believe that there are people that*

*do not do it right on purpose."-GP1*

#### Responsibility

One of the GP's specifically states that she wants the tool to put the responsibility at the patient. The patient should be alarmed when they need to take action. Besides that it was mentioned that the system that GP's use is communicating poorly and that making changes to the system takes years. It could be wise to avoid trying to implement the tool into the standard GP systems but to make stand-alone tool for GP's out of which information can be implemented into the system

*"What I would like is if the patient is working with the tool that they get the message "your asthma is not in control, this is important for you, try " and otherwise contact your doctor"-GP1*

#### Information that doctor gives

Shortly after diagnosis the GP explains that it is important to explain to patients what asthma is, and that when keeping asthma in control they can have a normal life expectancy, this way she puts a lot of responsibility at the patient. She assumes however that often GP's tell their patient that they have asthma, then prescribe the medication and refer to a website. A practice assistance that I spoke to also emphasizes the importance of patients really understanding their condition.

#### Explanation of medication

Another point that was stressed is the importance of explaining why a patient takes certain medicines and what the different medicines do. The GP mentioned also that patients should understand that asthma is chronic and that taking the medication once does not help  
Do you have any idea why patients do not take their medication correctly?

*"I think most of the blame is on the care givers, that they have never really explained what their exact disease means. That the patient does not know what they are doing and thus are doing it wrong. I do not believe that there are people that do not do it right on purpose." GP1*

-->knowledge of medication is important

#### Collaborative care

*"Because asthma is different for every person and the way medication should be taken as well I really think it is the job of the care giver to make clear to patients to make things negotiable, its really working together."*

-->stimulate negotiating things



# Appendix 6

## Creative session with VanBerlo

### 6.1 Method

#### Method

A creative session was done with four designers of VanBerlo. The goal of this session was to discuss all the findings, to re-evaluate the findings and to organize the findings. Also some early brainstorming was done.

#### Research setup

##### Introductory presentation

In this presentation the designers were introduced to the assignment of the project. The context of the project was explained, and some initial research findings were presented

##### Quotes

the next step was to identify clusters in the findings. The findings were presented as printed quotes. These quotes were either based on literature or on the patient research, and the quotes were sub-divided into categories. In the top-right corner of each quote the category was listed. (see appendix 6.2 for some examples of quotes)

##### Clustering

The quotes were hung on a whiteboard and re-clustered in the session. The goal was to identify problem areas (see appendix 6.3 for some pictures of the process)

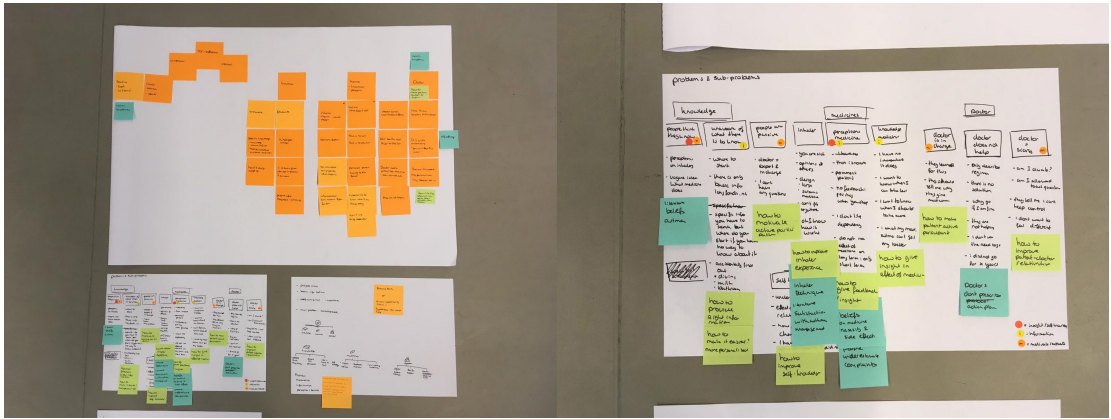
##### Brainwriting

After the quotes were clustered into problem areas the participants could vote for the problem areas that they found most promising to work with. The top four problem areas were then re-written into "How to.." questions. On each of these questions a sketching session of 5 minutes was held. (see appendix 6.4 for the result of the session)

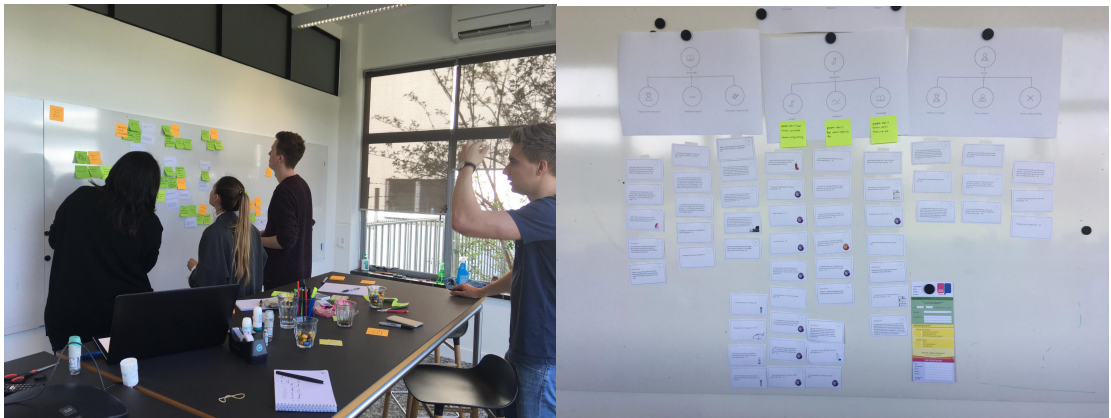
## 6.2 Materials



### 6.3 Session pictures



Preparation of the session: Re-clustering findings for the session



Creative session

### 6.4 Outcome



The end result



# Appendix 7

## Design directions

This appendix shows the design directions that were identified for the mid-term meeting.

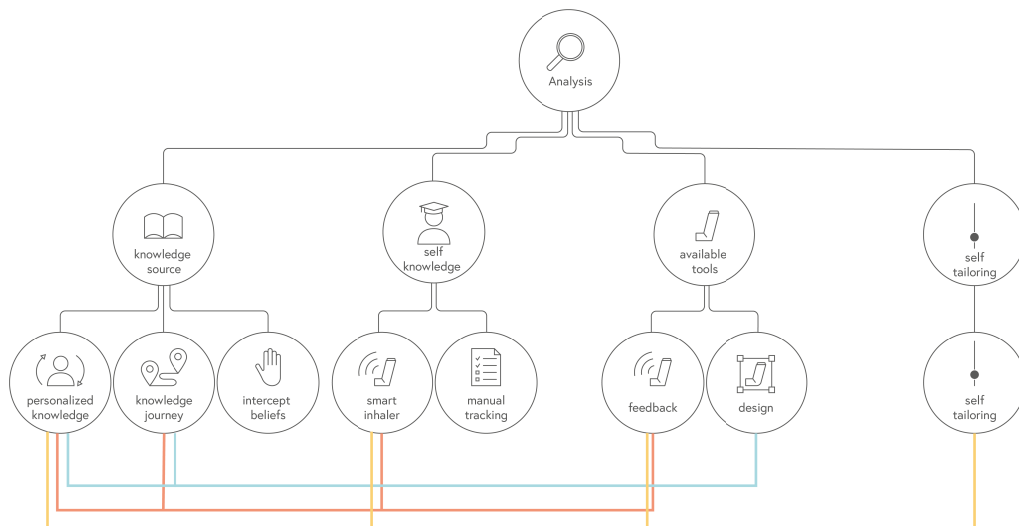
Direction 2 was initially chosen as concept direction. However during brainstorming phase it was noticed that the redesign of an inhaler was not really leading towards an holistic and integrated concept. Besides that, redesigning the inhaler was difficult as there was some conflict of interest with the workgroup.

The goal of "creating a better useable inhaler" was to increase the capability of the user. Therefore a step back was taken during concept development to "increase the patients capability". The initial design direction thus became:

*"personalized knowledge, knowledge journey, increasing capability"*

Later developed into:

*"Develop a personalized knowledge source that creates a journey of education, increased insight, and translates this into concrete actions for the patient. This will be done through design for increased competence and autonomy."*



- Direction 1: personalized knowledge, knowledge journey, smart inhaler
- Direction 2: personalized knowledge, knowledge journey, redesign usability inhaler
- Direction 3: personalized knowledge, smart inhaler, self-tailoring

# Appendix 8

## List of requirements

### Requirements

- R1 The design should be personalized based on the kind of asthma that a patient has
  - R1.1 The design should be personalized based on type of asthma
  - R1.2 The design should be personalized based on severity of asthma
  - R1.3 The design should be personalized based on triggers of the asthma patient
  - R1.4 the design should personalize based on persona
    - R1.4.1 The tone of voice should be adjusted to the persona
- R2 The design should allow patients to keep track of changing conditions over a longer time.
  - R2.1 The design should implement the ACQ
- R3 The design should stimulate adherence to medication
  - R3.1 The design should stimulate adherence to anti-inflammatory medication
  - R3.2 The design should stimulate adherence to reliever medication
  - R3.3 The design should provide the functionality to track adherence to both reliever and controller medication
  - R3.4 The design should enable the user to set reminders for their medication
  - R3.5 The design should provide feedback on medication use
  - R3.6 The app should allow the patient to fill out their medication schedule
- R4 the design should create awareness on the patient-side that they can actively participate in their treatment
  - R4.1 The design should encourage the patient to become more active in their treatment
- R5 The design should motivate the user to better self-manage their asthma
  - R5.1 The design should provide positive feedback
  - R5.2 The design should stimulate a feeling of progress
  - R5.3 The design should give insight in positive trends
  - R5.4 The design should motivate by means of increasing a feeling of competence
  - R5.5 The design should motivate by means of giving the user autonomy in the choice of their approach to self-management
- R6 The design should give the patient autonomy
  - R6.1 The design should give the user options and freedom to make choices in their approach to self-management
  - R6.2 The patient should be in charge of his or her data
- R7 The main focus of the design should be on medical self-management
- R8 The design should support patients in obtaining asthma control through enhanced self-management.
- R9 The design should educate the user
  - R9.1 The design should support the development of self-knowledge
    - R9.1.1 The design should support the discovery of triggers
    - R9.1.2 The design should provide users with the tools to act upon discovered triggers

- R9.1.3 The tool should support patients to recognize complaints
- R9.2 The design should provide knowledge on medication
- R9.3 The design should educate the user on what asthma
- R9.4 The design should educate the user on asthma treatment
- R9.5 The design should educate the user on self-management tasks
- R9.6 The design should spread the process of gathering knowledge
- R10. Patients should be supported to use their inhaler correctly.
- R11 The design should translate gathered data into insight
  - R11.1 The design should provide insight in level of asthma control
  - R11.2 The design should provide insight in triggers
  - R11.3 The design should provide insight in progress of asthma control
- R12 The design should activate the user
  - R12.1 The design should provide action-oriented information
  - R12.2 The design should provide action-oriented feedback
  - R12.3 The design should enable patients to turn the gathered data into action
- R13 The onboarding of the app should prepare for personalization
  - R13.1 The patient name should be filled out
  - R13.2 The patient attitude/persona should be defined
- R14 Reminders should become more persuasive over time
- R15 The design should not be stigmatizing
  - R15.1 The design should be a support or buddy rather than an authority
  - R15.2 The design should not have a medical look
  - R15.3 The design should not openly display personal information

## Digital design requirements

- R16 The digital design should personalize based on persona
  - R16.1 The digital design must be able to identify persona
  - R16.2 The digital design must adjust the tone of voice based on persona
- R17 The digital design must personalize knowledge
  - R17.1 The digital design must learn from user data
  - R17.2 The digital design must personalize knowledge to type of asthma
  - R17.3 The digital design must personalize knowledge to severity of asthma
  - R17.4 The digital design must personalize knowledge on triggers
  - R17.5 The digital design must personalize knowledge on asthma control
- R18 The digital design must include the GP of the patient
  - R18.1 The digital design must ask for approval to share insights
  - R18.2 The digital design must include a portal for the GP

## **Physical design**

R19 The physical design should serve as a reminder

R19.1 The physical design must be able to remind user of actions

R20 The physical design should be discrete

R20.1 The physical design should be quiet

R20.2 The physical design should not display any personal information

R20.3 The design should have a not medical appearance

R21 The physical design should support the functionality of the digital design

## **Feasibility**

R22 The design should be cost effective

R23 The design should demonstrate feasibility of general, digital and physical design requirements

R24 Technological development of the design as a whole should be feasible within 5 years

## **Viability**

R25 The design should be ethically justified

R26 The design should be an addition to traditional care

R27 The design should be innovative

R28 The design should be time effective for the GP

## Wishes

- W1 Besides focusing on medical self-management, the design should also take into consideration emotional self-management and behavioral self-management
- W2 the design should prevent the development of beliefs
  - W2.1 the tool should tackle beliefs by providing knowledge on the topic at hand.
- W3 . The design should collect data as efficient as possible to minimize the effort required by the user.
- W4 the design should be understandable at a glance
- W5 the design should use gamification
- W6 the design should be aesthetically pleasing
- W7 the design should support patients in finding specific information that applies to their specific need at that time

## Desirability

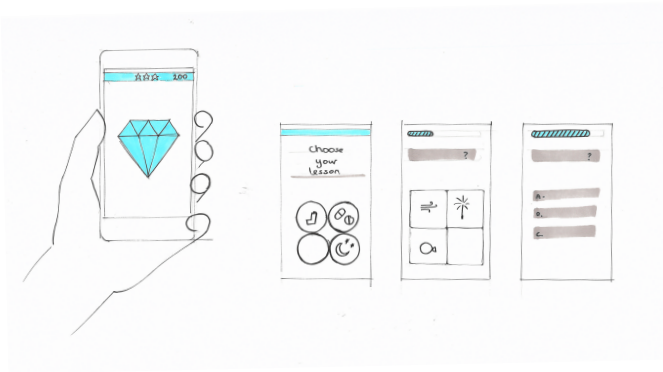
- W8 The design should create value for asthma patients
  - W8.1 The design should be beneficial for the self-management of asthma patients
  - W8.2 The design should provide a feeling of support
- W9 The design should fit the context of use
  - W9.1 The design should be usable independently by asthma patients
  - W9.2 The design should be suitable for patients that recently got asthma diagnosis (no required knowledge)
  - W9.3 The design should be desirable for well literate patients
  - W9.4 The design should provide insight for the GP
- W10 The digital design should support the development of self-knowledge
  - W10.1 Design should support discovery of triggers
- W11 Logging of data should be time efficient
- W12 The design should meet the wishes of all stakeholders
  - W12.1 The design should support the GP in treatment of the asthma patient
  - W12.2 The design should support the asthma patient with their self-management
  - W12.3 The design should create meaning for CAHAG as an organization
  - W12.4 The digital design should function both in combination with the physical design and independently

# Appendix 9

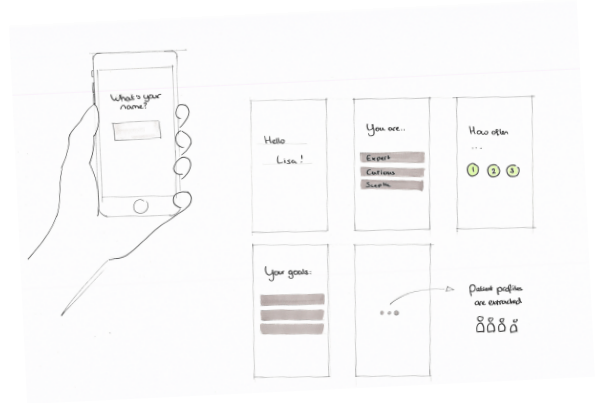
## Ideation

### 9.1 explorations mid-term

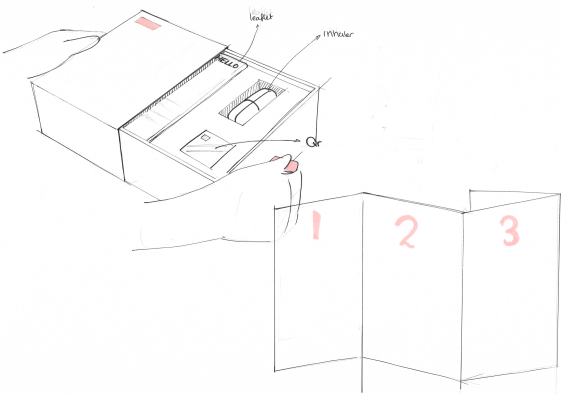
Playful learning



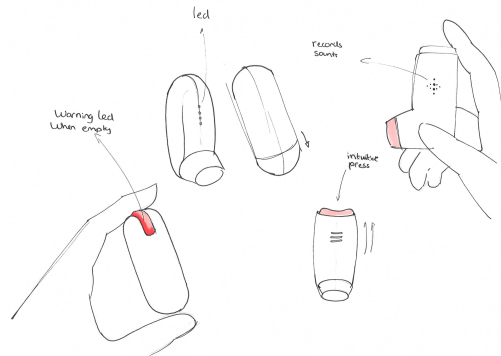
Personalized knowledge



On-boarding



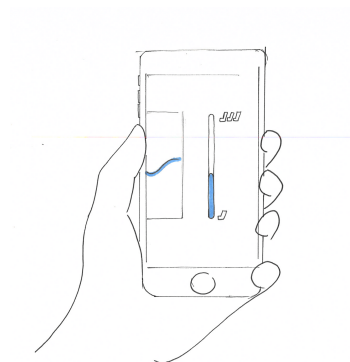
Redesign inhaler



Tracking inhaler



Self-tailoring



## 9.2 Moodboards



a few goal areas

unlock levels

knowledge horizons  
- basics  
- self tracking  
- tips

short lessons to complete

score perfect

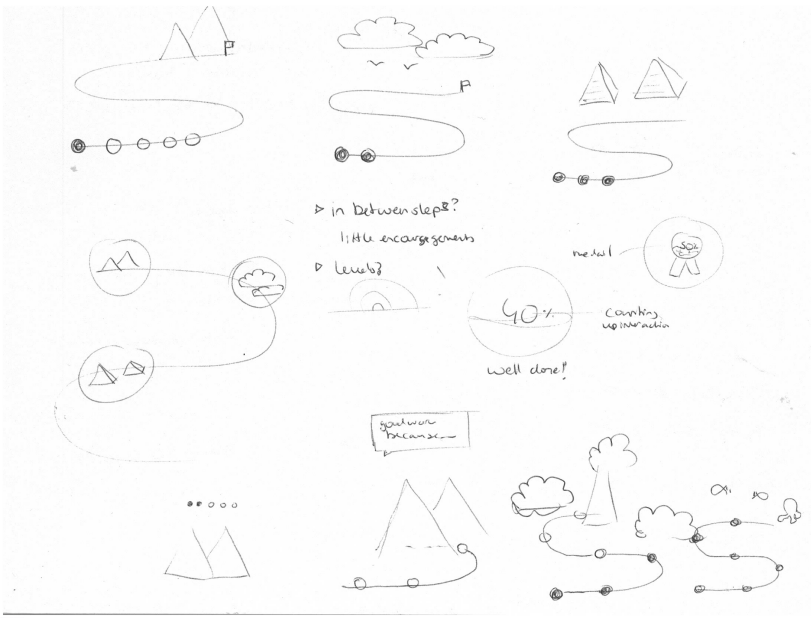
repetition over time sometimes decreases

it's essentially planning to keep them all up-to-date

1: general for all app concepts: Basic functionalities  
- knowledge horizons - adherence + reminders  
- doctor tip  
- questionnaire for personalisation

2 diff concepts: abstract visual  
- duo lines  
- mindfulness

3 personalisation  
- tone of voice  
- type of info



Meditation

Verlies je doet niet uit het oog

Different topics with a few lessons shows overview of progress made

○○○○○  
○○○○○  
↑ max 10: clear overview + encouraging

lessons need to be repeated or skills go down

demotivating  
lock = negative  
barriering

horizons you can unlock levels  
4 topics each 10 lessons in each level

Playlists voor jou

Muziek voor elk moment

Podcasts voor iedereen

learn from listening podcasts

become your best self with adherence  
- stick to therapy  
- make goals come true

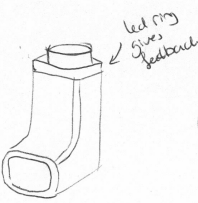
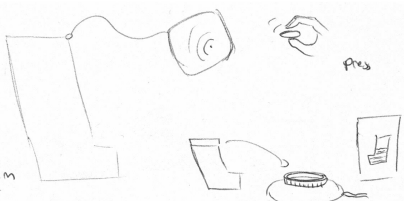
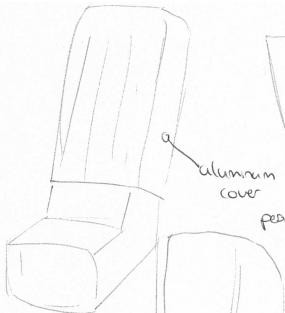
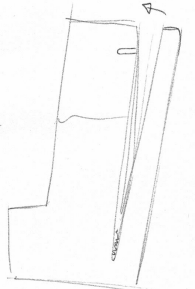
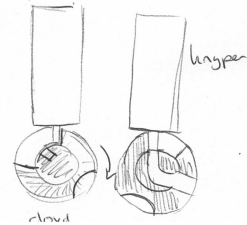
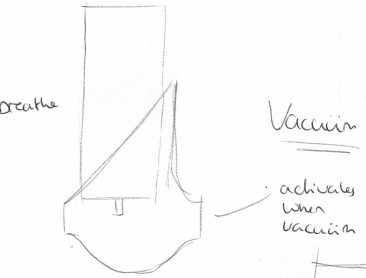
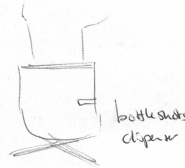
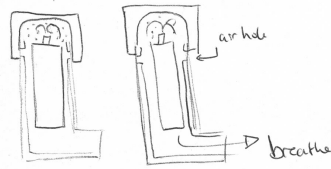
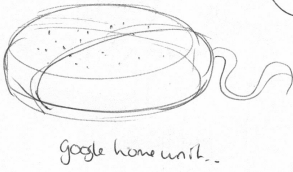
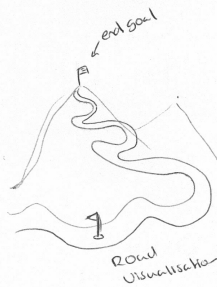
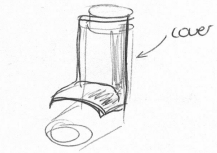
glt fit?

10mi

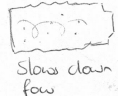
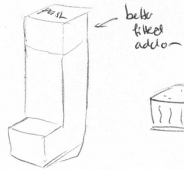
lira stemming of moment of that die of opdat moment wil bestede Son

Different focus areas  
- meditation  
- health  
- exercise  
- food

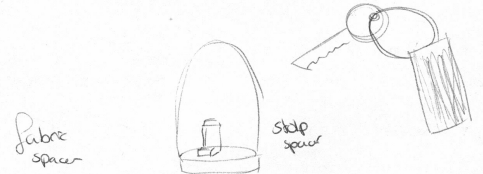
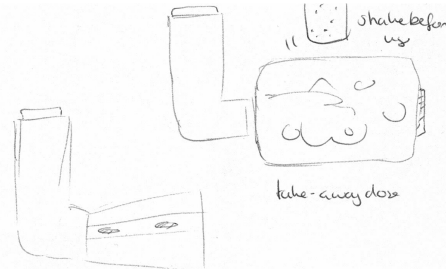
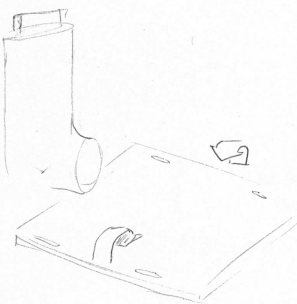
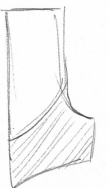
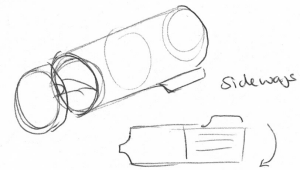
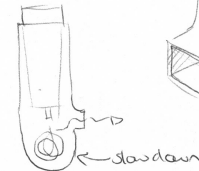
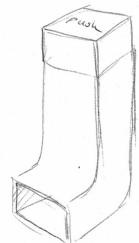
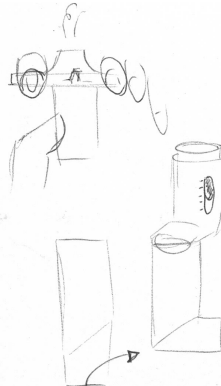
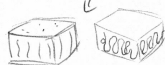
### 9.3 Early sketches



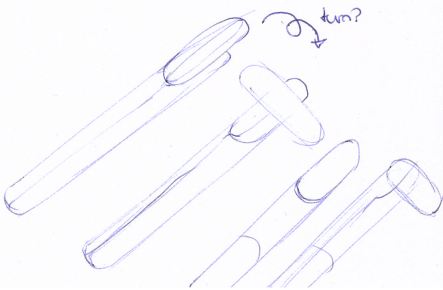
soft circuit



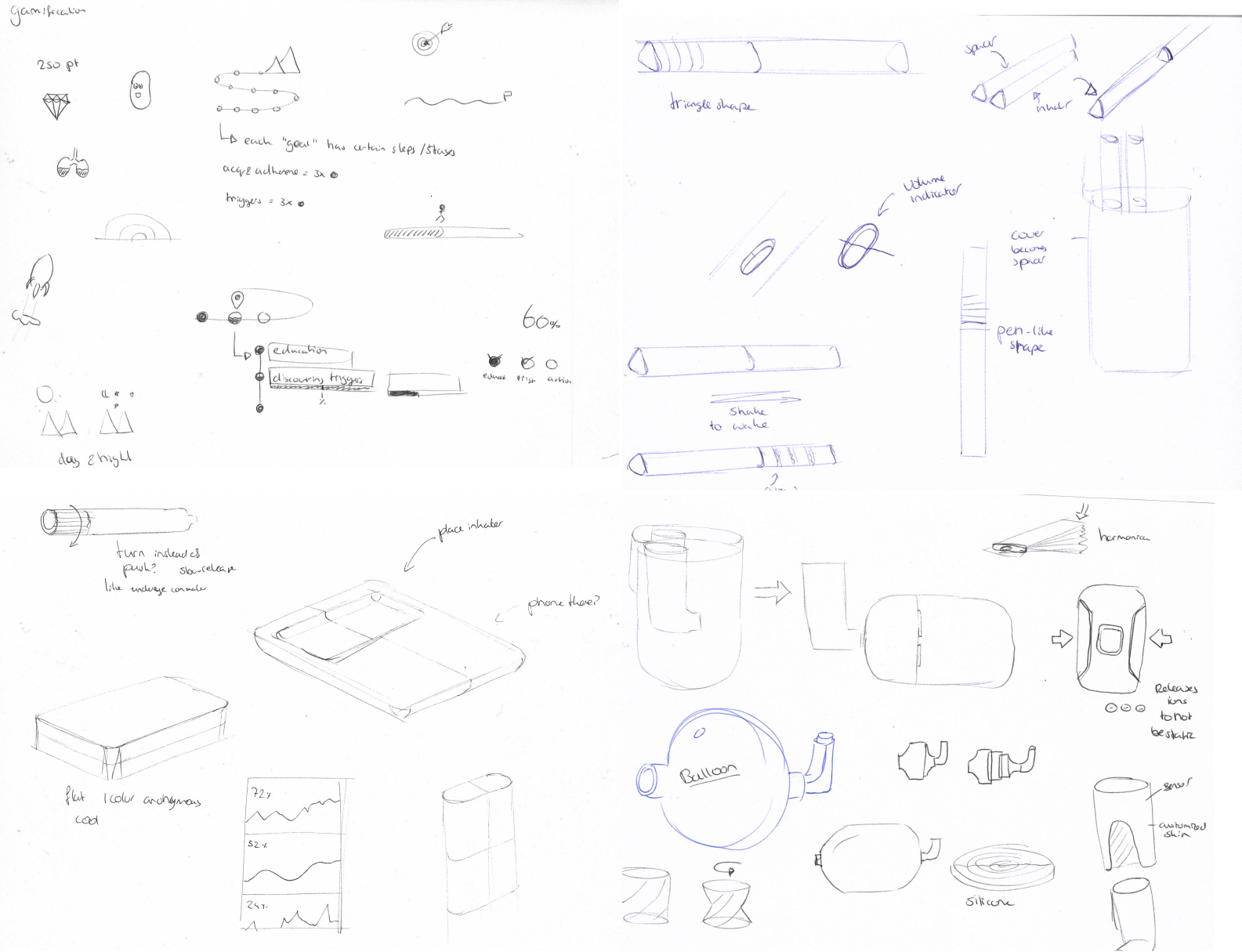
personalization



→ washable!







## 9.4 Brainstorming with non-designers



# Appendix 10

## Sketch session VanBerlo

### 10.1 Setup

For the sketch session a PowerPoint presentation was prepared that sketched the identified problems. Below some examples of the slides are shown.

Main Problems



**Correct inhaler technique**

Inhalers are difficult to use and do not provide any feedback to the user



**Regular medicine intake**



**Knowledge of treatment**

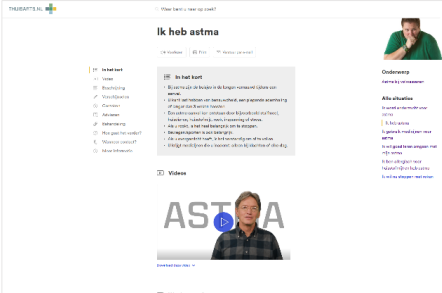
Patients are not educated well enough to take good care of themselves, and current knowledge sources have shortcomings. Lack of education leads to beliefs

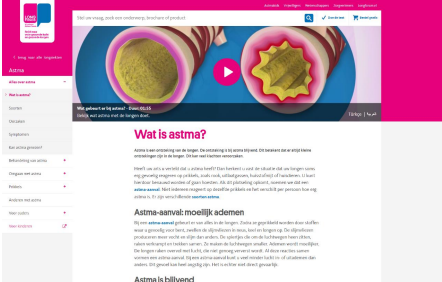


**Self-monitoring**

## Current situation


**After diagnosis**  
Asthma patient gets referred to:  
[www.Thuisarts.nl](http://www.Thuisarts.nl)  
Or  
[www.Longfonds.nl](http://www.Longfonds.nl)





The slides below were used to initiate the sketching sessions. In total five sketch sessions were held of each 10 minutes.


## Solution space



**Redesign spacer & inhaler combination:**

- Smaller
- more discrete
- easy to carry
- easy to clean


**How might we...**  
Redesign the spacer to be more compact  
Redesign the pMDI in a way that the spacer is unnecessary



**Redesign inhaler for easier use:**

- provide use cues
- provide feedback
- improve aesthetics

**How might we**  
Make hand & breath coordination easier  
Guide the user through the use steps  
Give feedback on inhalation technique  
Improve the aesthetics of the inhaler




**Design add on solution:**

- Track use
- Track technique
- Personalise
- Provide feedback

**How might we... using an add-on solution**  
Guide the user through the use steps  
Give feedback on inhalation technique  
Motivate users to take their medicines  
How can we improve the inhaler without changing the design?


## Solution space



**Personalizing knowledge:**

- Based on attitude
- Type of asthma
- Asthma severity

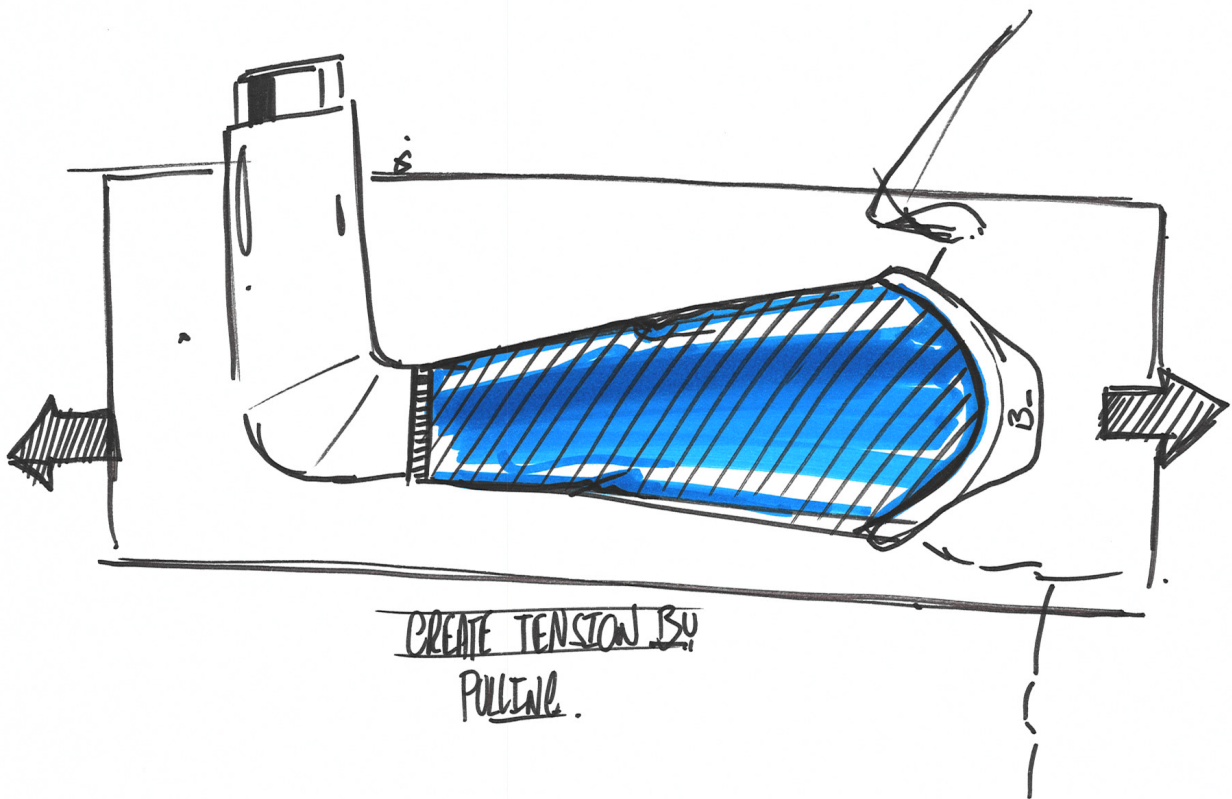
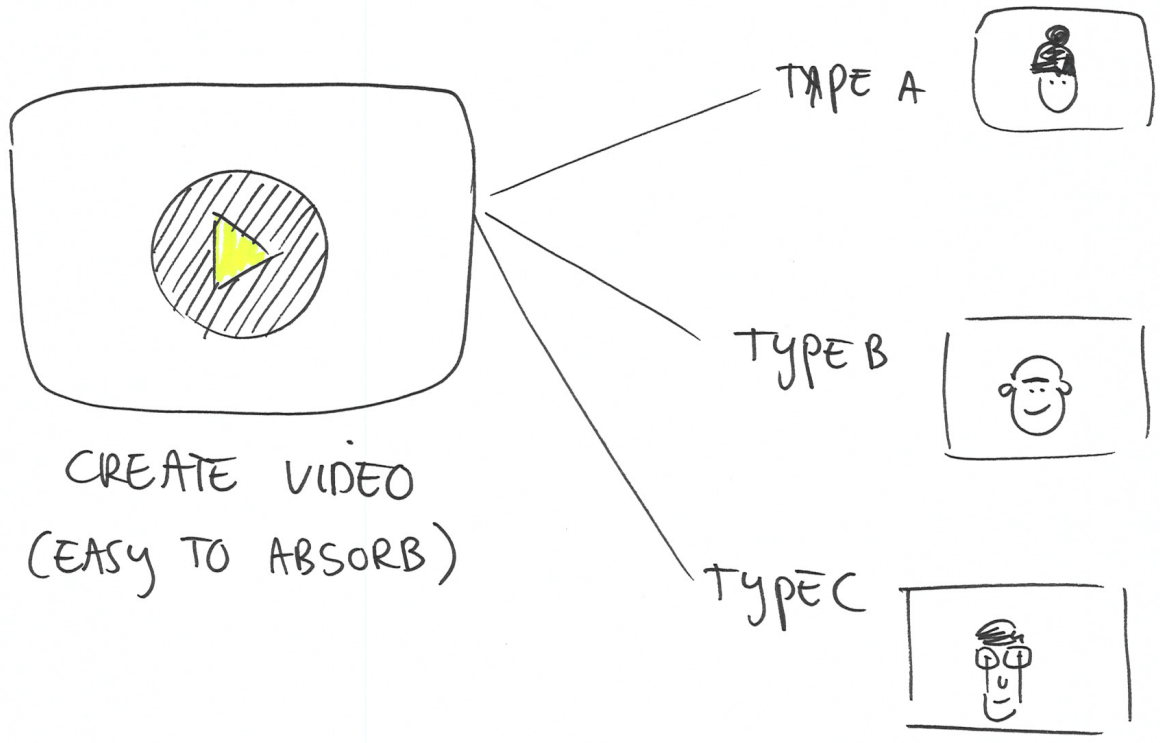
**How might we...**  
Personalize knowledge

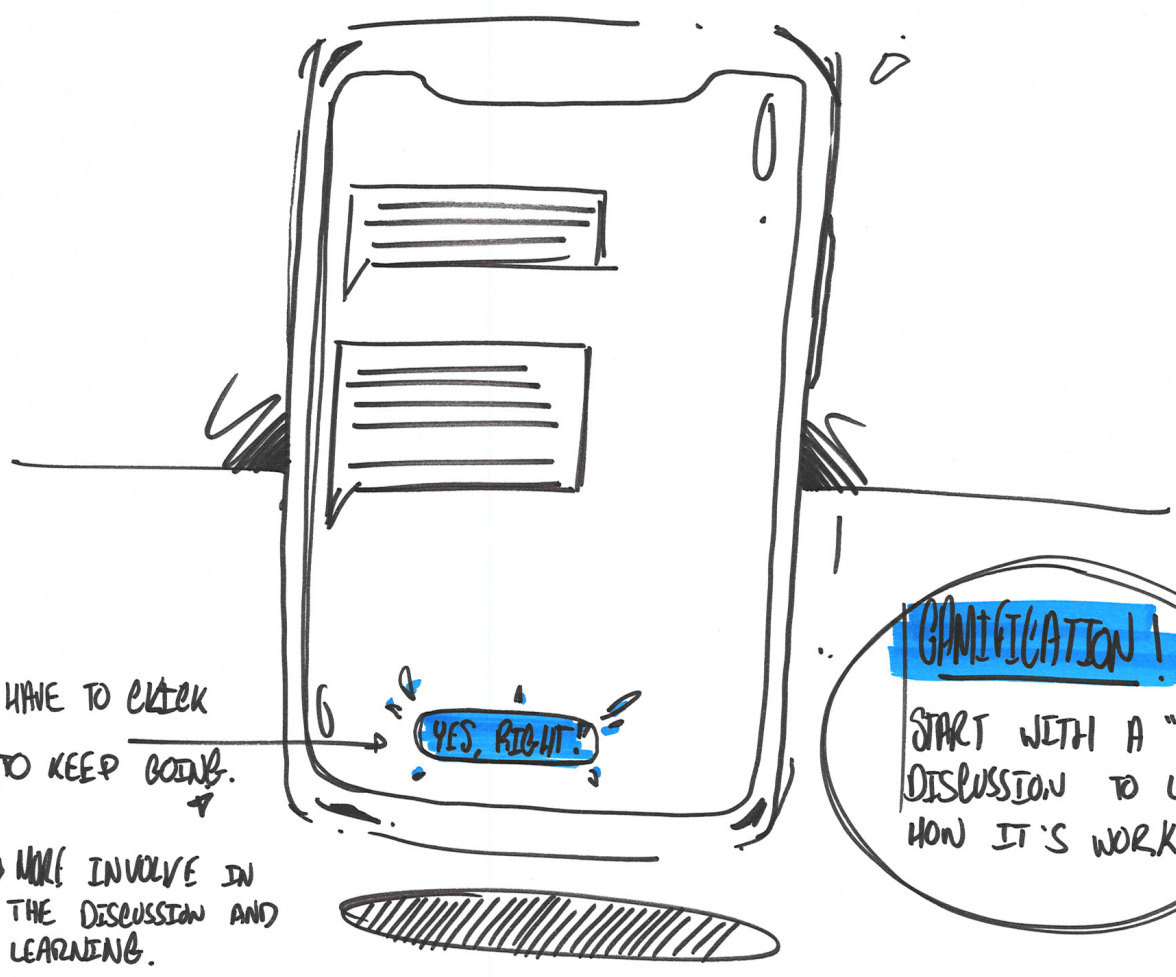
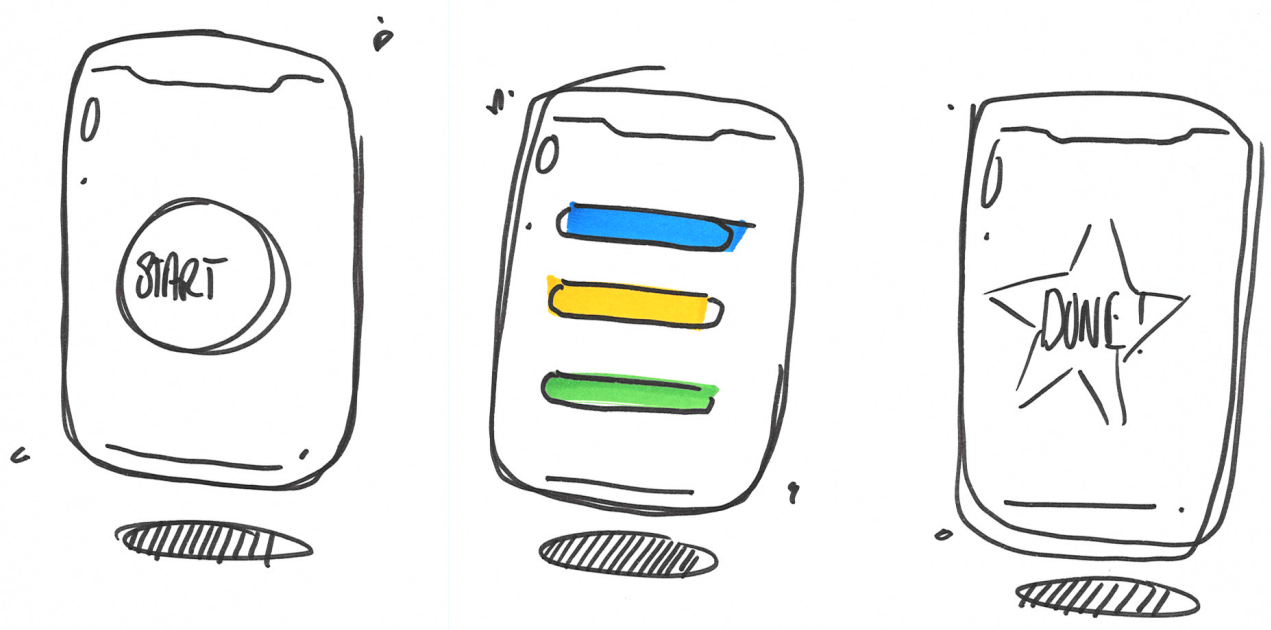


**Creating a knowledge journey:**

- Divide in smaller steps
- Motivate users to learn about asthma
- Keep patients engaged

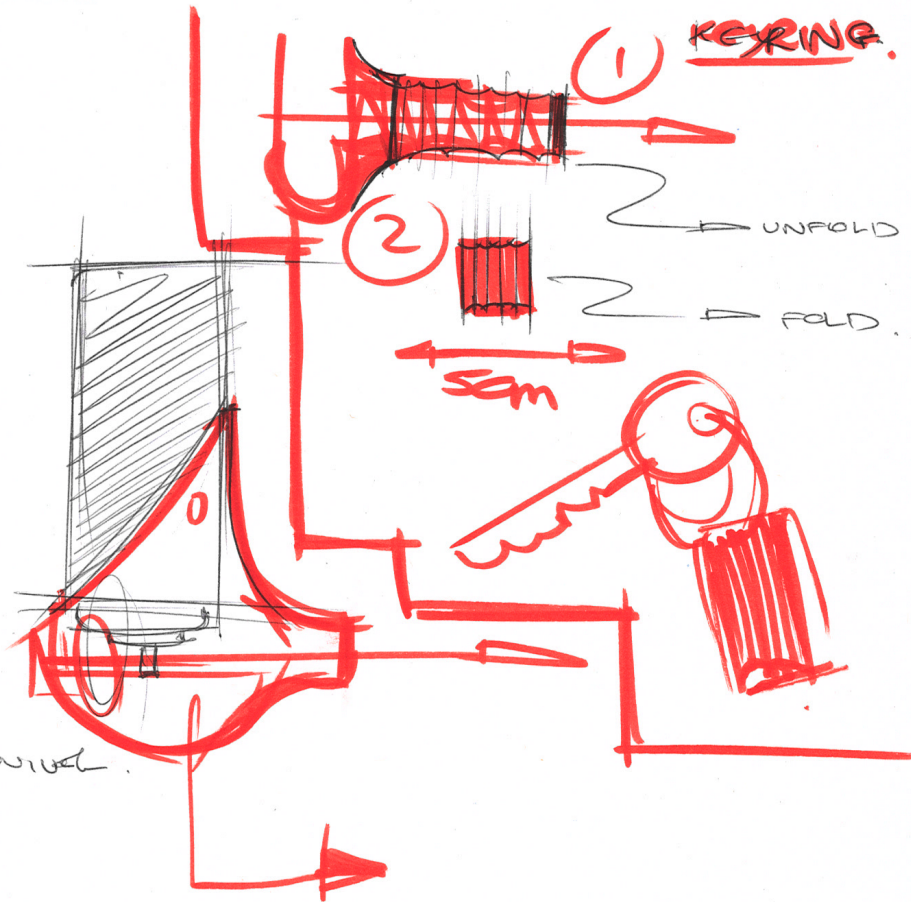
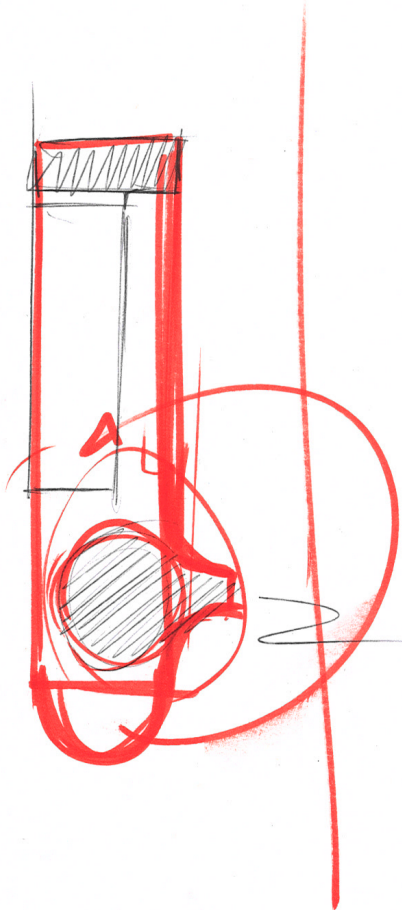
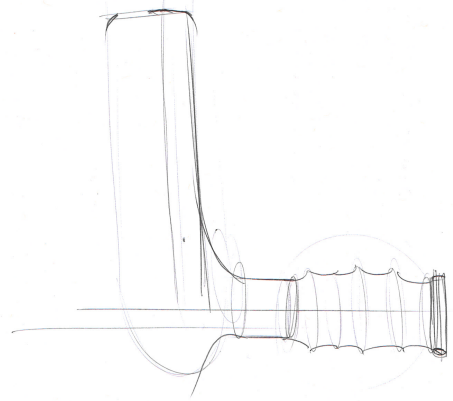
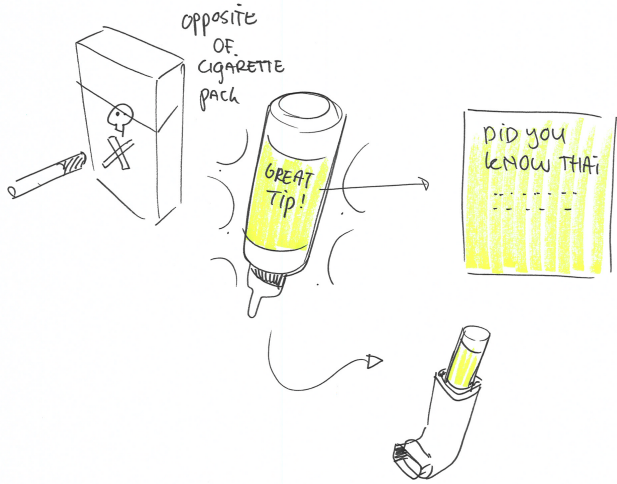
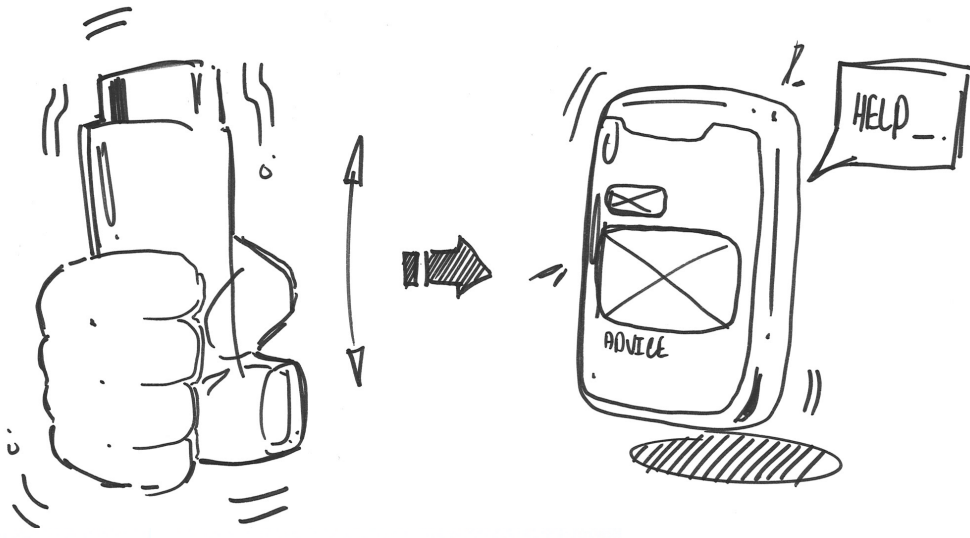
**How might we...**  
Personalise knowledge  
Motivate users to acquire new knowledge and keep them engaged  
Support patients to develop self-knowledge

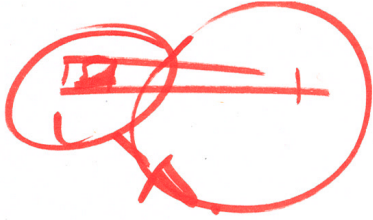




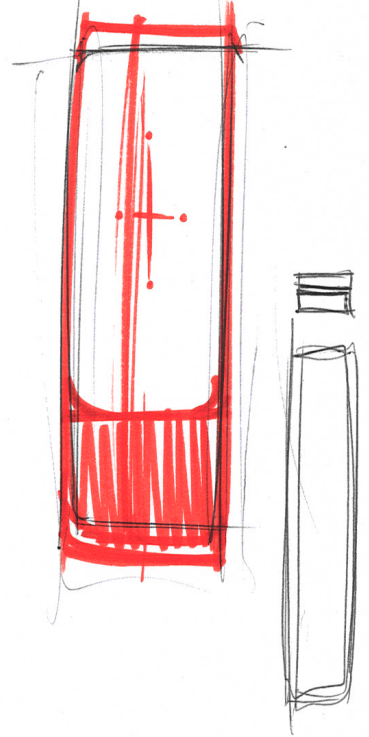
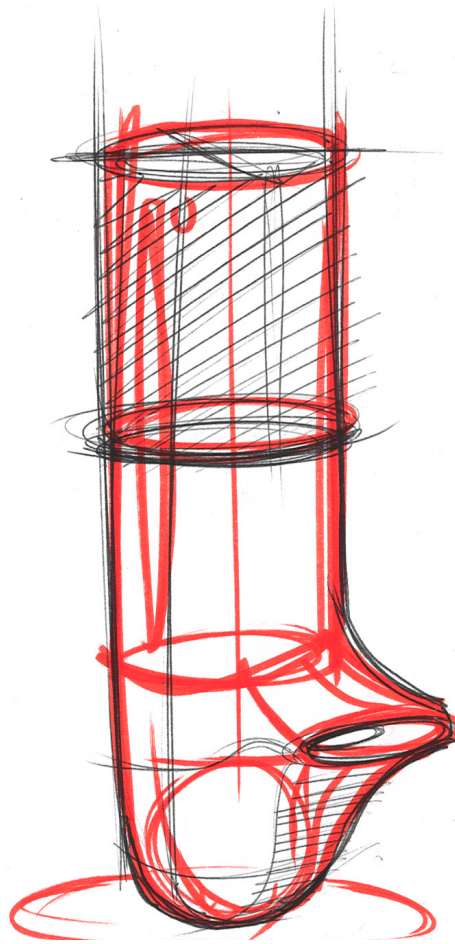
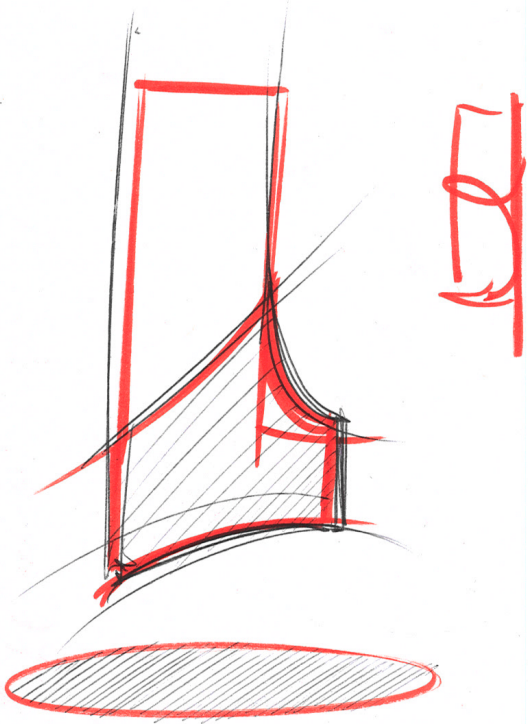
HAVE TO CLICK  
TO KEEP GOING.  
↓  
→ MAKE INVOLVE IN  
THE DISCUSSION AND  
LEARNING.

**GAMIFICATION!**  
START WITH A "FAKE"  
DISCUSSION TO LEARN  
HOW IT'S WORK.

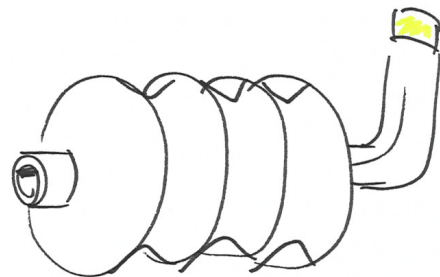
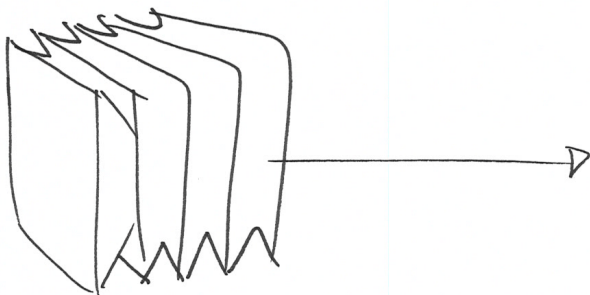
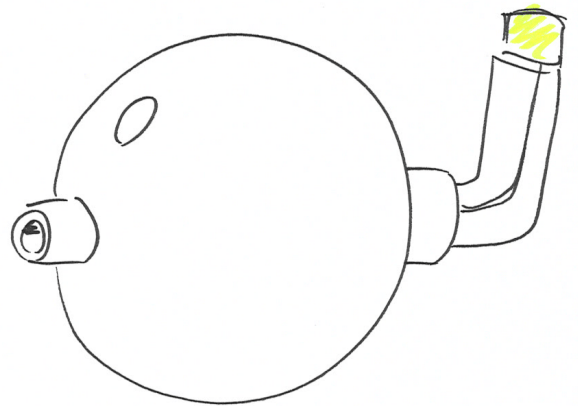
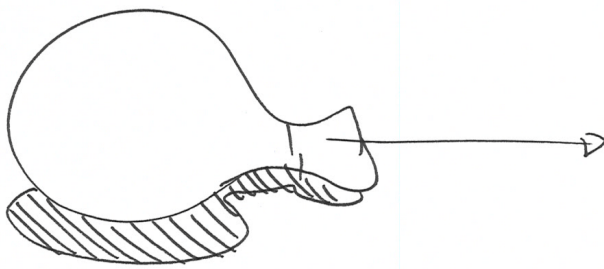




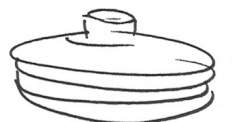
ASIRNATURE.



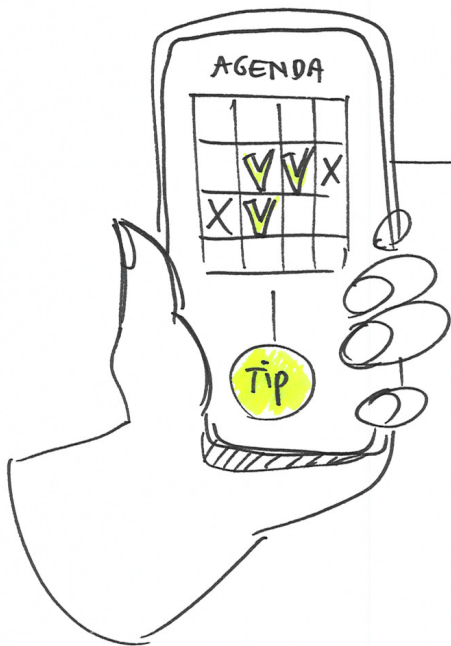
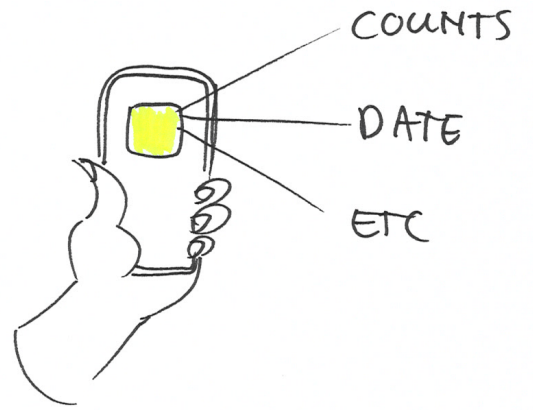
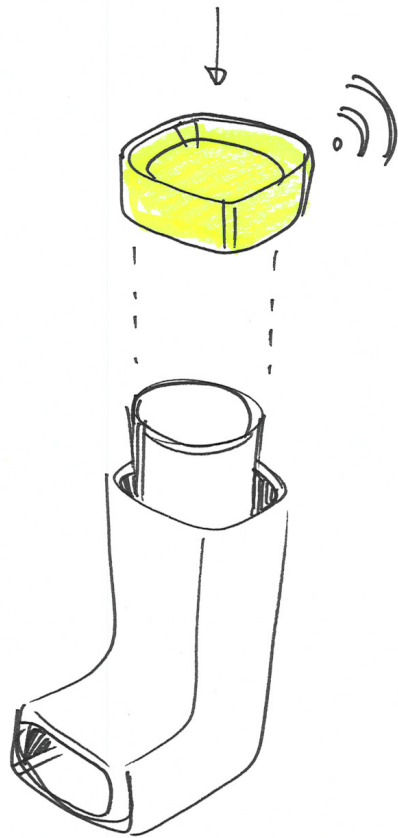
BALLOON



HARMONICA



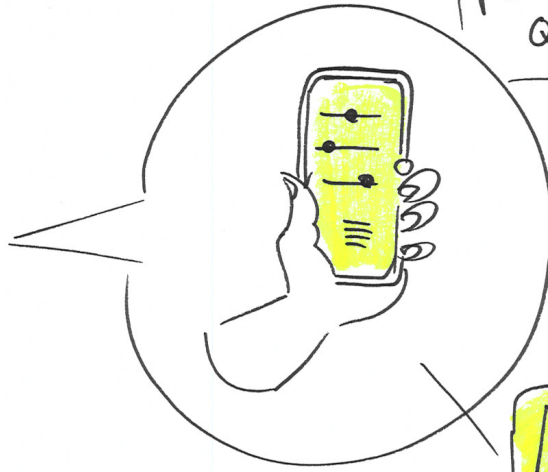
SMART BUTTON



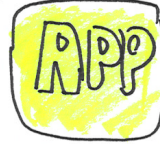
- \* DIRECT FEEDBACK  
WHAT COULD HAPPEN  
IF YOU DON'T USE IT.
- \* OR POS FEEDBACK ON  
USING IT FREQUENTLY.



# \* KNOWLEDGE JOURNEY.



PERSONAL  
QUESTIONNAIRE

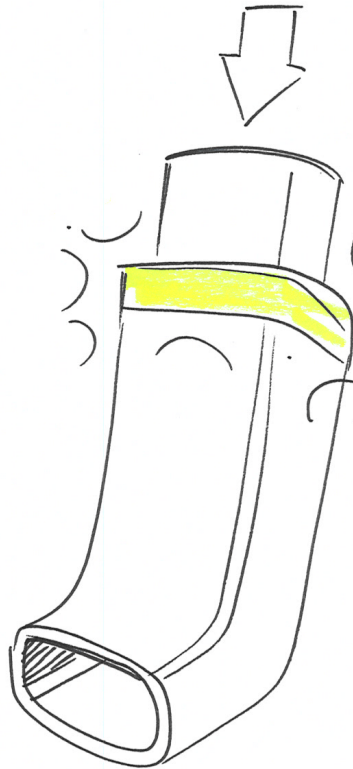


STEP BY STEP.  
AND  
MORE PERSONAL.

TRACK YOUR DATA OVER TIME



INCL  
CHATBOT



LED FEEDBACK

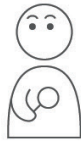

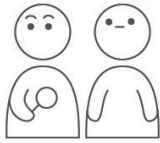
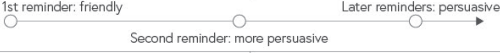



# Appendix 11

## Digital design

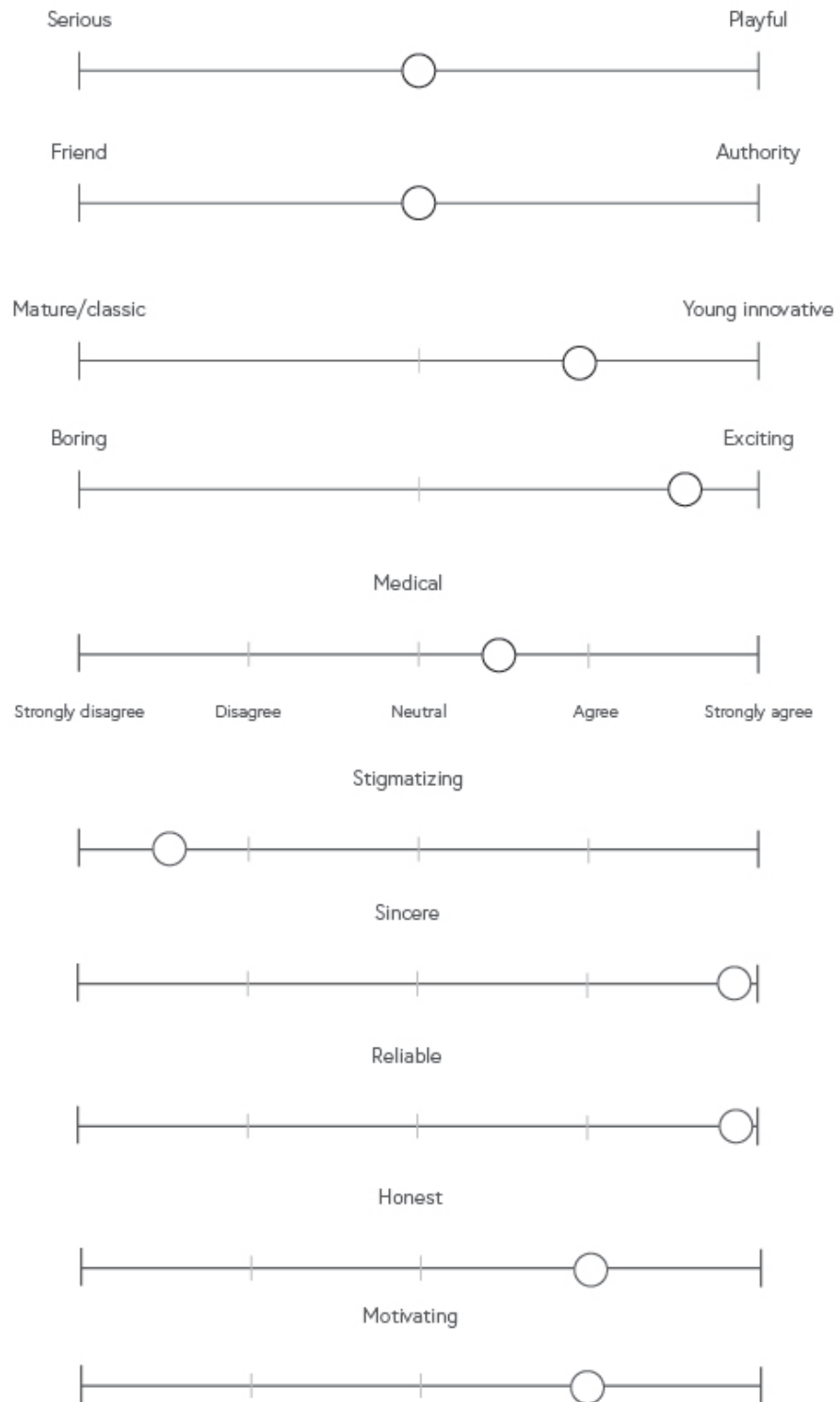
### 11.1 Elaboration on features - personalisation scheme

text

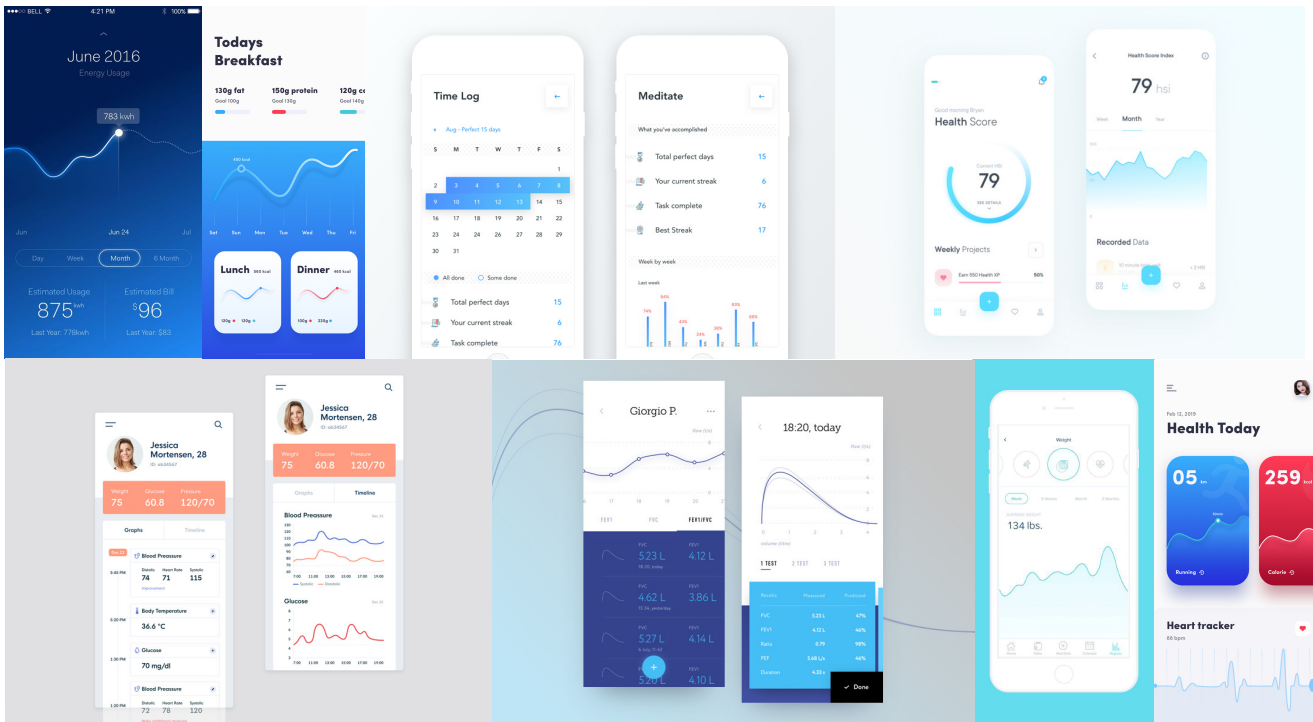
|                                 | <br>Curious | <br>Passive | <br>Both |
|---------------------------------|--|--|--|
| <b>On-boarding</b>              |  |  |  |
| Name                            | ●  | ●  | ●  |
| Identify persona                | Curious  | Passive  | ●  |
| Identify severity               | Mild intermittent  | Mild intermittent  | ●  |
| <b>General</b>                  |  |  |  |
| ACQ                             | ●  | ●  | ●  |
| Medication schedule             | ●  | ●  | ●  |
| Choice of goals                 | ●  | ●  | ●  |
| Reminders                       |           |  | ●  |
| Raise awareness                 | You can...   | You should...  |  |
| Focus                           | Autonomy<br>You have the tools to...   | Support<br>Through offered tools   |  |
| Information Architecture Matrix | Choice of goals<br>Structure in goal   | Choice of goals to some extent   | ●  |
| Information Architecture Tunnel | Only when needed   | Structure in goal  | ●  |
| <b>Discover triggers</b>        |  |  |  |
| Tone of voice                   | Explanation  | Argumentation  |  |
|                                 | This is what we need from you<br>In order to..   | This is what we need from you<br>Because..   |  |
|                                 | No judgment  | No judgment  | ●  |
| Focus                           | Possibilities  | Possibilities+possible consequences  |  |
|                                 | Autonomy<br>You can..  | Support<br>You should/we advise  |  |
| Reminders                       |           |  |  |
| Triggers already known          | ●  | ●  | ●  |
| Triggers discovered             | ●  | ●  | ●  |
| <b>Adherence &amp; ACQ</b>      |  |  |  |
| Medication schedule             | ●  | ●  | ●  |
| Tone of voice education         | Inform   | Convince   |  |
| Intended user goal              | Confirm competence   | Proof  |  |
| Adherence                       | ●  | ●  | ●  |
| ACQ                             | ●  | ●  | ●  |

## 11.2 Aesthetics

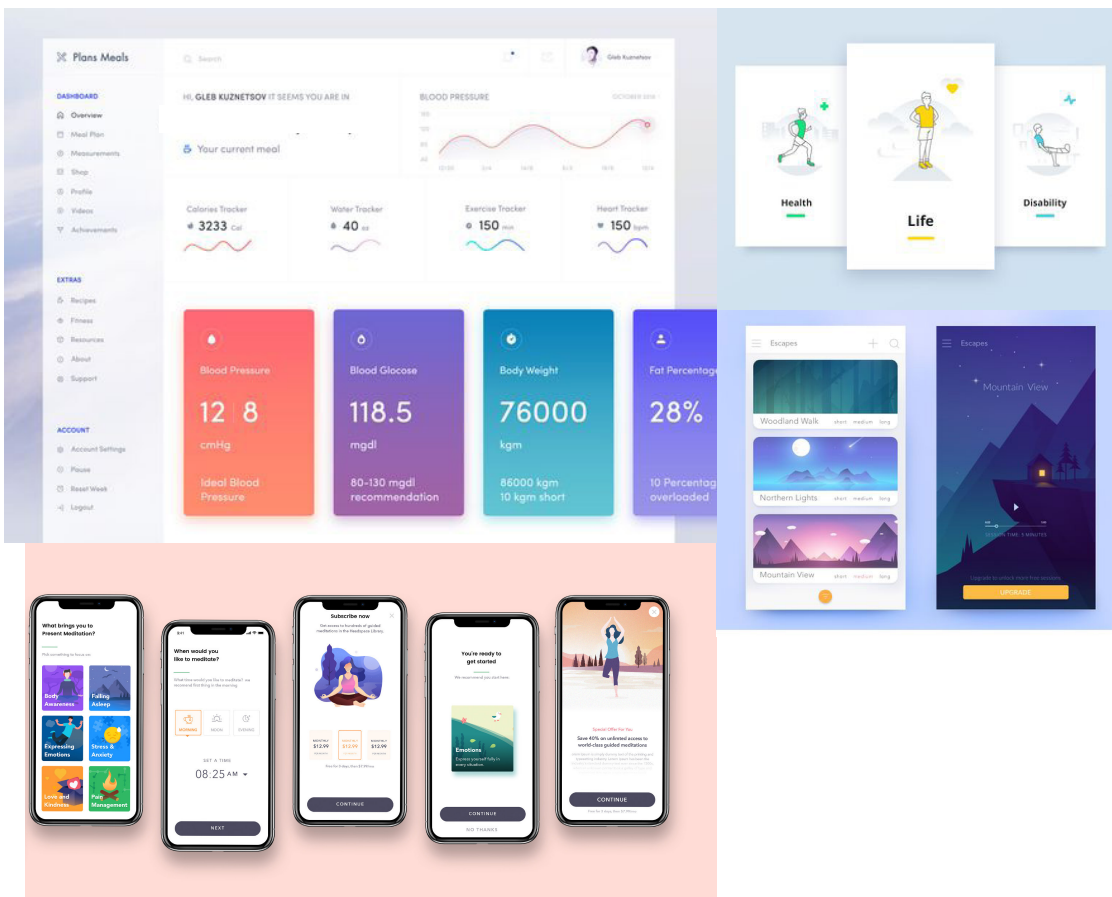
Personality sliders that were set up:



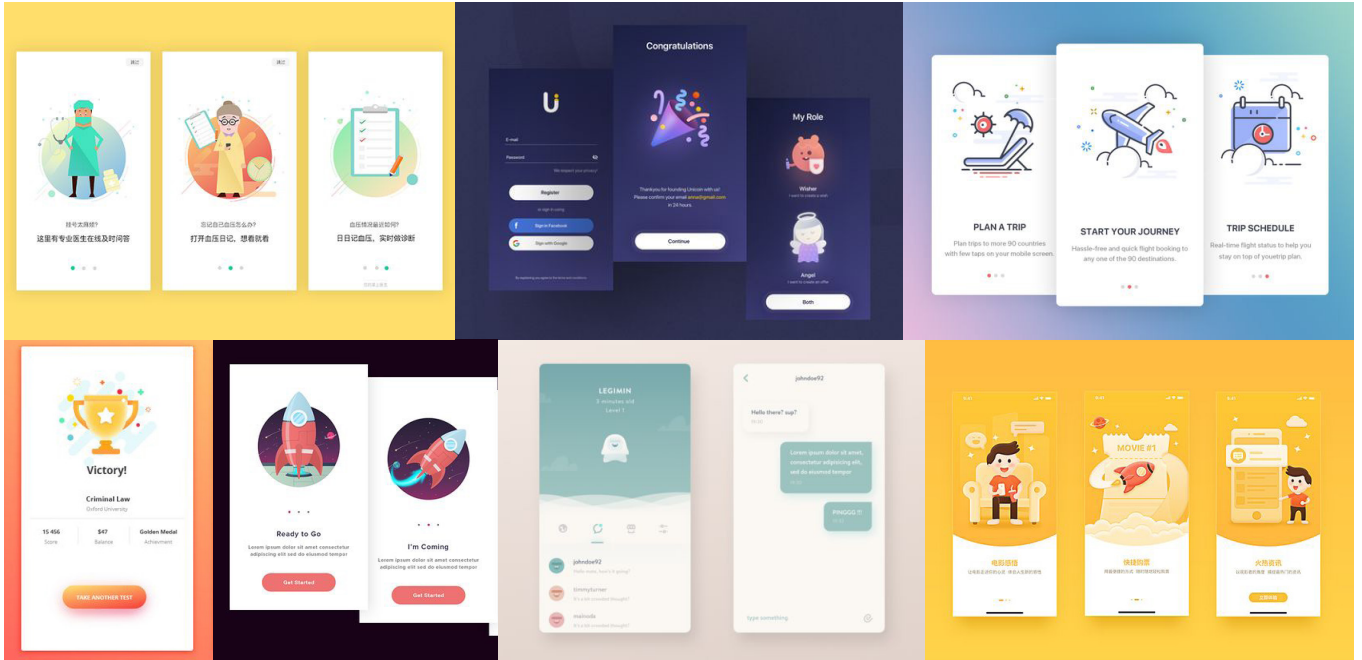
Moodboards that were user=d for testing:



Moodboard 1



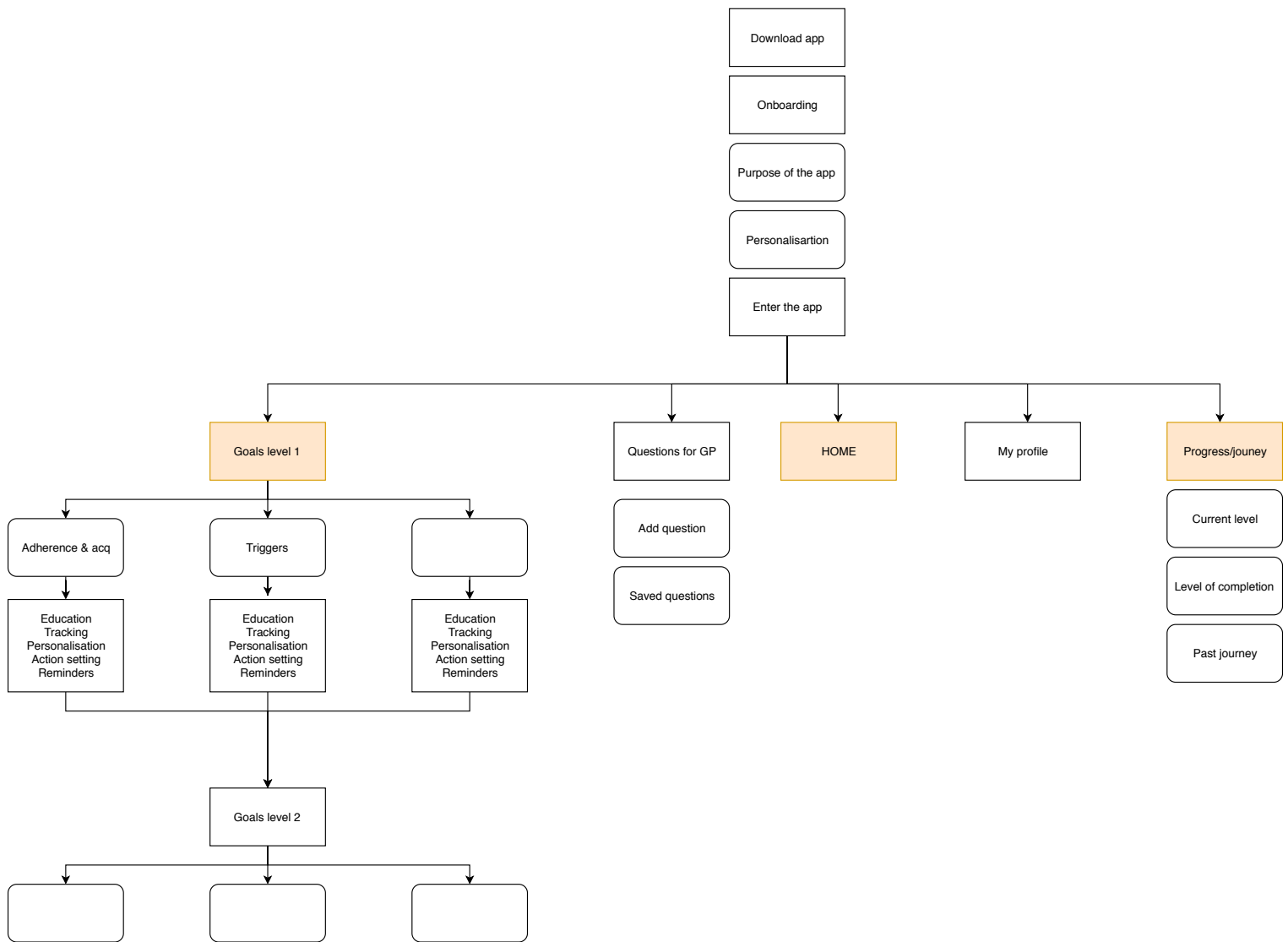
Moodboard 2



Moodboard 3



### 11.3 Determining the app architecture

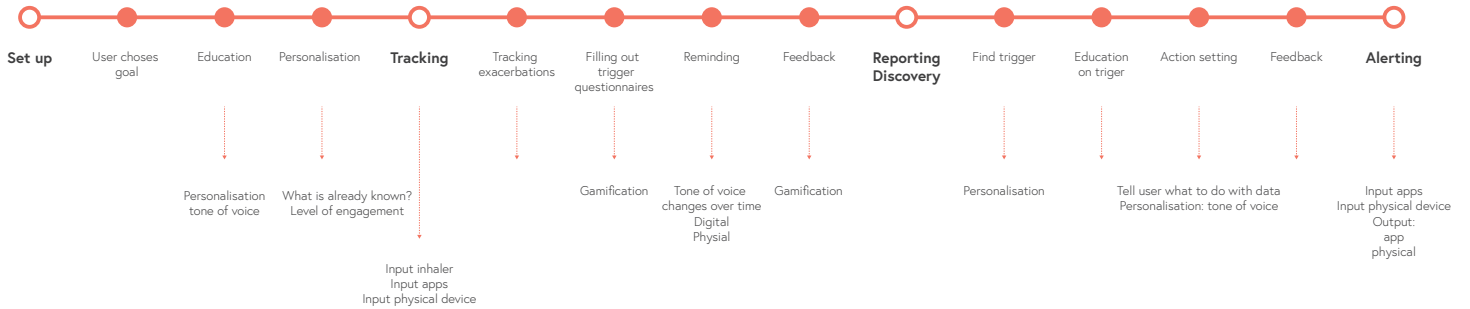


## 11.4 Making use-flows

### Goal: Track my asthma



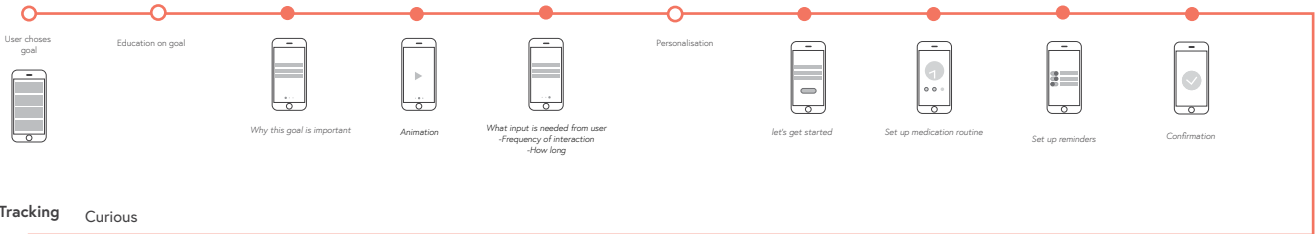
### Goal: finding triggers



Further developing the use-flows into scenarios of use

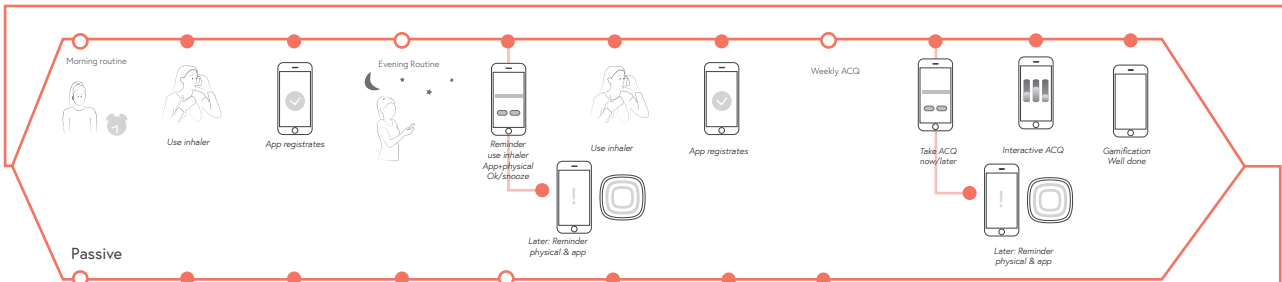
Scenario discover triggers:

**Set up**



**Tracking**

**Curious**



**Passive**



**Reporting Progress**

**Alerting**

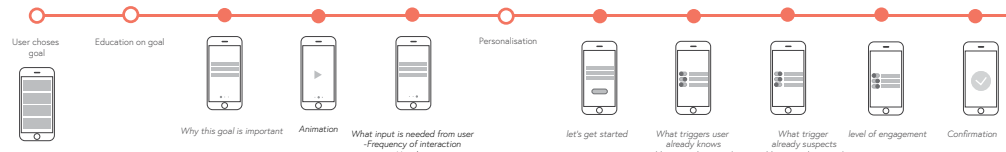
**Other**



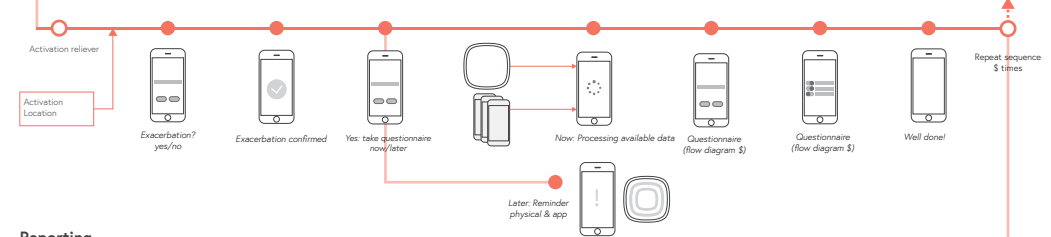


# Scenario see progress

## Set up



## Tracking



## Reporting Discovery



## Alerting

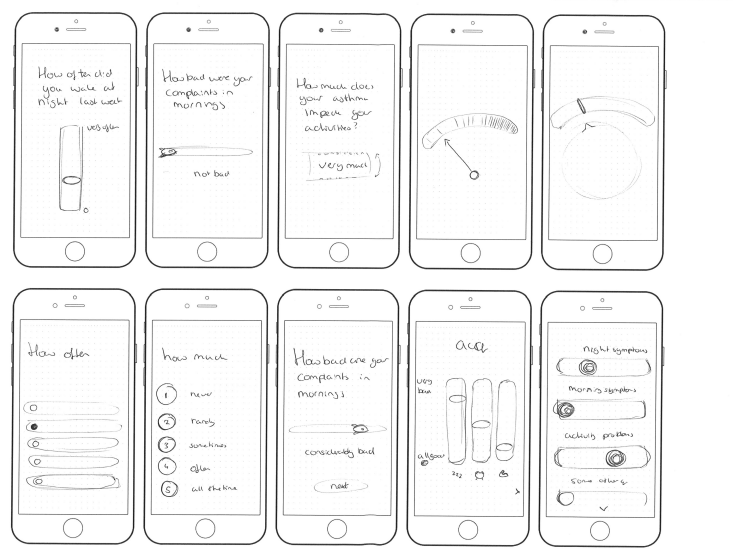
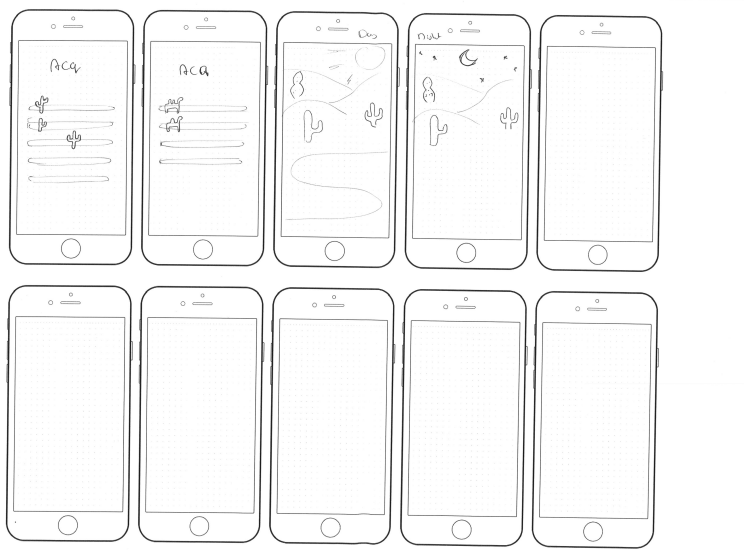
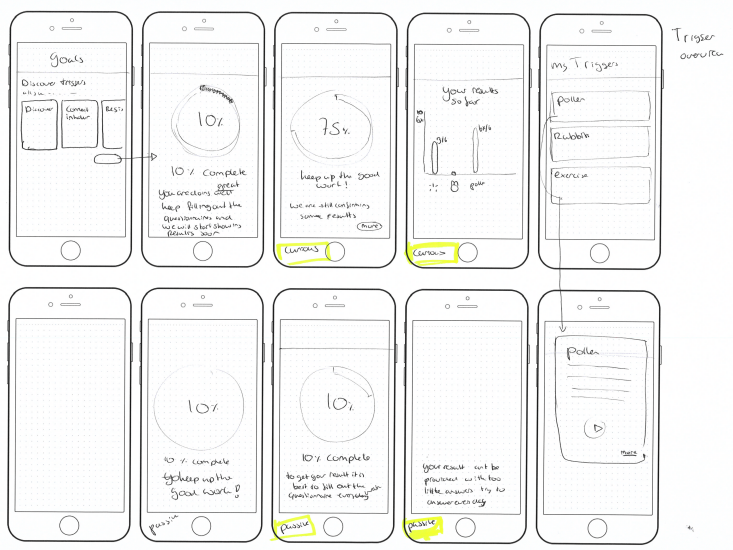
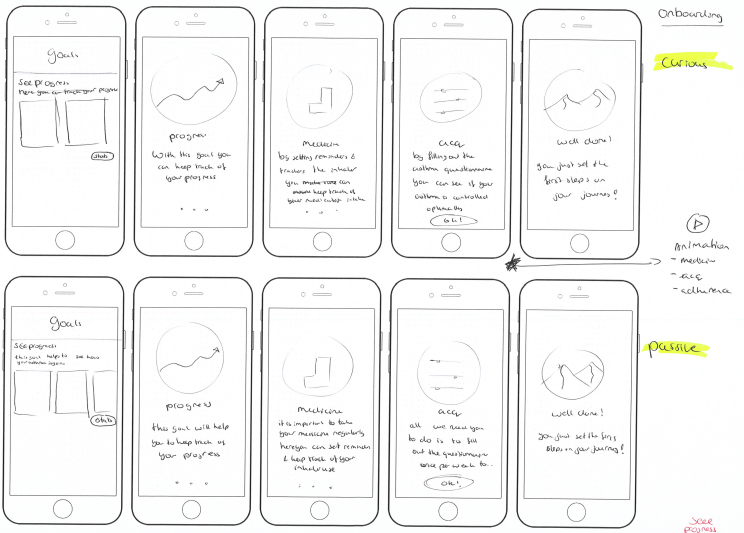
### Level 2

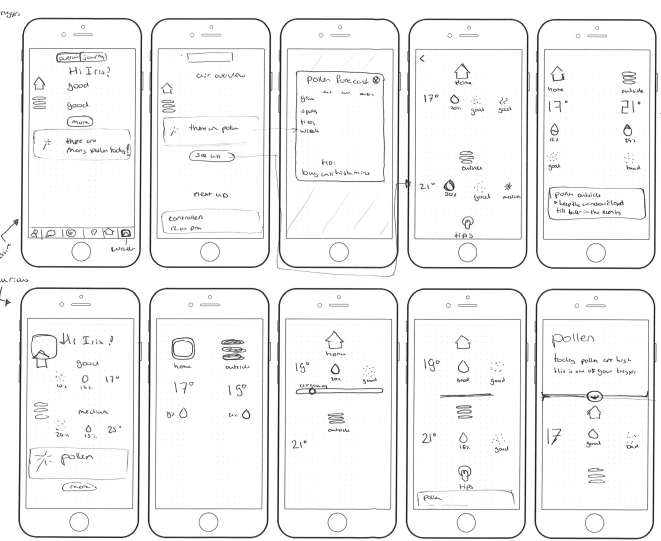


## Other

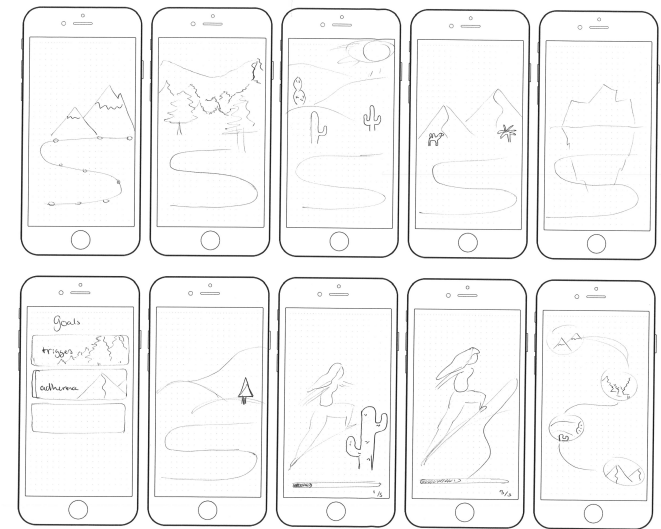
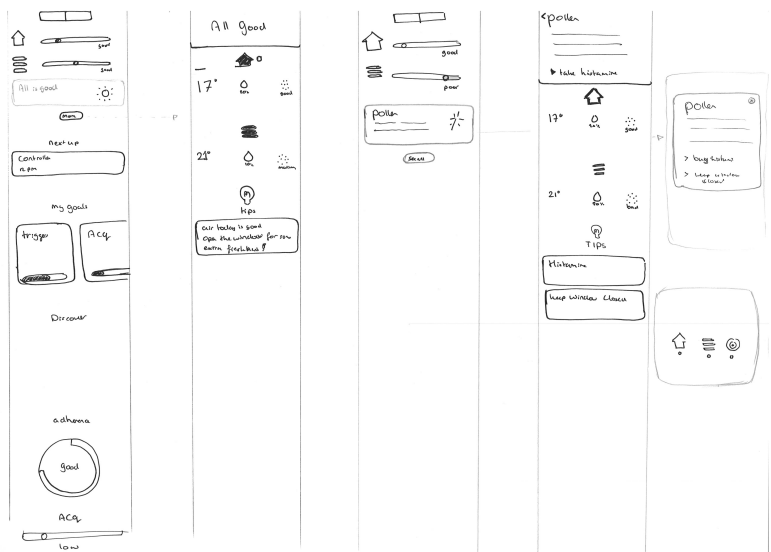


# 11.5 sketching screens

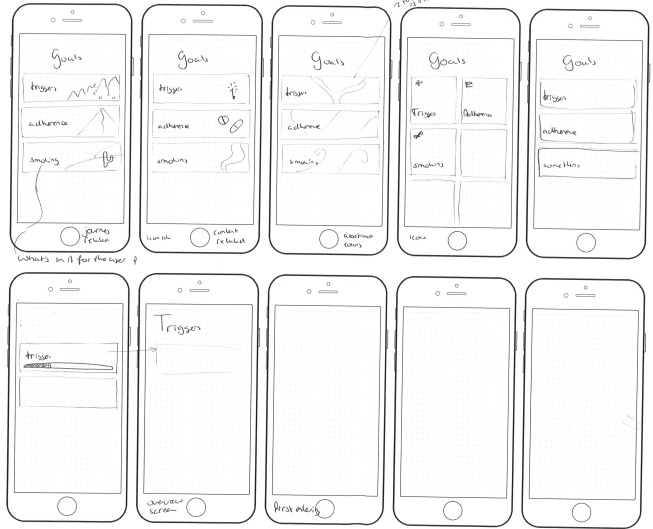




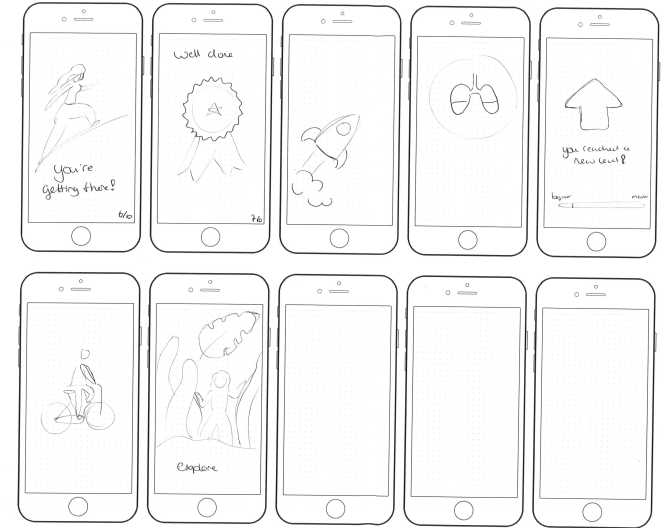
○ Home icon  
 ○ Pollen icon  
 ○ Goals icon  
 ○ Adherence icon  
 ○ 17° temp



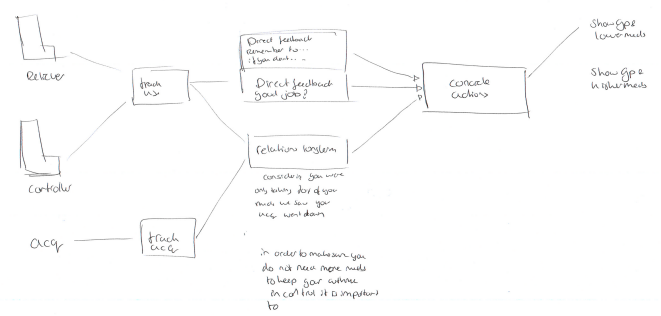
Journey destination



What's in it for the user?



Well done.



## 11.6 Asthma control questionnaire

Original ACQ:



### Vragenlijst ACQ6 (Asthma Control Questionnaire)

Doelgroep volwassenen. 6 vragen. Score 0-6 punten per vraag.

1. Hoe vaak bent u per nacht gemiddeld **wakker geworden door uw astma** in de afgelopen week?

|   |                    |   |                               |
|---|--------------------|---|-------------------------------|
| 0 | Nooit              | 4 | Vaak                          |
| 1 | Bijna nooit        | 5 | Heel vaak                     |
| 2 | Een paar keer      | 6 | Kon niet slapen vanwege astma |
| 3 | Verscheidene keren |   |                               |
  
2. Hoe **ernstig waren uw astmaklachten bij het 's morgens wakker worden** gemiddeld in de afgelopen week?

|   |                      |   |                        |
|---|----------------------|---|------------------------|
| 0 | Geen klachten        | 4 | Vrij ernstige klachten |
| 1 | Heel lichte klachten | 5 | Ernstige klachten      |
| 2 | Lichte klachten      | 6 | Heel ernstige klachten |
| 3 | Matige klachten      |   |                        |
  
3. In welke mate werd u over het algemeen in de afgelopen week door uw astma **beperkt bij uw activiteiten**?

|   |                       |   |                  |
|---|-----------------------|---|------------------|
| 0 | Helemaal niet beperkt | 4 | Erg beperkt      |
| 1 | Nauwelijks beperkt    | 5 | Heel erg beperkt |
| 2 | Een beetje beperkt    | 6 | Volledig beperkt |
| 3 | Tamelijk beperkt      |   |                  |
  
4. In welke mate werd u over het algemeen **kortademig** gevoeld in de afgelopen week ten gevolge van uw astma?

|   |               |   |              |
|---|---------------|---|--------------|
| 0 | Helemaal niet | 4 | Vrij ernstig |
| 1 | Nauwelijks    | 5 | Ernstig      |
| 2 | Een beetje    | 6 | Heel ernstig |
| 3 | Middelmatig   |   |              |
  
5. Hoe vaak had u in de afgelopen week over het algemeen een **piepende ademhaling**?

|   |           |   |         |
|---|-----------|---|---------|
| 0 | Nooit     | 4 | Vaak    |
| 1 | Zelden    | 5 | Meestal |
| 2 | Af en toe | 6 | Altijd  |
| 3 | Geregeld  |   |         |
  
6. Hoe veel **pufs/inhalaties van een kortwerkende luchtwegverwijder** (bv Ventolin, Bricanyl, salbutamol of aeromir) heeft u op de meeste dagen genomen in de afgelopen week?

|   |                     |   |                             |
|---|---------------------|---|-----------------------------|
| 0 | Geen                | 4 | 9-12 pufs/inhalaties        |
| 1 | 1-2 pufs/inhalaties | 5 | 13-16 pufs/inhalaties       |
| 2 | 3-4 pufs/inhalaties | 6 | meer dan 16 pufs/inhalaties |
| 3 | 5-8 pufs/inhalaties |   |                             |

Publicatiedatum: januari 2018

# ACQ test screens

|  |   |   |  |   |   |
|--|---|---|--|---|---|
| <p>How often did you wake up due to your asthma in the past week?</p> <p>never</p> <p>Next</p> | <p>How often did you wake up due to your asthma in the past week?</p> <p>Very often</p> <p>Next</p> | <p>How often did you wake up due to your asthma in the past week?</p> <p>Never</p> <p>Next</p>  | <p>How often did you wake up due to your asthma in the past week?</p> <p>Often</p> <p>Next</p>   | <p>How often did you wake up due to your asthma in the past week?</p> <p>never</p> <p>How severe were your complaints in mornings after waking up??</p> <p>no complaints</p> <p>To what extent were you limited in your activities?</p> <p>Not at all</p> <p>To what extent were you out of breath due to your asthma?</p> <p>not at all</p> <p>How often did you have a wheeze?</p> <p>Never</p> <p>How many puffs of the reliever did you have to use on most days?</p> <p>None</p> <p>OK</p> | <p>How often did you wake up due to your asthma in the past week?</p> <p>Often</p> <p>How severe were your complaints in mornings after waking up??</p> <p>Moderate</p> <p>To what extent were you limited in your activities?</p> <p>Very limited</p> <p>To what extent were you out of breath due to your asthma?</p> <p>Severe</p> <p>How often did you have a wheeze?</p> <p>Regularly</p> <p>How many puffs of the reliever did you have to use on most days?</p> <p>5-8 puffs</p> <p>OK</p> |
| <p>How often did you wake up due to your asthma in the past week?</p> <p>Next</p>              | <p>How often did you wake up due to your asthma in the past week?</p> <p>Next</p>                   | <p>How often did you wake up due to your asthma in the past week?</p> <p><input type="radio"/> Never</p> <p><input type="radio"/> Hardly ever</p> <p><input type="radio"/> A few times</p> <p><input type="radio"/> Several times</p> <p><input type="radio"/> Often</p> <p><input type="radio"/> Very often</p> <p><input type="radio"/> I could not sleep due to it</p> <p>Next</p> | <p>How often did you wake up due to your asthma in the past week?</p> <p><input type="radio"/> Never</p> <p><input type="radio"/> Hardly ever</p> <p><input type="radio"/> A few times</p> <p><input checked="" type="radio"/> Several times</p> <p><input type="radio"/> Often</p> <p><input type="radio"/> Very often</p> <p><input type="radio"/> I could not sleep due to it</p> <p>Next</p> |   |   |
| <p>How severe were your complaints in mornings after waking up??</p> <p>Never</p> <p>&gt;</p>  | <p>How severe were your complaints in mornings after waking up??</p> <p>Often</p> <p>&gt;</p>       | <p>How often did you wake up due to your asthma in the past week?</p> <p>Never</p> <p>Hardly ever</p> <p>A few times</p> <p>Several times</p> <p>Often</p> <p>Very often</p> <p>I could not sleep due to it</p>   | <p>How often did you wake up due to your asthma in the past week?</p> <p>Never</p> <p>Hardly ever</p> <p>A few times</p> <p>Several times</p> <p>Often</p> <p>Very often</p> <p>I could not sleep due to it</p>  |   |   |
| <p>How often did you wake up due to your asthma in the past week?</p> <p>Never</p> <p>Next</p> | <p>How often did you wake up due to your asthma in the past week?</p> <p>Often</p> <p>Next</p>      | <p>How often did you wake up due to your asthma in the past week?</p> <p>Next</p>   | <p>How often did you wake up due to your asthma in the past week?</p> <p>Next</p>  |   |   |

## 11.7 Personalisation questionnaire

### Personalisation

Persona questionnaire

- Previous knowledge
- Attitude
- Asthma type

### Questionnaire

What is your name?

Hi (name) good to see you here!

What is your gender?

- Male
- Female
- Other

When it comes to knowledge about asthma you are

- A beginner
- Moderate
- Expert

When it comes to the severity of your asthma you..

- ...
- ...

Do you smoke?

- Yes
- No

When it comes to learning about asthma, your attitude is best described as:

- The doctor will tell me what I need to know
- I did some basic research, its not that big of a deal
- I want to make sure I read everything
- The current information is not sufficient, I want to know more

When it comes to the treatment of your asthma, who is in charge?

- The doctor
- Me
- It's a collaboration between me and the doctor
- I don't know

When it comes to taking medication, you are:

- pro – Medicines will make me better
- sceptic – I want to take as little medicines as possible
- neutral – I take the medicines my doctor prescribes me

When it comes to getting better/ self-management in asthma you are:

- Sceptic - I want to know what works first
- Reserved - I want to keep things the way they are
- Reserved - I don't want to be told what to do
- Interested – I'm ready to get started
- Dedicated – I want to do anything I can

When it comes to asthma treatment you care most about:

- Living life without complaints
- Getting as fit as possible
- Spending as little time worrying about my disease as possible
- Neutral, it's not going to cure my asthma anyway

Within your journey you are interested in

- o Information
- o Hands on tips
- o Seeing my progress
- o Sharing information with my doctor
- o Reminders for medication
- o Learning about my type of asthma
- o Improving my condition
- o Support
- o I'm not interested

Do you have any of these allergies?

- Food
- Pollen
- Animals
- Dust mite
- I'm not sure

## Questionnaire calculation

When it comes to knowledge about asthma you are

| Answer   | Points |
|----------|--------|
| Beginner | P      |
| Moderate | P,E    |
| Expert   | E,C    |

Do you smoke?

| Answer | App         |
|--------|-------------|
| Yes    | Add goal    |
| No     | Remove goal |

When it comes to learning about asthma, your attitude is best described as:

| Answer   | Points |
|--|--------|
| The doctor will tell me what I need to know                    | P      |
| I did some basic research, its not that big of a deal          | E,S    |
| I want to make sure I read everything                          | C      |
| The current information is not sufficient, I want to know more | C      |

When it comes to the treatment of your asthma, who is in charge?

| Answer        | Points |
|---------------|--------|
| The Doctor    | P      |
| Me            | C      |
| Collaboration | C      |
| Not sure      | P      |

When it comes to taking medication, you are:

| Answer  | Points |
|---------|--------|
| Pro     | C      |
| Sceptic | S      |
| Neutral | P,E    |
|         |        |



When it comes to getting better/ self-management in asthma you are:

| Answer  | Points |
|---|--------|
| Sceptic - I want to know what works first         | S      |
| Reserved - I want to keep things the way they are | P,E    |
| Reserved - I don't want to be told what to do     | E      |
| Open – Tell me what I could do                    | P,C    |
| Interested – I'm ready to get started             | C,     |
| Dedicated – I want to do anything I can           | C      |

When it comes to asthma treatment you care most about:

| Answer  | Points |
|---|--------|
| Living life without complaints                                |        |
| Getting as fit as possible                                    | C      |
| Spending as little time worrying about my disease as possible |        |
| Neutral, it's not going to cure my asthma anyway              | S      |

Within your journey you are interested in

| Answer                             | Points |
|------------------------------------|--------|
| Information                        | 1      |
| Hands on tips                      | 1      |
| Seeing my progress                 | 1      |
| Sharing information with my doctor | 1      |
| Reminders for medication           | 1      |
| Learning about my type of asthma   | 1      |
| Improving my condition             | 2      |
| The things my doctor advises me    | 1      |
| Support                            | P,C    |
| Im not interested                  | S,E    |

- 1-3 = sceptic / expert / passive
- 3-7 = curious/passive
- 3-9 = curious
- 

Do you have any of these allergies?

| Answer       | Action    |
|--------------|-----------|
| Food         | Implement |
| Pollen       | Implement |
| Animals      | Implement |
| Dustmite     | Implement |
| I'm not sure |           |
| No           | Implement |

App calculates which letter the user has most, that will be their persona

P= Passive

C=Curious

E=Expert

S=Sceptic

## In the app:

Reminders:

- 0-1 = curious
- 1-3 = passive

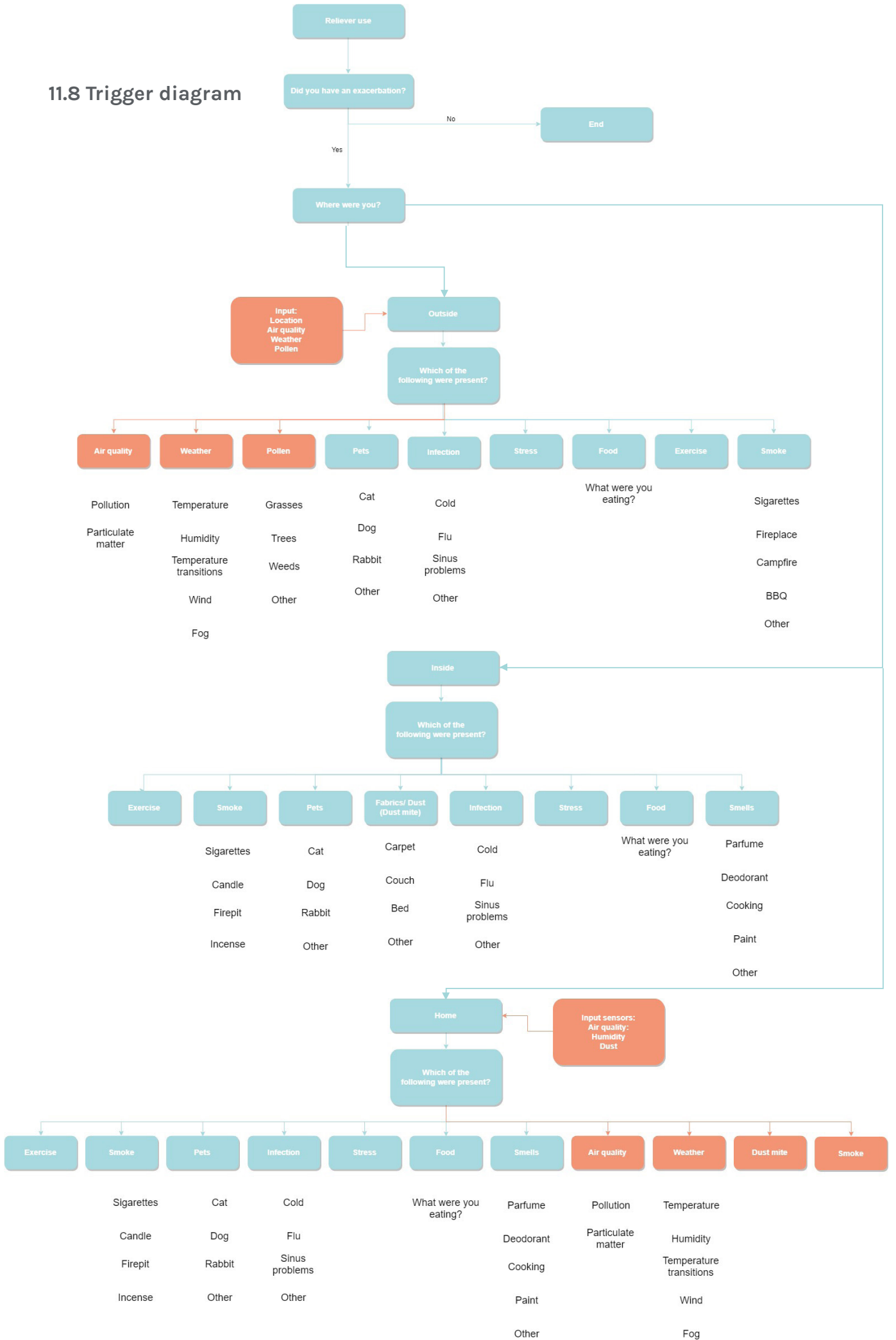
ACQ & Adherence & Medication schedule

- Low ACQ & low adherence
- Low ACQ & high adherence
- High ACQ & low adherence
- High ACQ & High adherence
- Low dosing medicines
- High dosing medicines

Triggers

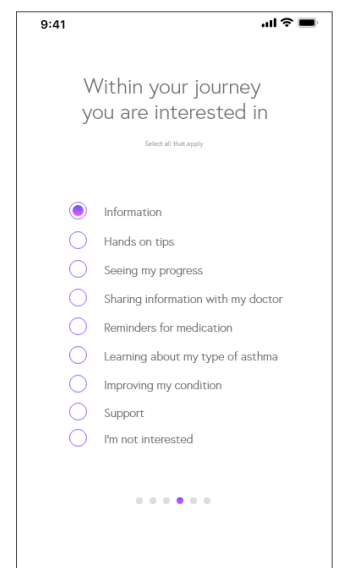
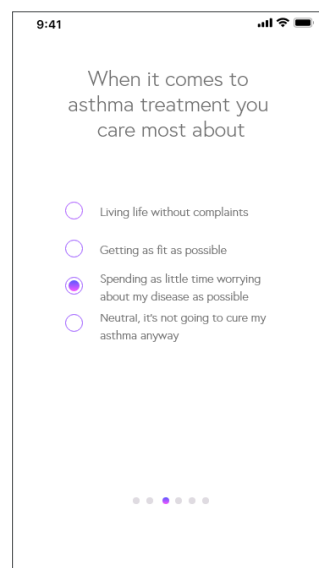
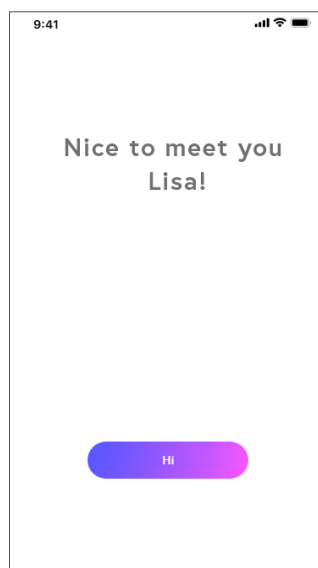
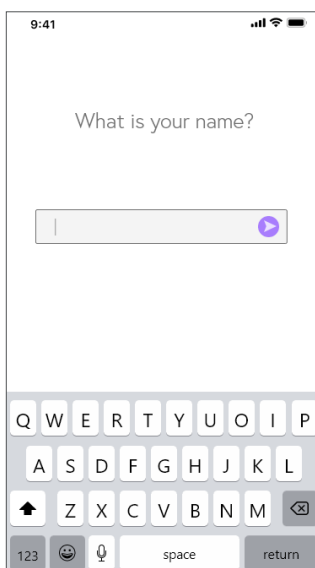
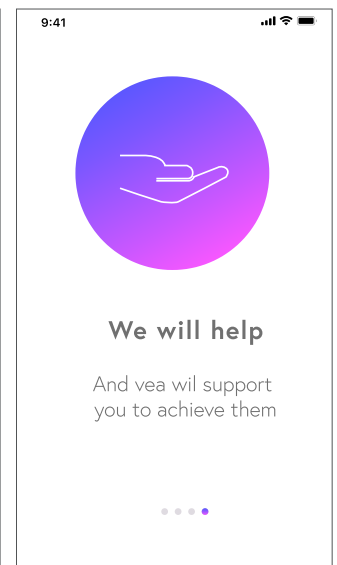
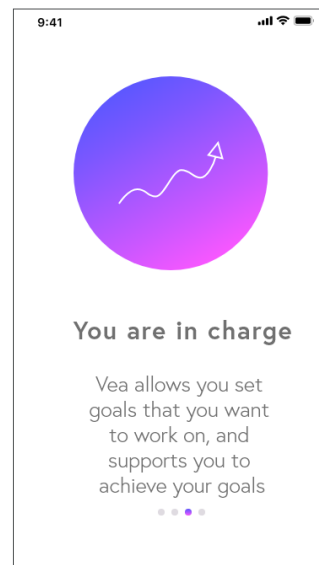
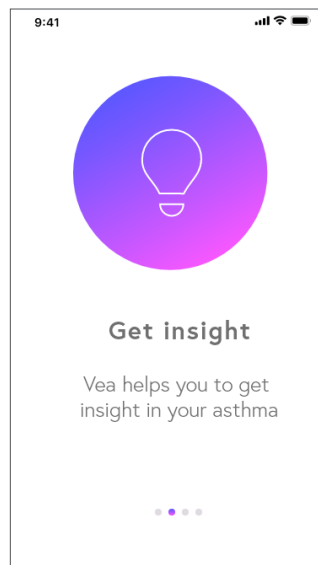
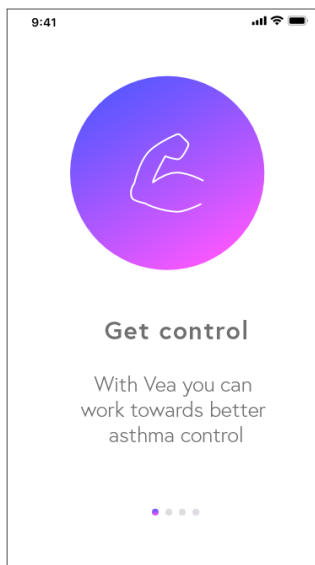
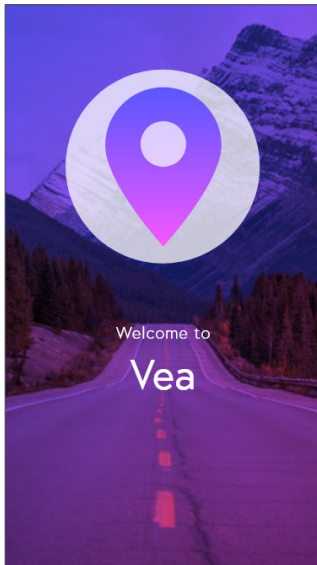
- Information & advice on triggers already know
- Information & advice on triggers Discovered
-

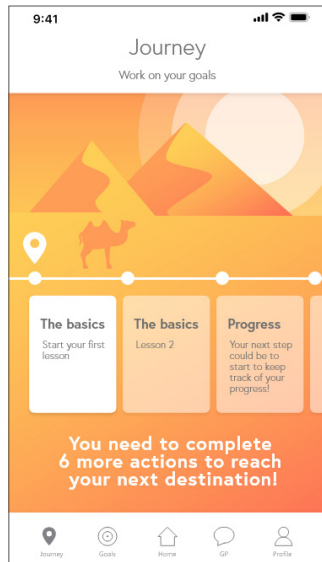
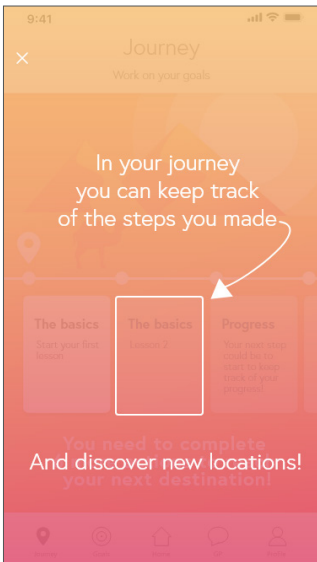
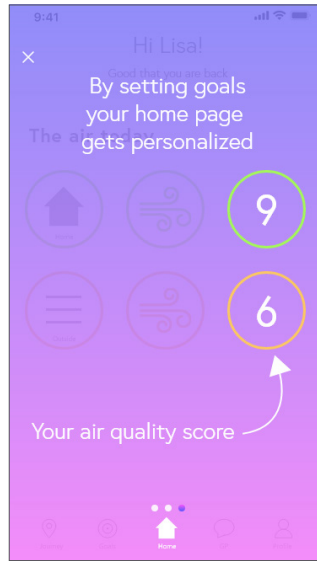
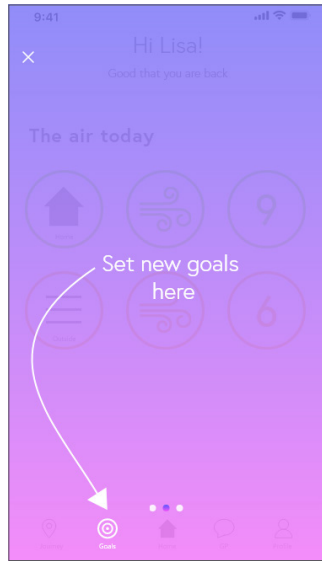
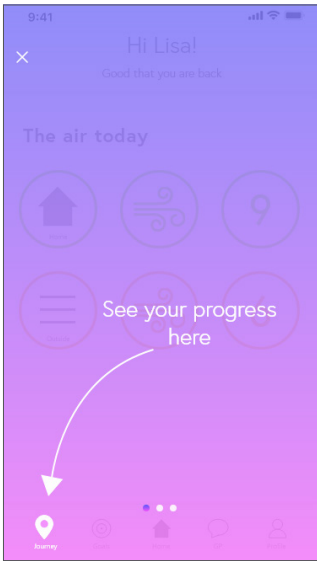
# 11.8 Trigger diagram



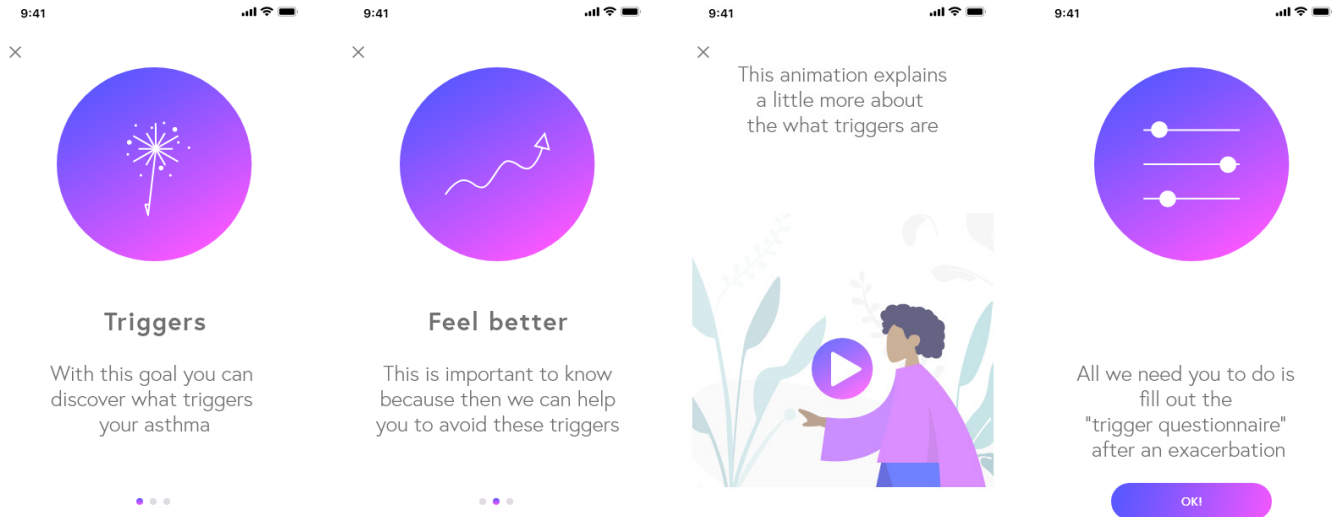
## 11.9 Additional screens

Onboarding of the app

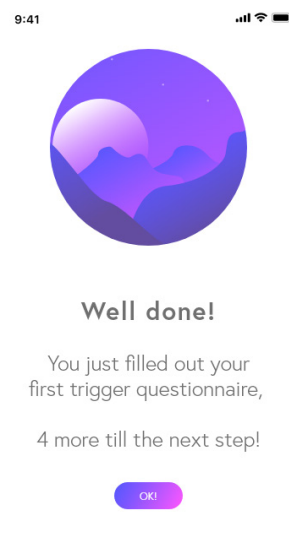
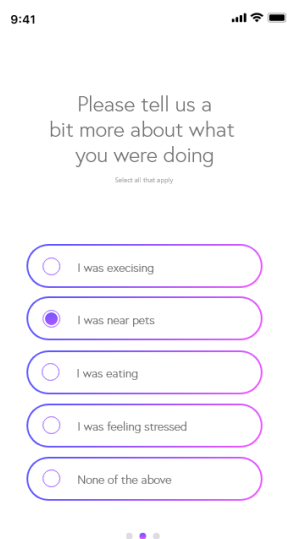
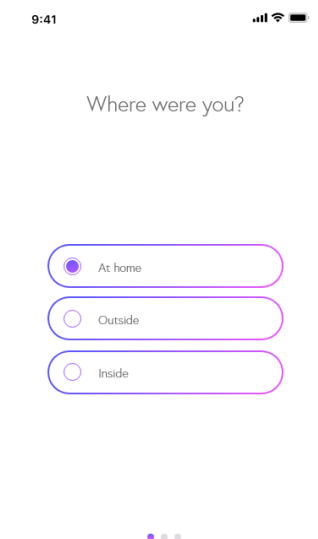
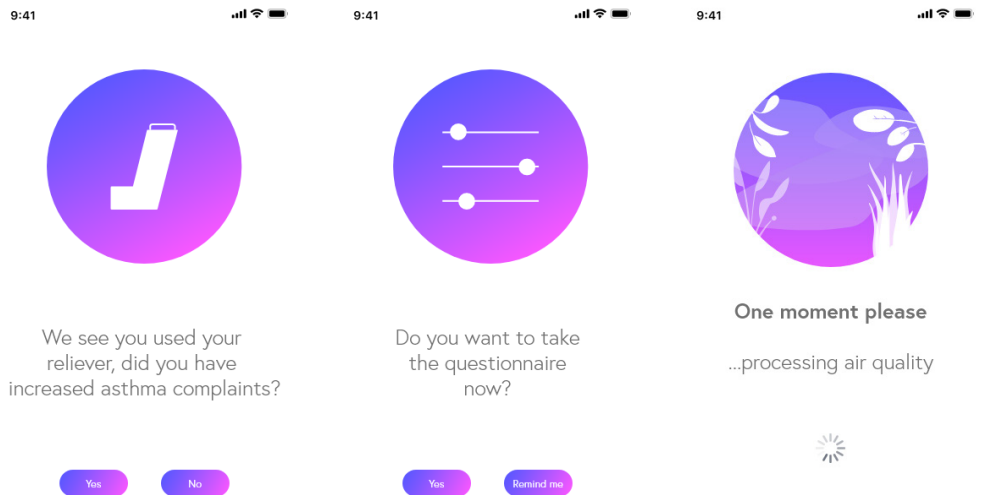




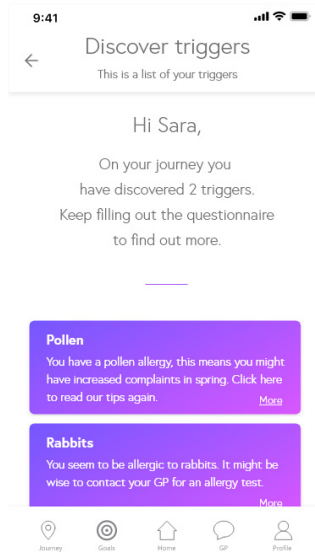
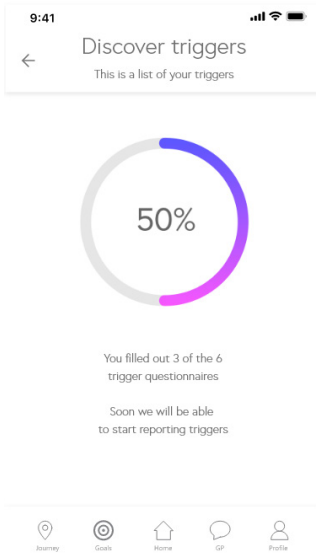
## Discover triggers Onboarding



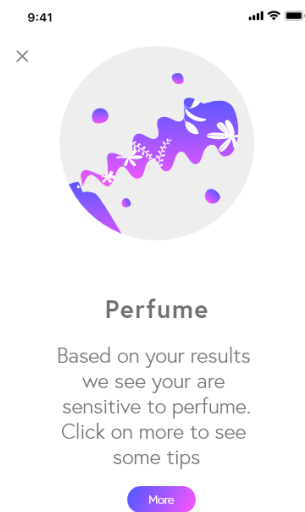
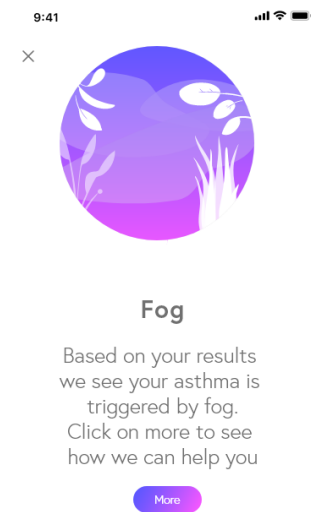
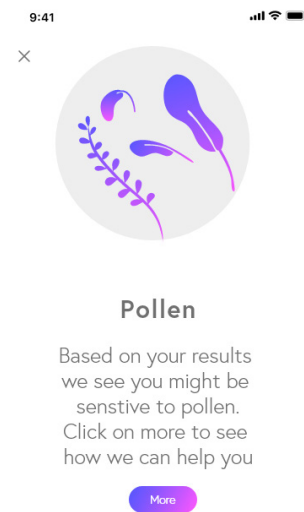
## Trigger questionnaire



## Entering the goal




## Discovered triggers



Onboarding See progress

9:41

×




**Progress**

With this goal you can keep track of your progress

...

9:41

×



**Medicine**


By setting reminders & tracking your inhaler you can keep track of your medicine intake

...

9:41

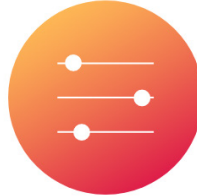
×

This animation explains a little more about the role of medicine and asthma control



9:41

×




**ACQ**

By filling out the asthma questionnaire weekly you can see if your asthma is controlled optimally

OK!

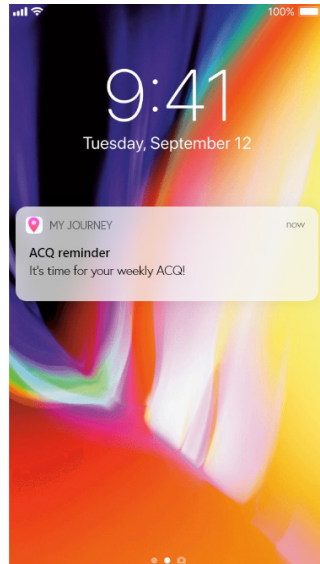
Asthma Control Questionnaire



**Well done!**


You just set the first steps on your journey!

OK!



9:41

×




How often did you wake up due to your asthma in the past week?

Never  I could not sleep due to my asthma

...

9:41

×




How often did you wake up due to your asthma in the past week?

No complaints  Very severe complaints

...

9:41

×




To what extent were you limited in your activities?

Not at all  Completely limited

...

9:41

×




To what extent were you out of breath due to your asthma?

Not at all  Very severe

...

9:41

×



How often did you experience a wheeze whilst breathing?

Never  All the time

...

9:41

×

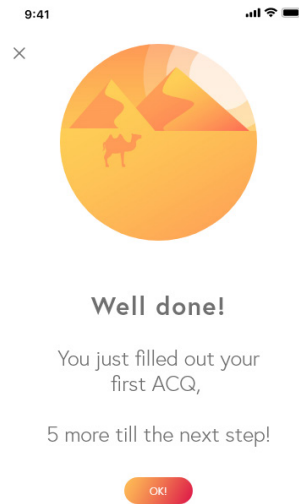
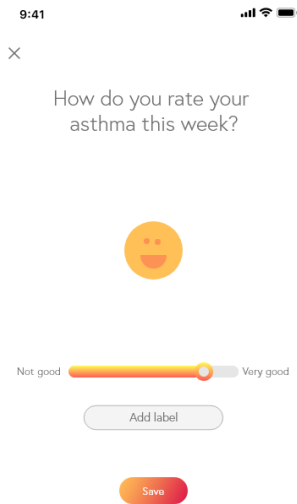


How many puffs of the reliever did you have to use on most days?

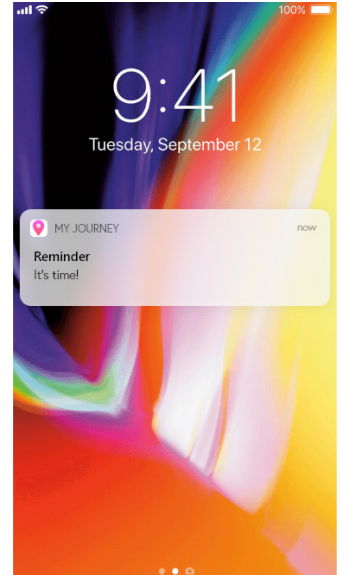
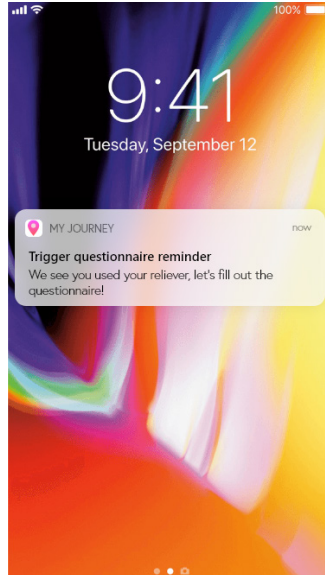
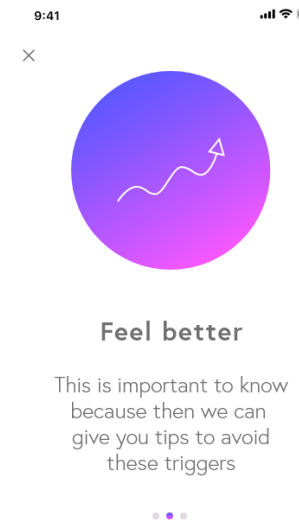
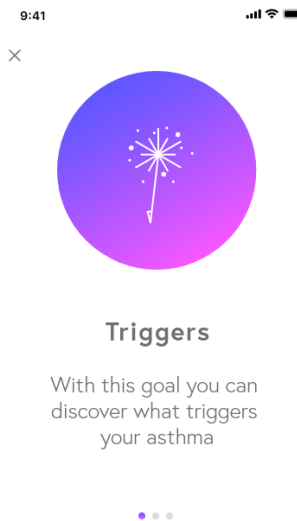
Zero  More than 16

Save

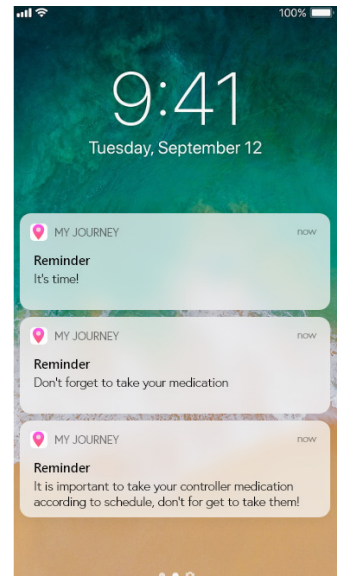
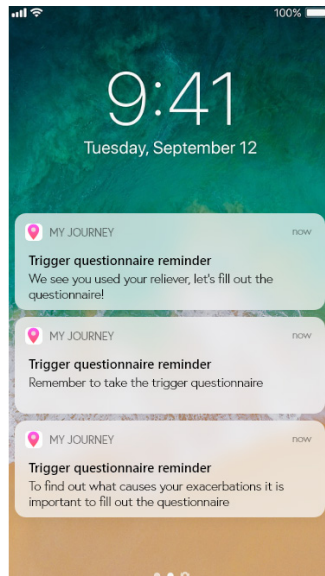
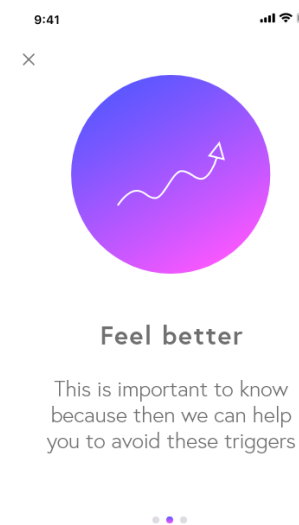
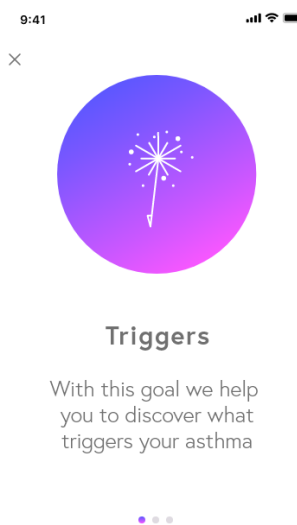




Curious:



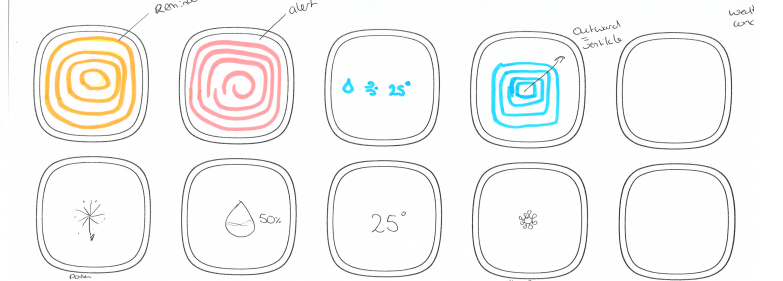
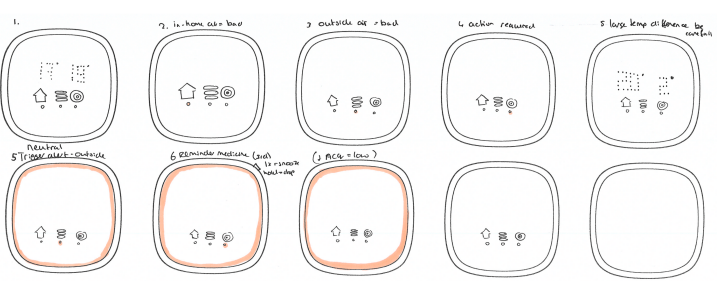
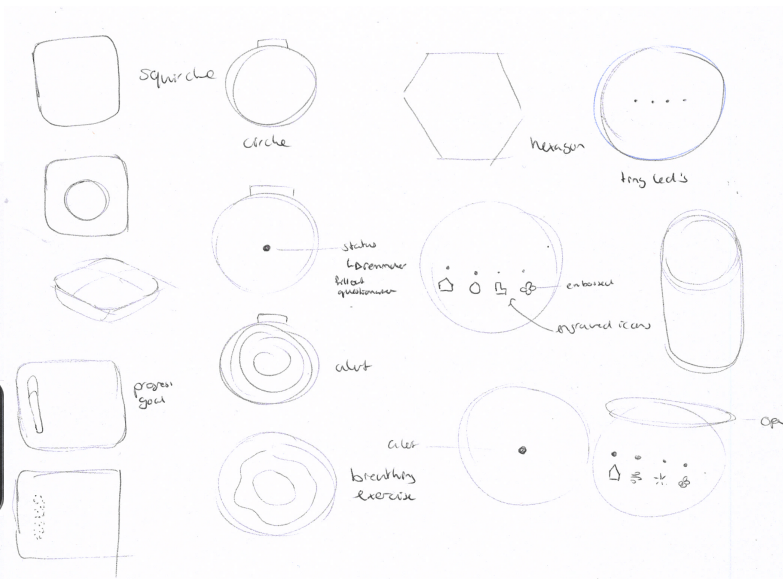
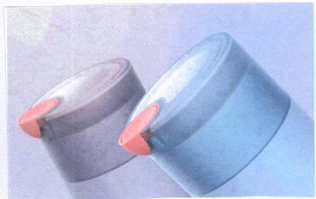
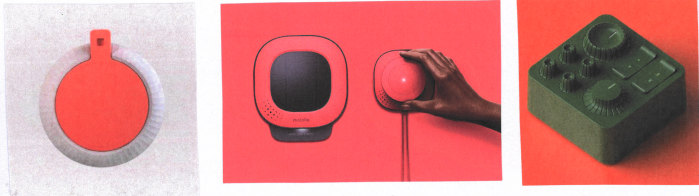
Passive



# Appendix 12

## Physical Design

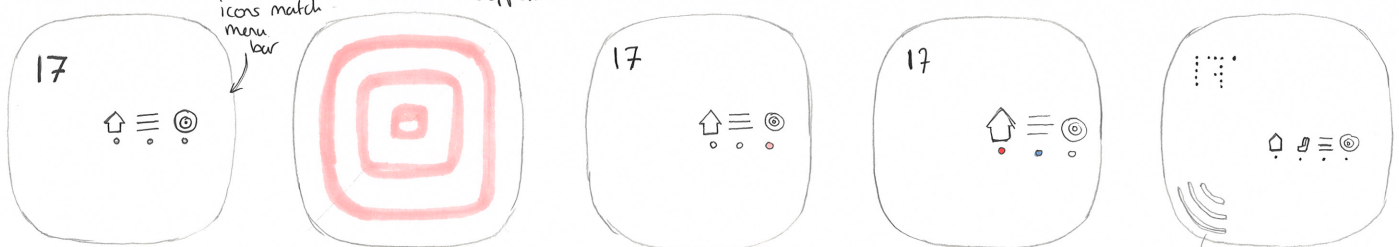
### 12.1 Exploring physical design



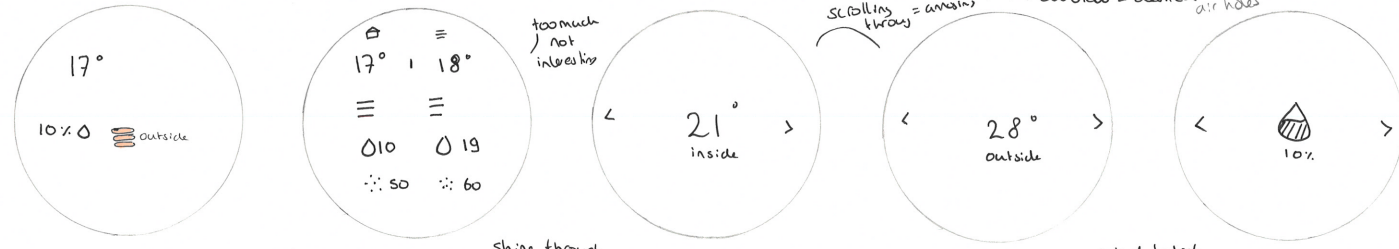
↑ ≡ ◎  
inside - outside - goal

alert: accq low  
lots of pollen?

reminder?



icons match  
menu bar



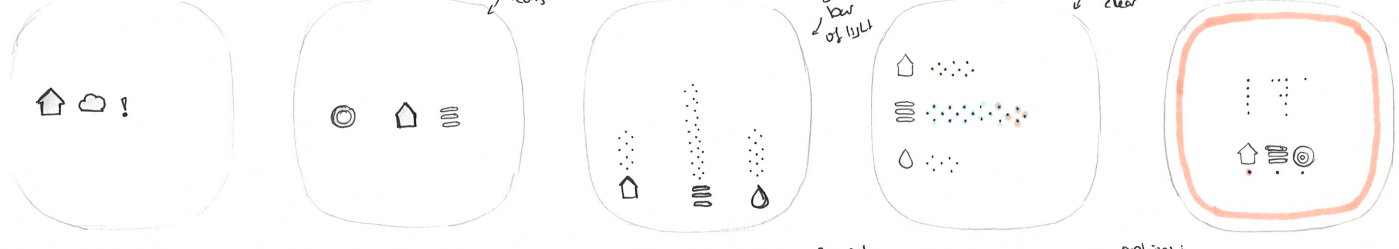
too much  
not  
interesting

scrolling  
through = annoying

→ overview = cleaned

air holes

what to  
do with  
this info?

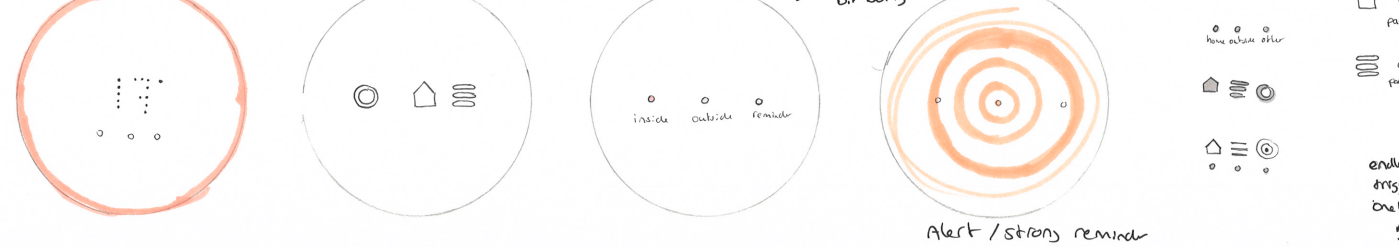


shine through  
icons

growing  
bar  
of light

abstract but not  
clear

alert  
+ where  
@  
bicon



round =  
bit boring

options:



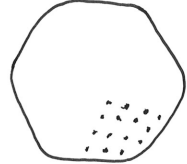
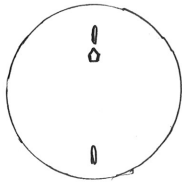
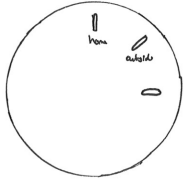
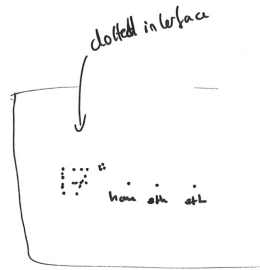
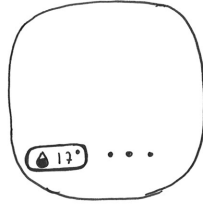
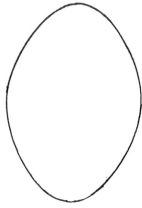
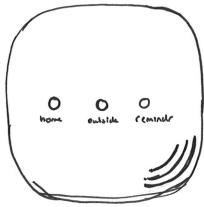
endless list of  
triggers...  
one by one matter?  
no

Alert / strong reminder

Good bad neutral - open window

humidity & temp are graspable so can be on interface

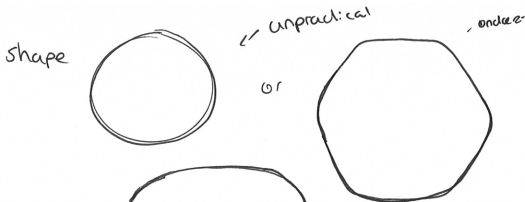
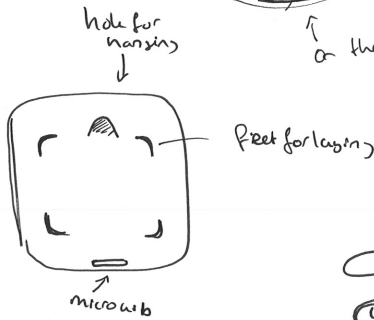
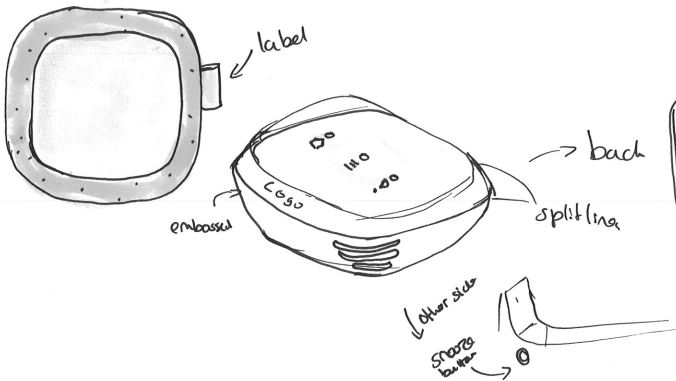
others are too much and should just remind of the app



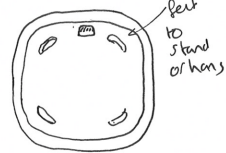
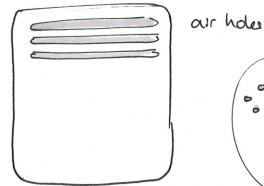
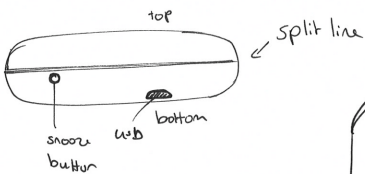
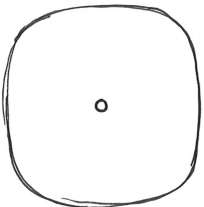
or on the side



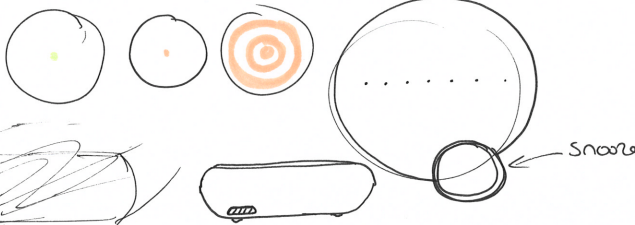
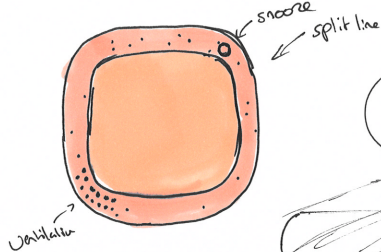
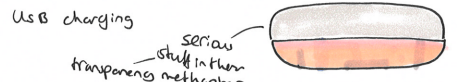
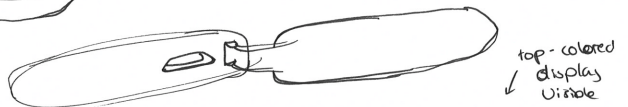
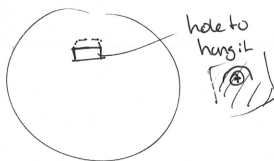
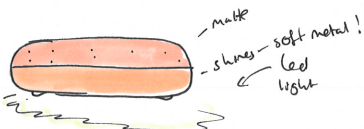
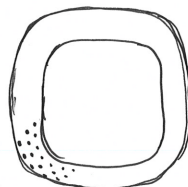
or the side



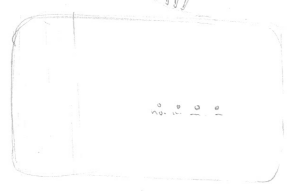
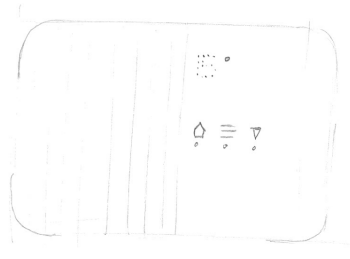
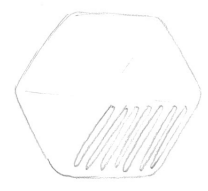
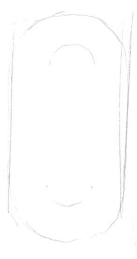
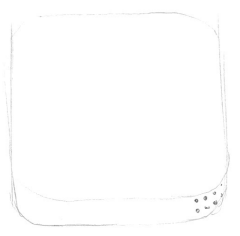
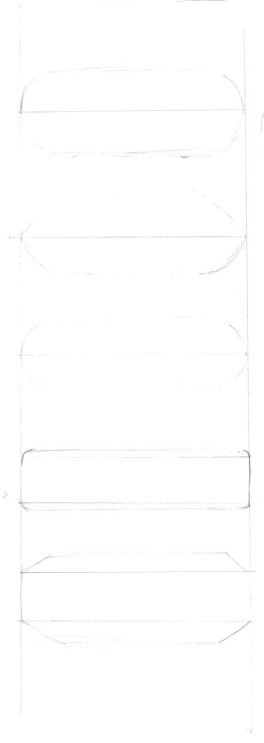
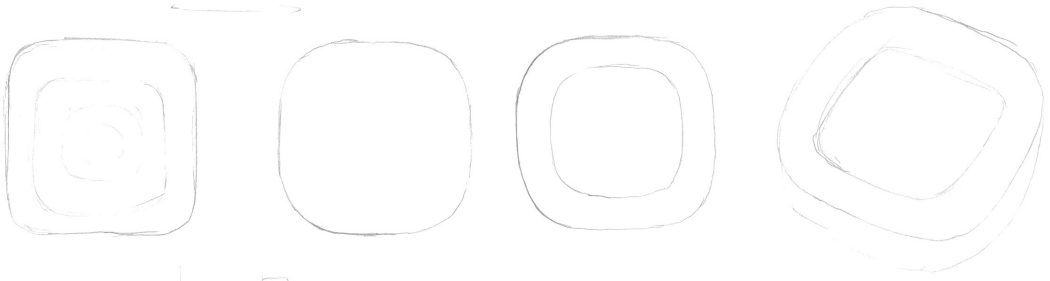
Materialisation:  
clear - color gradient  
shiny - matte  
matte - fabric



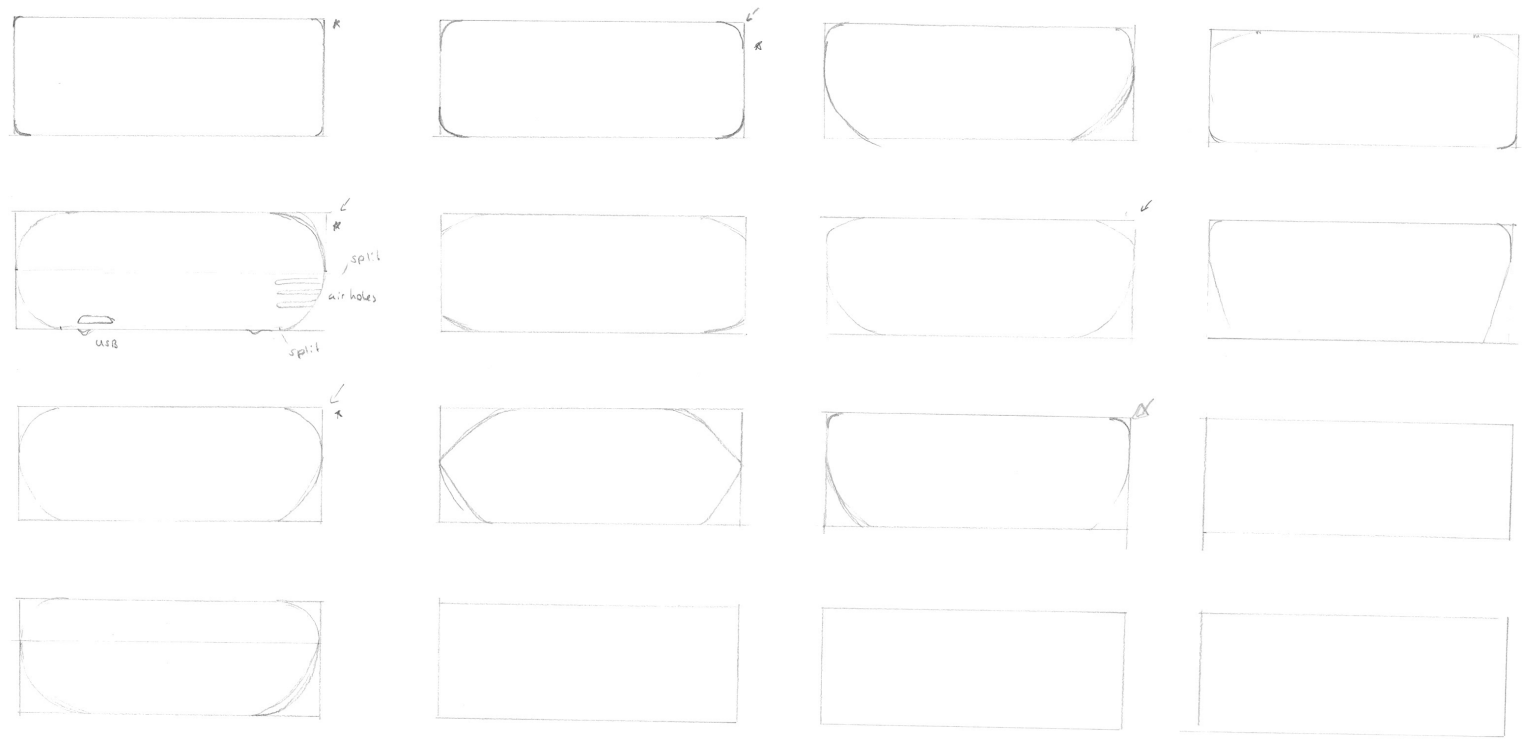
Shape



Reharding  
←→  
square  
circle



← Ribbed



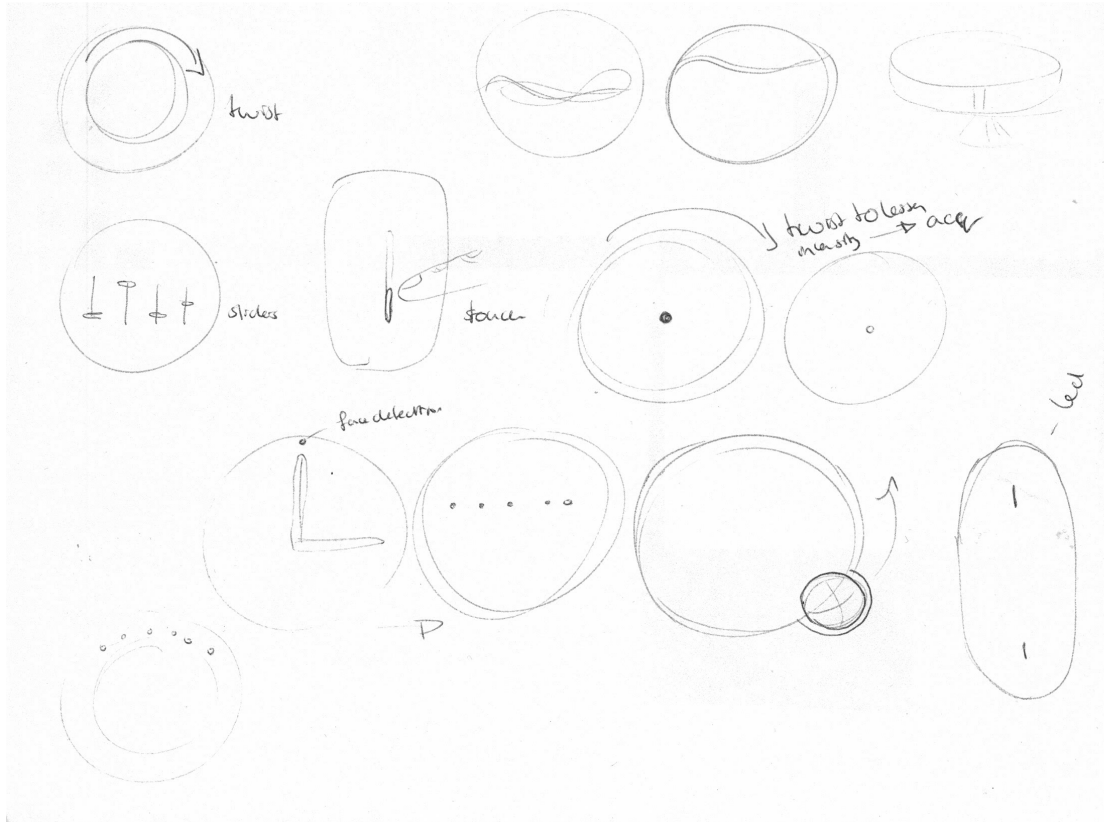
Air holes  
Split line  
micro USB

Engraved name or

tiny tiny tiny tiny tiny  
in hole hole hole hole hole

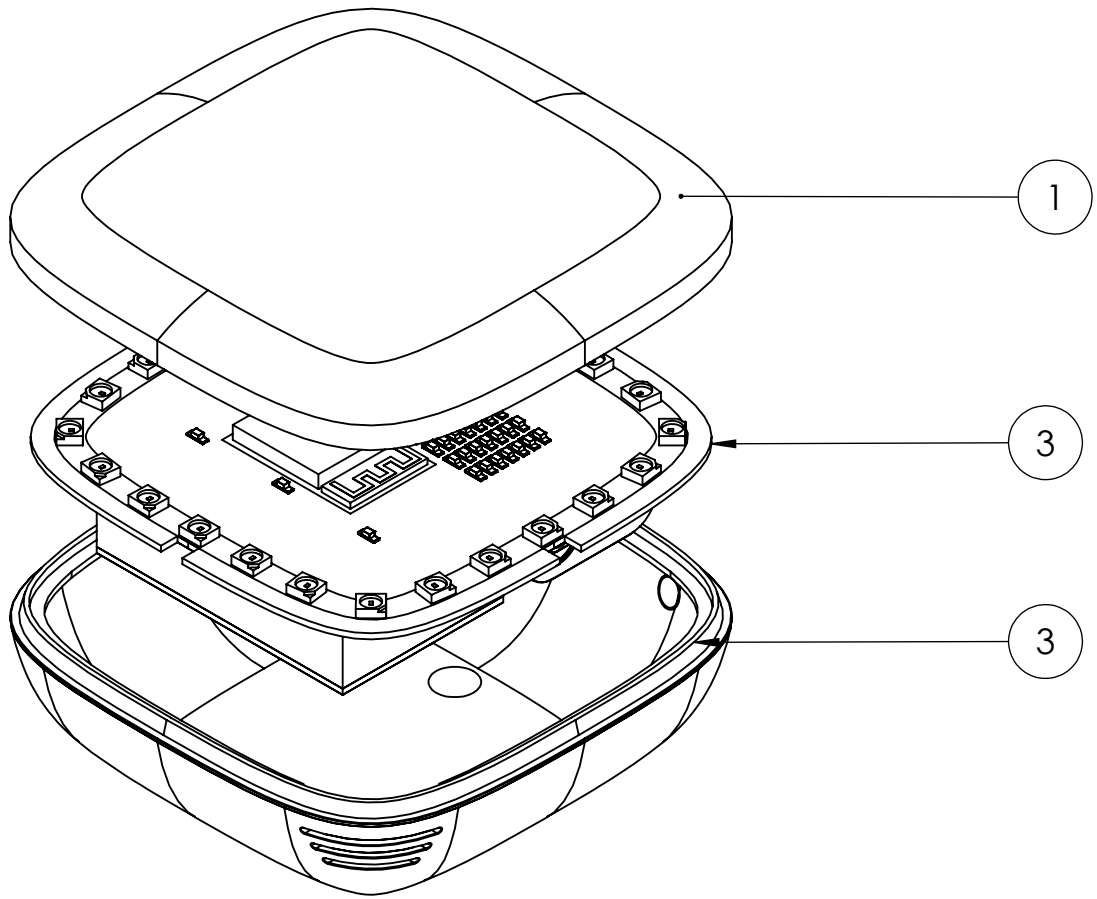
FC CE X

tiny hole for  
speaker



## 12.2 technical drawings

The following pages display the technical drawings of the final physical design. These are created with the intention to demonstrate the main shapes and components.



| ITEM NO. | PART NUMBER  | DESCRIPTION | QTY. |
|----------|--------------|-------------|------|
| 1        | Top_Cover    |             | 1    |
| 2        | PCB_Assembly |             | 1    |
| 3        | Bottom_Cover |             | 1    |

UNLESS OTHERWISE SPECIFIED:  
 DIMENSIONS ARE IN MILLIMETERS  
 SURFACE FINISH:  
 TOLERANCES:  
 LINEAR:  
 ANGULAR:

FINISH:

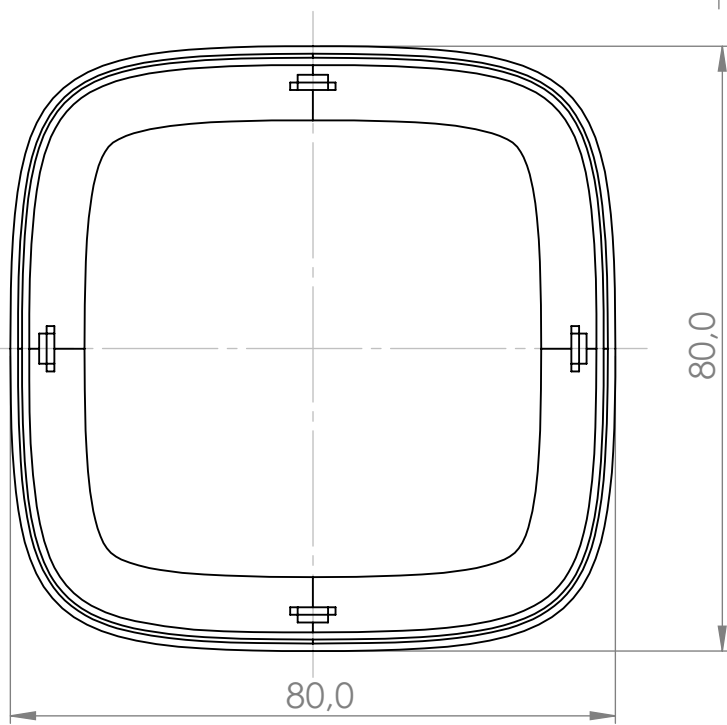
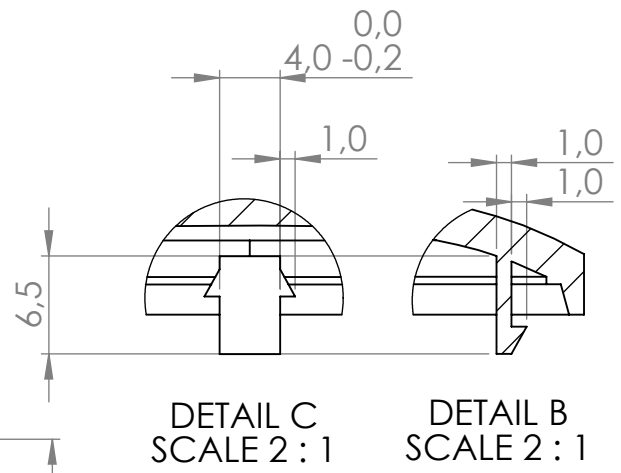
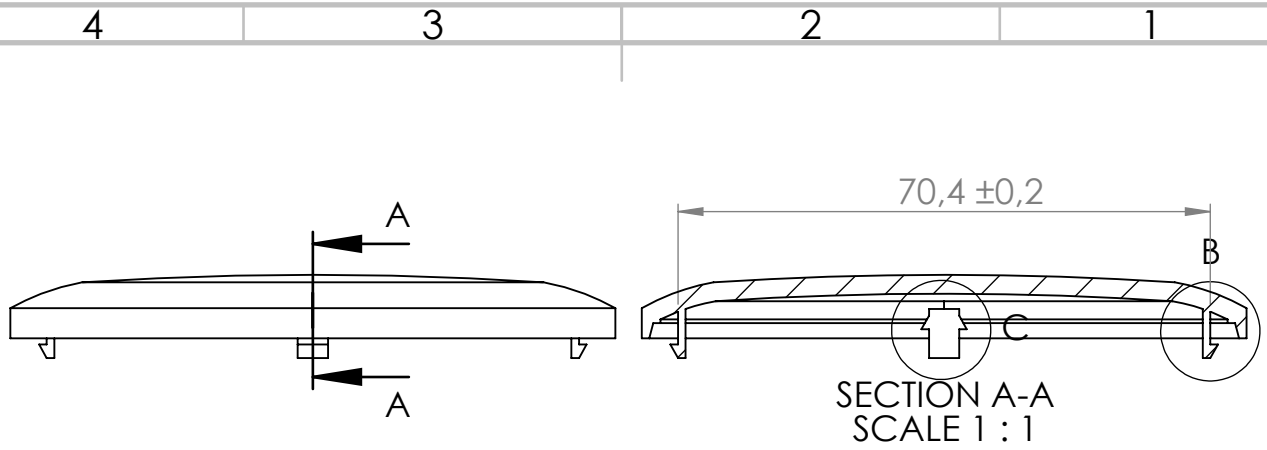
DEBURR AND  
 BREAK SHARP  
 EDGES

DO NOT SCALE DRAWING

REVISION

| NAME      | SIGNATURE | DATE | TITLE:       |
|-----------|-----------|------|--------------|
| DRAWN     |           |      |              |
| CHK'D     |           |      |              |
| APPV'D    |           |      |              |
| MFG       |           |      |              |
| Q.A       |           |      |              |
| MATERIAL: |           |      | DWG NO.      |
| WEIGHT:   |           |      | SCALE:1:2    |
|           |           |      | SHEET 1 OF 5 |

Technical drawings <sup>A4</sup>



UNLESS OTHERWISE SPECIFIED:  
DIMENSIONS ARE IN MILLIMETERS  
SURFACE FINISH:  
TOLERANCES:  
LINEAR:  
ANGULAR:

FINISH:

DEBURR AND  
BREAK SHARP  
EDGES

DO NOT SCALE DRAWING

REVISION

|        | NAME | SIGNATURE | DATE |
|--------|------|-----------|------|
| DRAWN  |      |           |      |
| CHK'D  |      |           |      |
| APPV'D |      |           |      |
| MFG    |      |           |      |
| Q.A    |      |           |      |
|        |      |           |      |
|        |      |           |      |
|        |      |           |      |

TITLE:  
**Top\_cover**

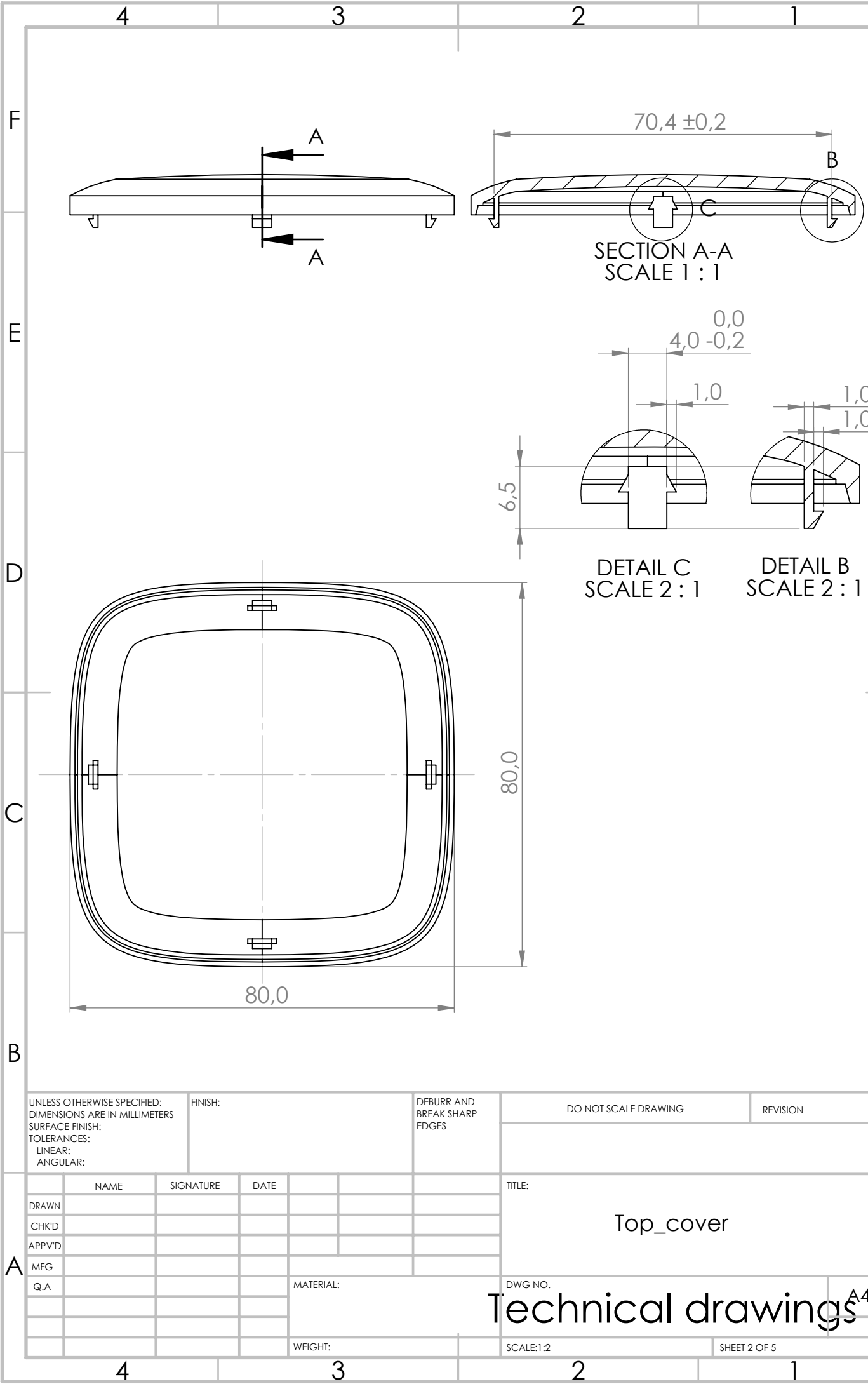
MATERIAL:

DWG NO.

**Technical drawings** A4

SCALE:1:2

SHEET 2 OF 5



4 3 2 1

F

F

E

E

D

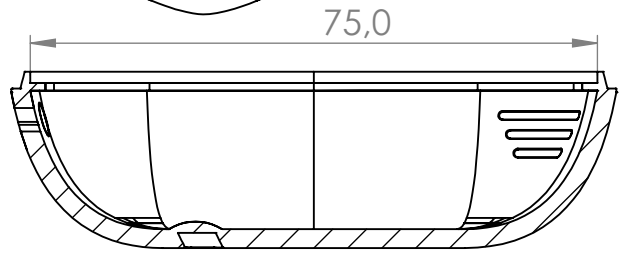
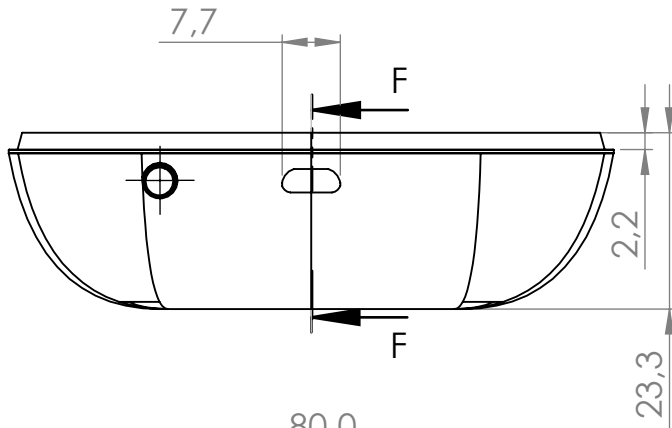
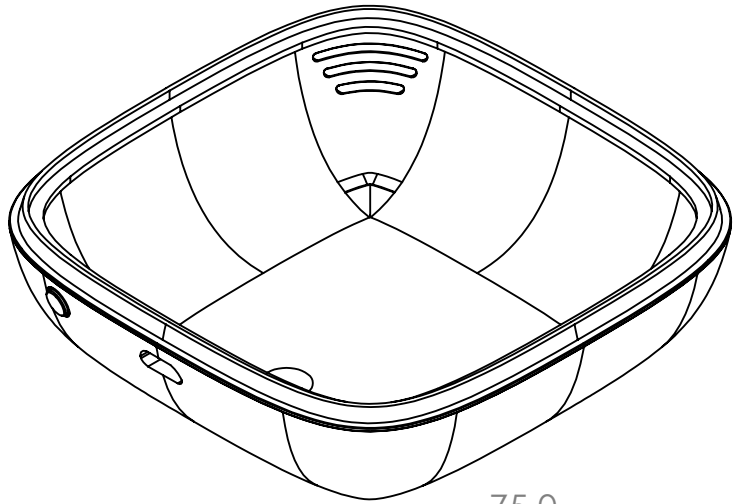
D

C

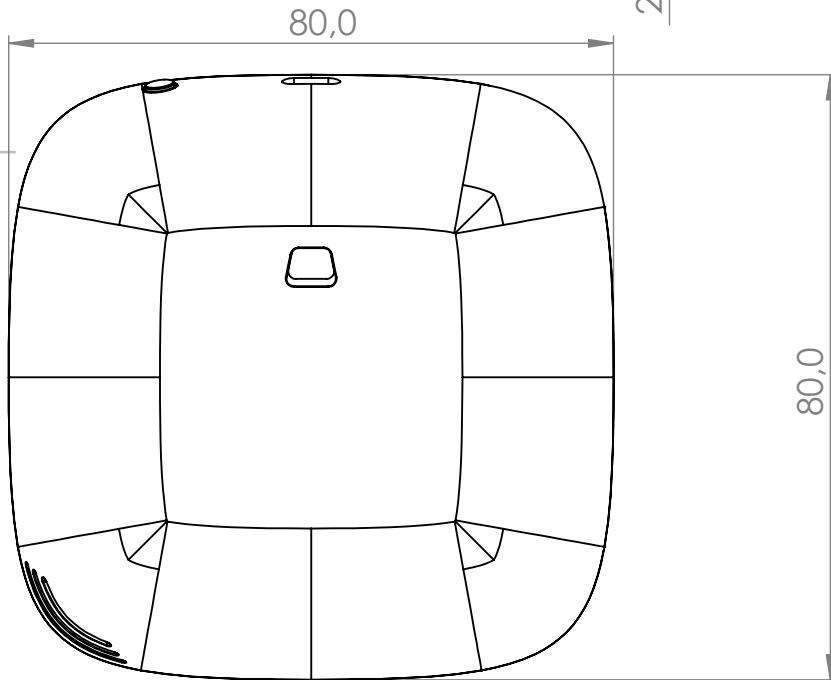
C

B

B



SECTION F-F  
SCALE 1 : 1



UNLESS OTHERWISE SPECIFIED:  
DIMENSIONS ARE IN MILLIMETERS  
SURFACE FINISH:  
TOLERANCES:  
LINEAR:  
ANGULAR:

FINISH:

DEBURR AND  
BREAK SHARP  
EDGES

DO NOT SCALE DRAWING

REVISION

|        | NAME | SIGNATURE | DATE |
|--------|------|-----------|------|
| DRAWN  |      |           |      |
| CHK'D  |      |           |      |
| APPV'D |      |           |      |
| MFG    |      |           |      |
| Q.A    |      |           |      |

|           |              |  |
|-----------|--------------|--|
| TITLE:    | Bottom_Cover |  |
| DWG NO.   |              |  |
| MATERIAL: |              |  |
| WEIGHT:   |              |  |
| SCALE:1:2 | SHEET 3 OF 5 |  |

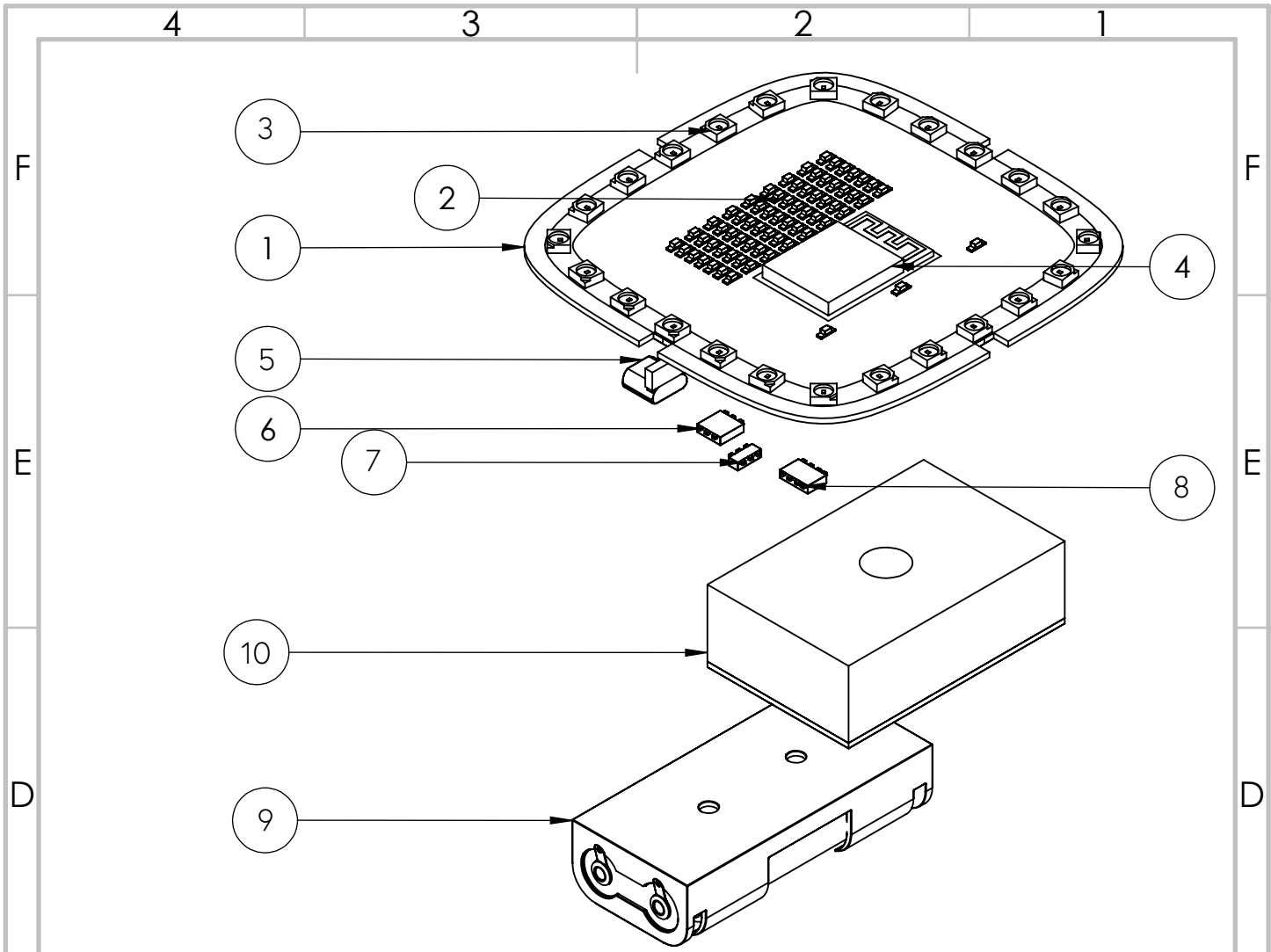
Technical drawings <sup>A4</sup>

4 3 2 1

A

A





| ITEM NO. | PART NUMBER        | DESCRIPTION | Default/ QTY. |
|----------|--------------------|-------------|---------------|
| 1        | PCB                |             | 1             |
| 2        | LED_Matrix         |             | 1             |
| 3        | LED_Ring           |             | 1             |
| 4        | Wi-Fi              |             | 1             |
| 5        | MicroUSB           |             | 1             |
| 6        | sensor_Temperature |             | 1             |
| 7        | sensor_VOC         |             | 1             |
| 8        | sensor_Humidity    |             | 1             |
| 9        | BatteryHolder      |             | 1             |
| 10       | sensor_Particle    |             | 1             |

UNLESS OTHERWISE SPECIFIED:  
 DIMENSIONS ARE IN MILLIMETERS  
 SURFACE FINISH:  
 TOLERANCES:  
 LINEAR:  
 ANGULAR:

FINISH:

DEBURR AND  
 BREAK SHARP  
 EDGES

DO NOT SCALE DRAWING

REVISION

|        | NAME | SIGNATURE | DATE |
|--------|------|-----------|------|
| DRAWN  |      |           |      |
| CHK'D  |      |           |      |
| APPV'D |      |           |      |
| MFG    |      |           |      |
| Q.A    |      |           |      |

TITLE: PCB\_Assembly

DWG NO. **Technical drawings** A4

SCALE: 1:2

SHEET 4 OF 5

4 3 2 1

F

F

E

E

D

D

C

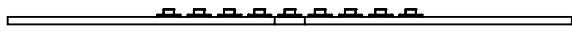
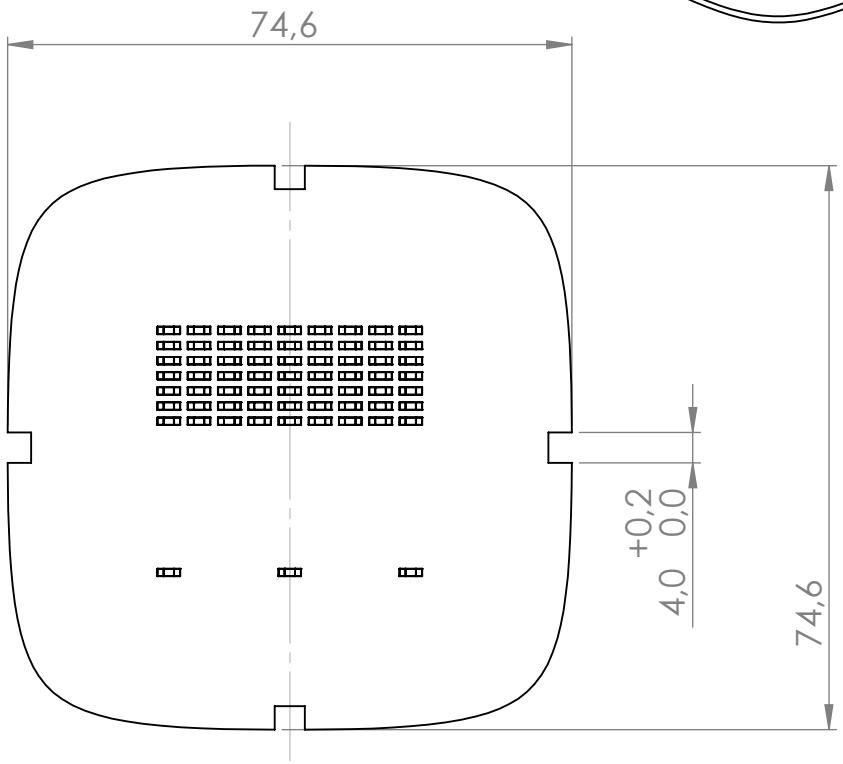
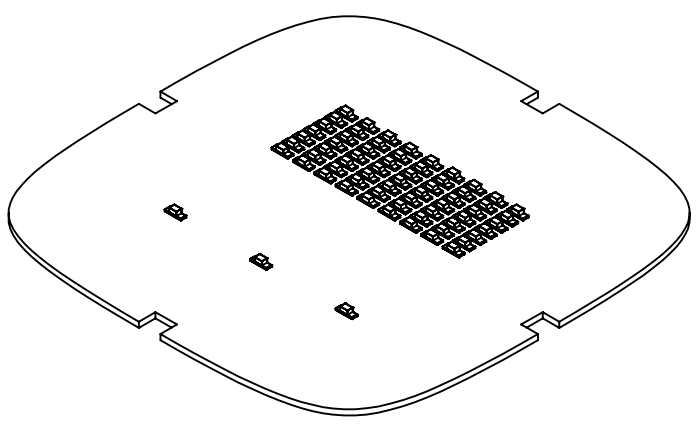
C

B

B

A

A



UNLESS OTHERWISE SPECIFIED:  
 DIMENSIONS ARE IN MILLIMETERS  
 SURFACE FINISH:  
 TOLERANCES:  
 LINEAR:  
 ANGULAR:

FINISH:

DEBURR AND  
 BREAK SHARP  
 EDGES

DO NOT SCALE DRAWING

REVISION

|        | NAME | SIGNATURE | DATE |
|--------|------|-----------|------|
| DRAWN  |      |           |      |
| CHK'D  |      |           |      |
| APPV'D |      |           |      |
| MFG    |      |           |      |
| Q.A    |      |           |      |
|        |      |           |      |
|        |      |           |      |
|        |      |           |      |
|        |      |           |      |

TITLE: PCB

DWG NO.

Technical drawings <sup>A4</sup>

SCALE:1:2

SHEET 5 OF 5

4 3 2 1



# Appendix 13

## Rules and legislation 13.1 - Medical device

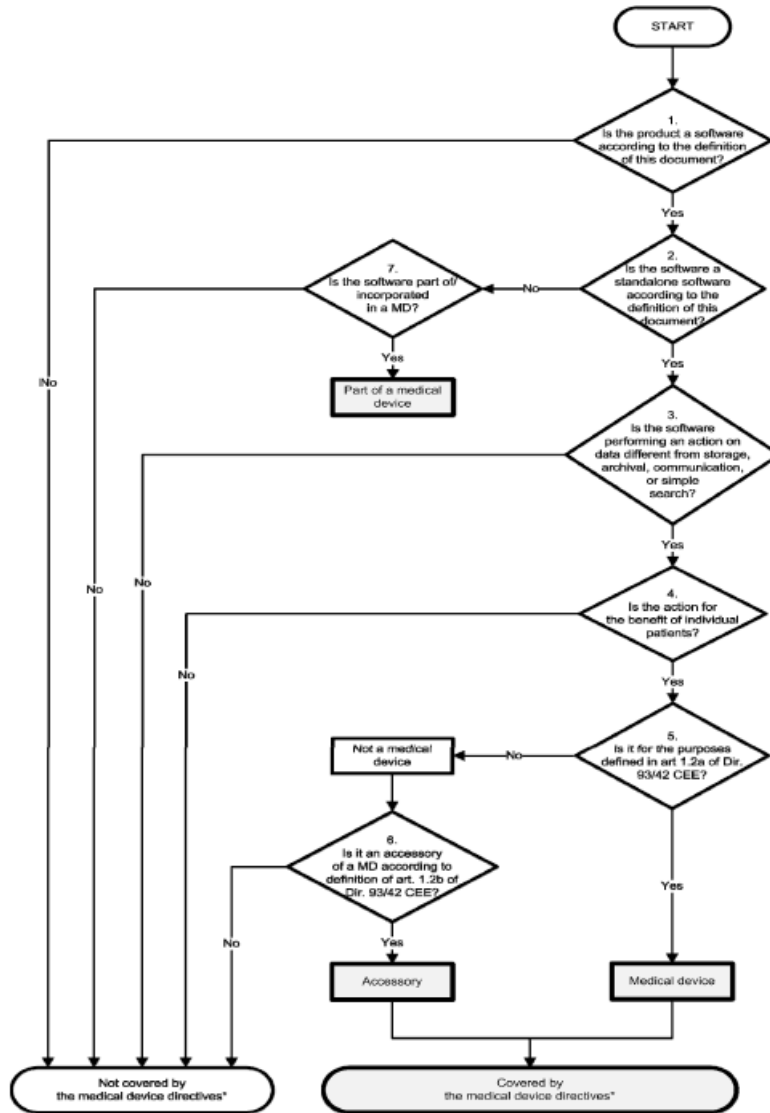
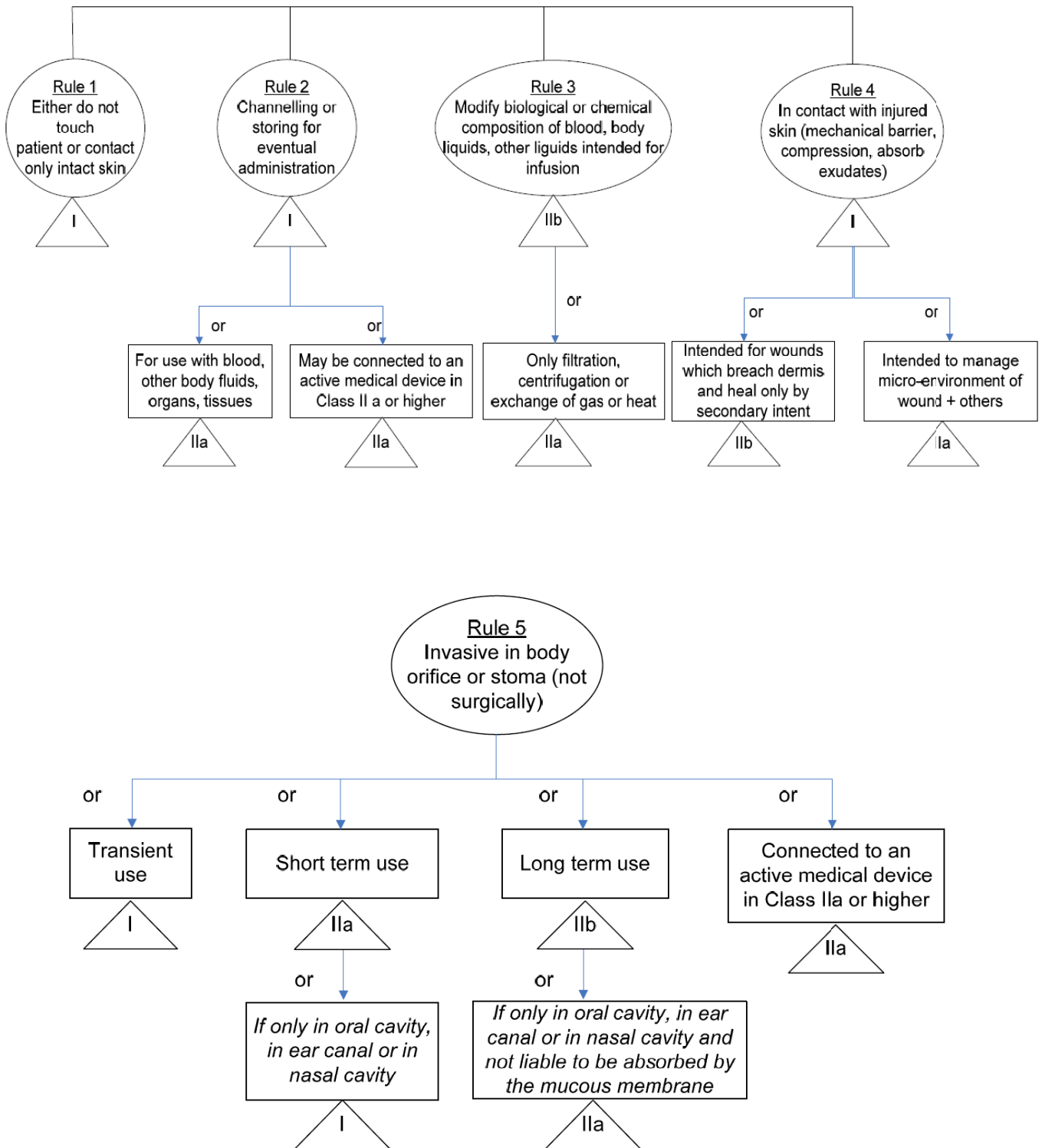
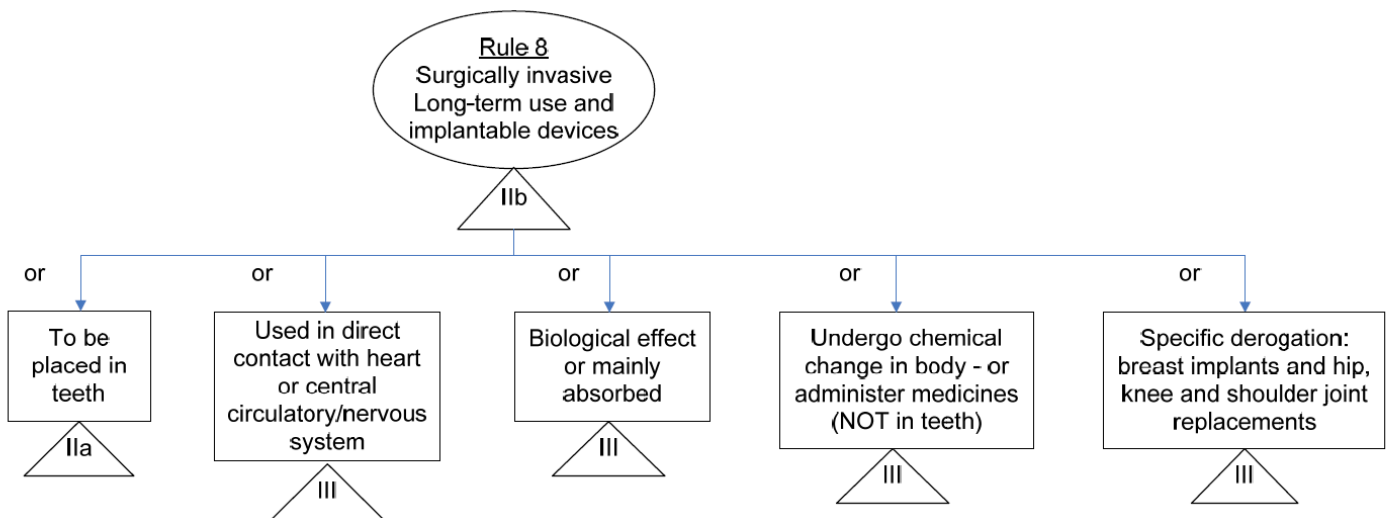
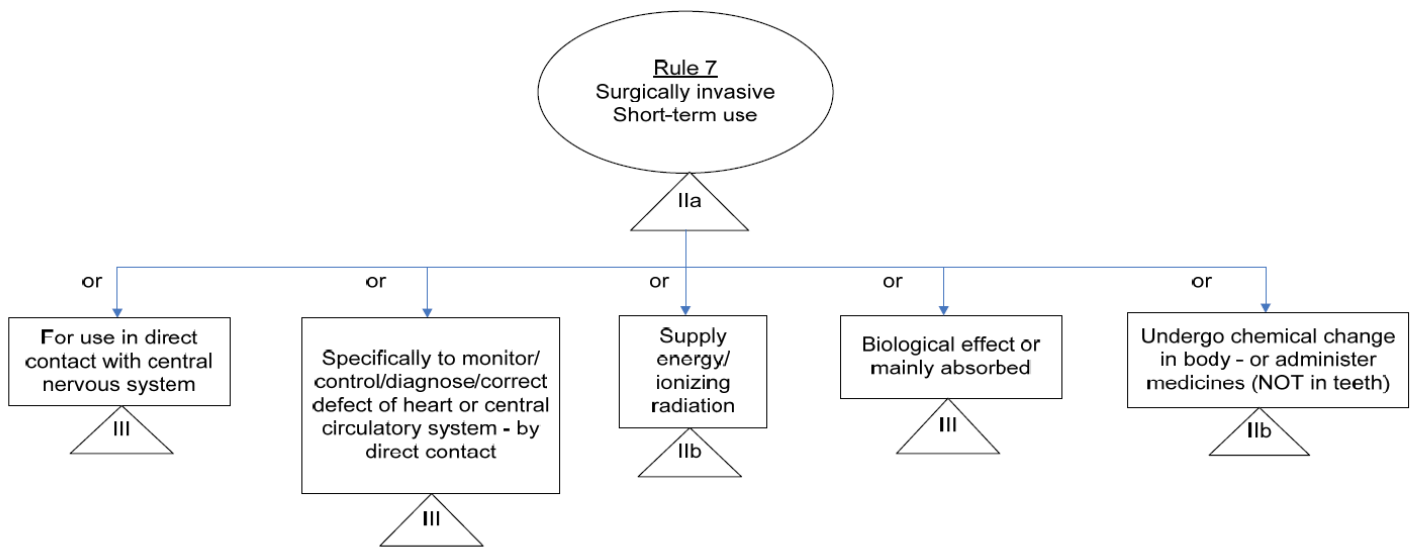
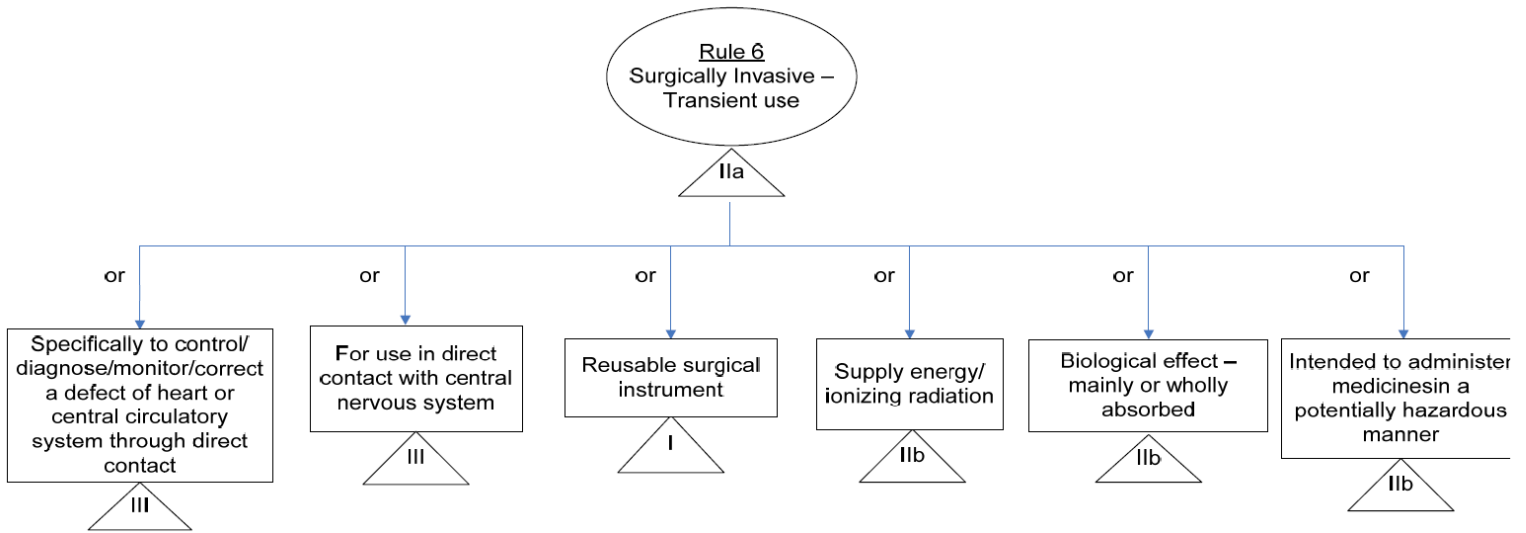


Figure 1: A decision diagram to assist qualification of software as medical device.

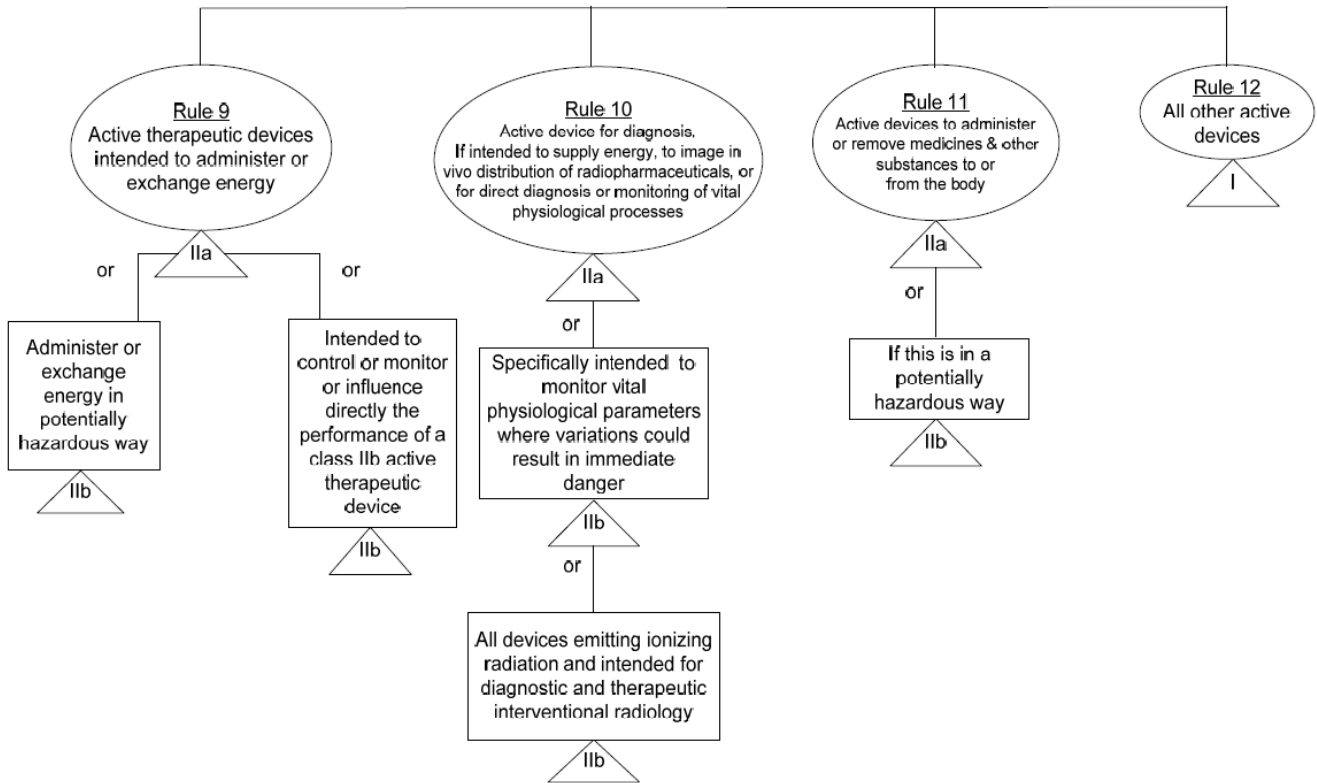
## 13.2 Classification medical device

### NON INVASIVE DEVICES

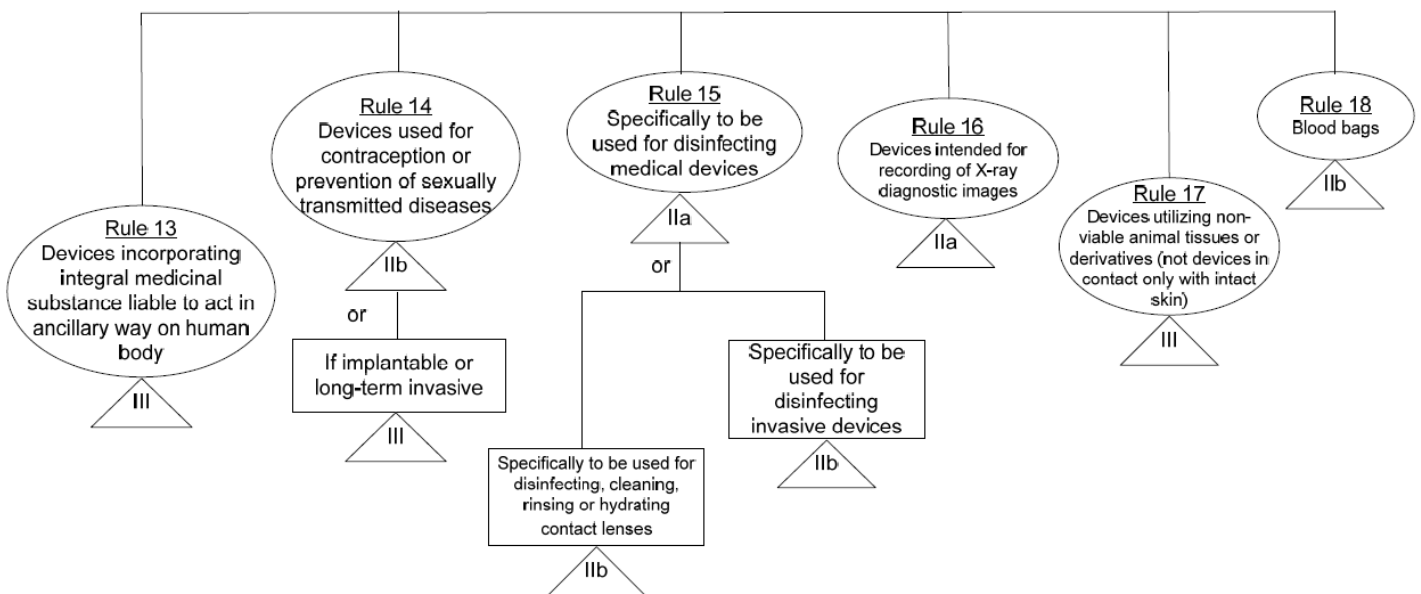




## ACTIVE DEVICES

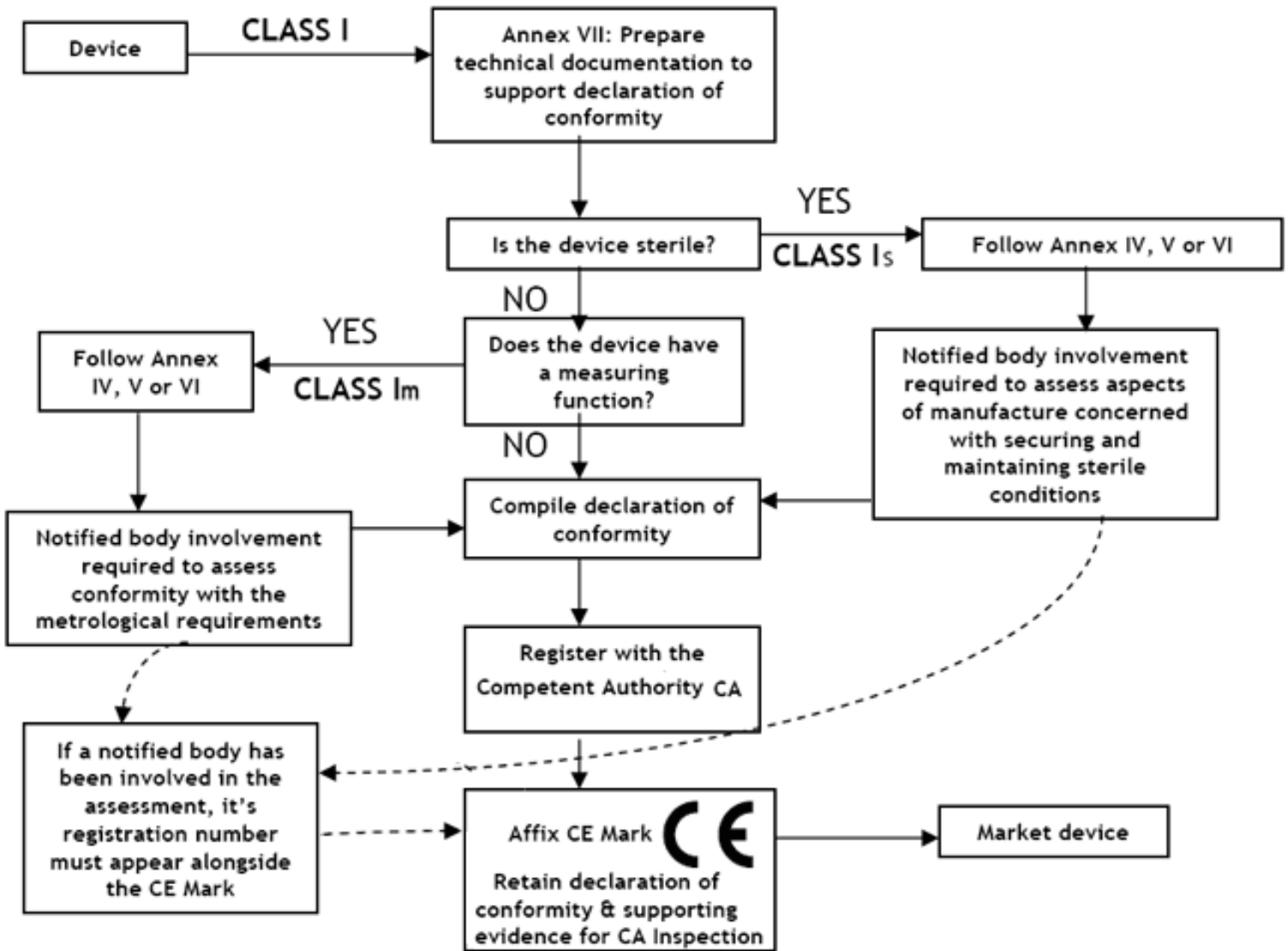


## SPECIAL RULES



13.3 Class 1 – CE Marking route

**CLASS I MEDICAL DEVICES - CE MARKING ROUTES**



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[www.CE-marking.us](http://www.CE-marking.us)   [www.CE-marking.cn](http://www.CE-marking.cn)   [www.CE-marking.de](http://www.CE-marking.de)   [www.CE-marking.co.uk](http://www.CE-marking.co.uk)



# Appendix 14

## Implementation

### 14.1 Cost digital design

This section provides a cost estimation for the development of the app. To be able to determine these costs, several assumptions have been made. First of all, these costs are based on the development of an MVP (minimum viable product). This means the development of a minimized first version of the app. Besides that, it is assumed that the development will be done by a medium sized design company, with an average hourly rate (not super cheap, not super expensive). For this cost estimation, the input of experts on app development was used for estimations of hourly rates and estimated amounts of hours. It is important to note that costs for the development of an app are highly variable depending on the chosen partners, requirements on the quality, and other agreements. For example, hourly rates may vary with an increasing number of hours, or the hours could be left entirely out of the equation, and the developing party calculates costs per activity. On the next page the elaborate cost calculation table can be found.

#### Research

The first step in the development will be a research phase. In this phase, the designers will talk to medical specialists to define how to make the app "smart".

Quickly explained, the designers would look at different sets of data that they could collect and discuss this with medical specialists. Through talking to specialists, they can determine how the data should be interpreted and what possible output could be created for the user. The costs for this phase are calculated per "content format".

#### *Example of a content format*

To explain what is meant with a content format, I use an example: determining the behavior for different types of "weather". The designers first look at the data that they could collect about the weather and the asthma patients' asthma condition. During a workshop with a medical expert, they will then determine how to interpret this data and what connections should be made. For example, a possible connection is the relation

between high humidity and increased asthma complaints. First, these types of connections, need to be identified, and next it needs to be determined what output (advice) the app should create. Doing this can be done in a workshop format.

#### *Cost of research*

For an MVP it is estimated that for one content format 32 hours are needed. This includes preparing a workshop, executing the workshop, and processing the workshop. In this cost calculation, two content formats were implemented. These are:

1. Content format for the relation between weather and the asthma patients' complaints.  
Input = weather + trigger questionnaire  
Output = desired behavior (tips, alerts etcetera)
2. Content format for the relation between the adherence and the asthma patients' complaints  
input: adherence + ACQ  
Output: desired behavior (graphs, interpretation of graphs, tips etcetera)

#### **Creative direction**

It is estimated that for creative direction in total 80 hours are needed for the MVP. This contains style definition: determining the strategy of the app and the positioning of the brand (how should VEA be perceived by the user), and creative copy: how to create this brand experience through written text (determining the tone of voice). The creative direction will be done by strategists; the hourly rate for strategists is relatively high: €130.

#### **UX**

UX stands for user experience, here the flow-frames and wire-frames will be further developed (the architecture of the app). Second, the visual design will be developed; what should be the content of the screens. It is estimated that this will take two UX-designers two full weeks. The hourly rate of UX designers is €100.

#### **Content**

Creating the content consists of creating illustrations and generating medical content.

It is estimated that creating the illustrations will take an illustrator about 40 hours; this will then be fundamental illustrations, comparable to the proposed design style. For the MVP no animations are integrated yet. Generating copy means writing the text of the app; for the text, the "creative copy" serves as a guideline. At last, creating the medical content will require the designers to look back at the results of the workshop and to implement the defined behaviors into the app using the right tone of voice.

### Development

The last phase is app development, the coding of the app. When the design of the app and its behavior is entirely determined both the front end (design) and back-end(coding) will need to be developed for the apple and android platform. Besides that, the algorithms for the "content formats" need to be developed. The app will be developed to work on both apple and android devices. For the calculation of the hours, the rule of thumb is applied that development takes about twice the amount of time of the design (content) work: 240 hours.

### Project management

Project management entails the management of the project. This entails activities such as communicating with different parties, making schedules, presenting results etcetera. Generally speaking, project management comes down to about 10% of the total development time, thus 70 hours.

### SLA

At last, it is advised to determine an agreement with the developer on SLA. SLA means Service License Agreement. SLA entails optimizing the design and keeping it up to date after it is launched (creating updates). It is advised to spend on average 8 hours a month on SLA. SLA does not require any groundbreaking design activities; therefore, the hourly rate is set to €80, which is relatively cheap.

| Main activity      | Sub activities        | Hourly rate | Estimated hours | Total cost price |
|--------------------|-----------------------|-------------|-----------------|------------------|
| Research           |                       | 130         | 64              | 8.320            |
|                    | Content format 1      |             | 32              |                  |
|                    | Content format 2      |             | 32              |                  |
| Creative direction |                       | 130         | 80              | 10.400           |
|                    | Style definition      |             | 40              |                  |
|                    | Creative copy         |             | 40              |                  |
| UX                 |                       | 100         | 120             | 12.000           |
|                    | Flow- and Wire-frames |             | 60              |                  |
|                    | Visual design         |             | 60              |                  |
| Content            |                       |             |                 | 10.400           |
|                    | Illustrations         | 80          | 40              |                  |
|                    | Copy writing          | 80          | 40              |                  |
|                    | Medical content       | 100         | 40              |                  |
| App development    |                       | 120         | 240             | 28.800           |
|                    | Back-end development  |             |                 |                  |
|                    | Front-end development |             |                 |                  |
|                    | Algorithms            |             |                 |                  |
| Project management |                       | 120         | 70              | 8.400            |
| <b>Total:</b>      |                       |             |                 | <b>73.820</b>    |
| SLA                |                       | 80          | 8 h/month       |                  |

## 14.2 Cost physical design

In table 3 the calculated total cost price of the physical product is listed. Below this calculation is further explained.

### Cost price casing:

For the cost price of the casing expertise of engineers of VanBerlo was consulted. The production method of the casing is injection molding, the experts of VanBerlo say that based on the shape of the product the complete casing could be made using one mold. The estimated costs for this mold are €35.000. Table 1 and 2 further demonstrate the cost calculation.

### Costprice PCB assembly

For the cost price of the PCB assembly a quotation was asked from [www.pcbway.com](http://www.pcbway.com). This price is based on the assembly of 74 separate parts, this includes the separate sensors, and the separate LEDs of the LED matrix, the LED ring is considered to be one piece.

### Costprice product assembly

For the cost price estimate of the product assembly it is assumed that assembling one product by hand takes 20 seconds. Hourly rate was set to €25,74

In total this comes down to a production price of €42,98 per piece.

| Product       | Volume                | Weight   | Batch size | Total weight |
|---------------|-----------------------|----------|------------|--------------|
| Volume top    | 15,95 cm <sup>3</sup> | 16,907 g | 10.000     | 169 kg       |
| Volume bottom | 22,16 cm <sup>3</sup> | 23,489 g | 10.000     | 235 kg       |
| Total         |                       |          |            | 404 kg       |

Table 1 - calculation material cost


| Product           | Cost price | Batch size | Total cost price |
|-------------------|------------|------------|------------------|
| MOLD              | € 35.000   | 1          | € 35.000         |
| ABS               | € 1,7 / kg | 404        | € 43.228         |
| Total cost price: |            |            | € 78.228         |
| Price per piece:  |            |            | € 7,82           |

Table 2 - calculation cost injection molding


### Pricing And Build Time

PCB Price

 Price Comparison Matrix

| Build Time   | Qty  | Total |
|--|------|-------|
|  3-4 days | 8000 | \$826 |

Assembly Service Price

| Per Piece   | Qty  | Total  |
|---|------|--------|
|  0.2/pcs | 8000 | \$1238 |

 Final price is subject to our review.

Shipping Cost:

 NETHERLANDS, THE   DHL

   3-5 Days , wt : 2.292 kg **\$48**

CHN Time Zone(GMT+8): 2019/7/5 19:45:13

Payment before 2019/07/06 06:00 (GMT+8 Only PCB)

|  |  |
|--|--|
|  Delivery time<br>2019/7/9 AM |  Receipt confirm<br>2019/7/13 |
|--|--|

PCB Cost: US \$ 826  
Assembly Service Cost: US \$ 1238  
Shipping: 18 \$48  
**Total: US \$ 2082**

Email

 **Add to Cart**

Assembly costs PCB

## User interview

| Product  | VEA                  |                        |                                |                               |  |  |  |                      |                   |
|--|----------------------|------------------------|--------------------------------|-------------------------------|--|--|--|----------------------|-------------------|
|  |                      |                        |                                |                               |  |  |  |                      | prijs per product |
| In-huis te vervaardigen  | prijs/stuk           | stuks/product          |                                | prijs per product             |  |  |  |                      |                   |
| Cover  | € 7,82               | 1                      |                                | € 7,82                        |  |  |  |                      |                   |
|  |                      |                        |                                | € 7,82                        |  |  |  | totaal vervaardiging | € 7,82            |
| <b>Inkopen</b>   | <b>prijs/eenheid</b> | <b>eenheid</b>         | <b>eenheid/product</b>         | <b>prijs per product</b>      |  |  |  |                      |                   |
| Particle sensor  | € 6,80               | stuk                   | 1                              | € 6,80                        |  |  |  |                      |                   |
| VOC sensor   | € 0,62               | stuk                   | 1                              | € 0,62                        |  |  |  |                      |                   |
| Humidity sensor  | € 1,14               | stuk                   | 1                              | € 1,14                        |  |  |  |                      |                   |
| Temperature sensor   | € 1,82               | stuk                   | 1                              | € 1,82                        |  |  |  |                      |                   |
| LED (Ring)   | € 0,44               | stuk                   | 24                             | € 10,56                       |  |  |  |                      |                   |
| LED(matrix)  | € 0,01               | stuk                   | 63                             | € 0,63                        |  |  |  |                      |                   |
| Push button  | € 1,23               | stuk                   | 1                              | € 1,23                        |  |  |  |                      |                   |
| Wi-Fi  | € 8,25               | stuk                   | 1                              | € 8,25                        |  |  |  |                      |                   |
| PCB  | € 0,50               | stuk                   | 1                              | € 0,50                        |  |  |  |                      |                   |
| AAA rechargeable   | € 0,20               | stuk                   | 2                              | € 0,40                        |  |  |  |                      |                   |
| Wiring + connectors  | € 1,50               | stuk                   | 1                              | € 1,50                        |  |  |  |                      |                   |
| Battery casing   | € 1,31               | stuk                   | 1                              | € 1,31                        |  |  |  |                      |                   |
| <b>Totaal</b>  |                      |                        |                                | € 34,76                       |  |  |  | <b>totaal inkoop</b> | <b>€ 34,76</b>    |
| <b>Assemblagekosten</b>  |                      | <b>assemblageserie</b> | 10.000                         |                               |  |  |  |                      |                   |
|  |                      |                        | <b>Prijs per stuk</b>          |                               |  |  |  |                      |                   |
| PCB assembly   |                      |                        | € 0,26                         | € 2.600,00                    |  |  |  |                      |                   |
|  |                      |                        | <b>totaal machinekosten</b>    | <b>€ 2.600,00</b>             |  |  |  |                      |                   |
|  | <b>mens/machine-</b> | <b>arbeidsuren</b>     | <b>uurtarief</b>               | <b>arbeidskosten</b>          |  |  |  |                      |                   |
| Product assembly station   | 1                    | 55                     | € 25,74                        | € 1.415,70                    |  |  |  |                      |                   |
|  |                      |                        | <b>totaal arbeidskosten</b>    | <b>€ 1.415,70</b>             |  |  |  |                      |                   |
|  |                      |                        | <b>totaal assemblagekosten</b> | <b>€ 4.015,70</b>             |  |  |  |                      | <b>€ 0,40</b>     |
| K <sub>p</sub> Productiekostprijs geassembleerd product voor interne calculatie: |                      |                        |                                | <b>Productiekostprijs VEA</b> |  |  |  |                      | <b>€ 42,98</b>    |

Table 3 - Total production costs physical design

# Appendix 15

## Patient evaluation

### 15.1 research set-up

#### Objective

The design was created according to the design direction. The goal of the user evaluation was to see if the design satisfies the requirements as set in the function analysis. Second it was evaluated if the design matches the desired "user experience vision" as defined in the section "user experience vision". Besides that the test was designed to evaluate if asthma patients understand the use of the app and the physical device. Below the main research questions are listed.

Does the design enhance self-management?

How are the different features of the concept perceived?

Is the concept motivating?

Does the app increase capability of self-management?

Do the participants' preferences match the persona they have been assigned?

#### Method

The user research was performed in individual sessions. The participants were presented with a click-through prototype of the app, scenarios on paper, a prototype of the physical design and renders of the physical design. By means of semi-structured interviewing and observing the research questions were evaluated. Before the research started each participant was explained what the research was about and they were asked

to fill out the consent form, see appendix 14.2.

#### Apparatus

The participants were presented with a click-through prototype of the app, scenarios on paper, a prototype of the physical design and renders of the physical design. The picture below gives an impression of the research set-up.

#### Processing

Each session was video- and audio-recorded. Right after each session the recordings were analysed, and quotes were written down and clustered. Each of the quotes related to these topics has been typed out and can be found in appendix 14.3.



## 15.2 Informed consent

### Consent Form for concept evaluation VEA

During this study you will be shown a concept for an app that is intended for people with asthma. You will be shown some moving and still images and asked for your opinion based on your experience with asthma and what is involved.

**Please tick the appropriate boxes**

**Yes No**

#### Taking part in the study

I have read and understood the study information above and I have been able to ask questions about the study and my questions have been answered to my satisfaction.

I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.

I understand that taking part in the study involves an audio- and video-recorded interview, which will be transcribed as text and used anonymously (without my name on it).

#### Use of the information in the study

I understand that information I provide will be used for Iris Ritsma's graduation report anonymously.

Upon separately asked permission some audio recorded quotes might be shared during the final graduation presentation or Iris Ritsma.

#### Signatures

\_\_\_\_\_  
Name of participant

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

\_\_\_\_\_  
Researcher name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## 15.3 Guideline interview questions

### User evaluation question guide

#### Introduction

- Graduation project
- Feedback to improve the design, feel free to say whatever comes up in your mind
- Consent form

Apparatus: consent form, audio + video recorder + camera

#### Question guide

- Think out loud
- Why do you.. / did you..?
- Could you explain...
- How does that make you feel?
- What are your impressions

#### 1. Onboarding – first impression

Apparatus: click through version of the app upon first opening

1. Open the app & click through first screens  
*Think out loud*
2. What is your first impression?

#### 2. Triggers

Apparatus: click through version of the app + scenario 1 on paper + emotion sheet

1. Imagine you just got diagnosed with asthma. In some situations (for example when being outside or during a certain activity) you notice an all of a sudden increase in complaints and you want to know what causes this. Could you show me what you would do?  
*Think out loud*
2. Show use scenario of discovering triggers.  
First impressions?  
(How)(when) do you think you would use this function?
3. How does this aspect of the app make you feel? Why?  
*Use emotion sheet*

#### 3. See progress

Apparatus: click through version of the app + scenario 2 on paper + emotion sheet

1. Imagine you just had an appointment with the GP and he advises you to keep track of your asthma, to see if it gets better or worse. Could you show me what you would do?
2. Show ACQ, have you seen this test before? “fill out + think out loud”
3. Show use scenario of see progress  
first impressions?  
(how)/(when) do you think you would use this, in what context?
4. How does this aspect of the app make you feel? Why?  
*use emotion sheet*



#### 4. Sharing data

Apparatus: home screen + consent screen

1. If you would want to change your settings where would you go?
2. Which data would you want to share with your GP and which data not? Why?

#### 5. Home screen and physical device

Apparatus: interface physical device + Scenario physical device in use

The app comes with this physical device. This device you can set up in your home and it can track the air quality in your home. This air quality data is then used by the app for:

-registering your triggers, say you always have asthma complaints when there is a lot of particles in the home

-it can tell you when your triggers are around inside and outside.

-it can send reminders for actions you forgot to do

1. What do you think is communicated in the different interfaces?  
*Sheet with interface*
2. Are there things you would like to know about the air quality around you? What? Why?
3. How do you think you could use the physical device? In what scenario, why?  
*Scenario*

#### 6. Journey and goals

Apparatus: full list of goals + journey screen + emotion sheet

1. What do you think of the idea of setting goals?
2. What goals would you use? Why(not)
3. What goal would you use the first do you think?
4. Are there any goals that are missing?
5. What is your impression of the journey? Does it add any value or not?
6. How does it make you feel? Why  
*emotion sheet*

#### 7. Personalization

Apparatus: screen tone of voice + Screen depth of information

1. Tone of voice: Which one do you prefer and why?
2. Which one would work best for you?
3. Which one do you prefer and why?
4. Which one would work best for you?

#### General evaluation

1. What influence do you think this design would have had on the time after diagnosis for you?
2. What influence do you think this design would have had on your adherence/non-adherence & attitude towards that?
3. What do you like about the concept?
4. What do you think can be improved on the concept?
5. Discuss competence
6. Discuss autonomy

Emotion sheet

**Happy**

Amused  
Delighted  
Optimistic  
Joyful

**Anger**

Annoyed  
Agitated  
Mad  
Critical  
Disgusted  
Bitter

**Energized**

Determined  
Motivated  
Inspired  
Healthy  
Focused

**Confusion**

Confused  
Uncertain  
Embarrassed  
Stressed

**Sad**

Depressed  
Desperate  
Upset  
Frustrated

**Strong**

Sure  
Certain  
Competent  
Autonomous  
Ambitious  
Confident  
Determined

## 15.4 Results user evaluation

### First impression

#### Overall

P2 - Ik zit meer gelijk te kijken van oh dat heb ik nooit gehad. Dus wat dat betreft is het wel een soort van makkelijk bij elkaar en misschien dat je ook wat actiever erover na gaat denken. Dus ik denk dat het zeker wel goed is.

P3 - Ik vind de opbouw wel goed.

P3- Dat je goals echt als doelen neer zet. Dit zijn wel echt stappen maken naar je doelen. En de basics zijn ehh niet zo zeer stappen naar je doelen maar meer je basis om te weten hoe je je doelen moet stellen.

P3 - Ik vind je opbouw wel goed. Want stel je begint net met astma, dan weet je inderdaad dit allemaal niet (basics)

P5 - First of all its cool.

P6 - Triggers die is ook wel nice. Want ik weet gewoon van mezelf dat ik last van stof heb, dus dat is ook een van die triggers dus dat is wel heel chill. Kan je dat dan ook opslaan dat je bijhoudt welke triggers je allemaal hebt?...Ooh ohjoh dat is wel echt een goeie dat ie dat allemaal bijhoud (triggers)

P6 - Ja ik was heel benieuwd toen je zei dat je een app had gemaakt dacht ik maar wat voor app dan? Maar ik vind het best wel vet eigenlijk dat ie alles bijhoud. Ook dat als je nog niet zo veel weet over je astma dat ie dat ook bijhoudt en dat je dat neer kan zetten dat het aan de luchtkwaliteit ligt. En dat vind ik ook gewoon een hele leuke (8.29) de luchtkwaliteit erbij. Want ook nu dan is het mooi weer en dan merk ik dat het buiten gewoon te benauwd is en dat kun je dan hier zien. En in je huis kun je dan zien oh lucht is niet geweldig, laat ik een raam openzetten laat ik gaan stofzuigen dat soort dingen. En als het buiten gewoon slecht weer is kun je besluiten ik neem alvast m'n inhalator in.

### Layout & design

P2 - En het zijn wel leuke felle kleurtjes

P2 - Wel leuk zo'n kort filmpje. Dat je gewoon even die informatie gelijk krijgt.

P4 - Ik vind het heel duidelijk qua tekst en heel overzichtelijk ook door die blokjes, het lettertype, tis gewoon goed leesbaar, de sfeer is heel aangenaam en ook een soort positief. Ik weet niet zo goed waar dat door komt, misschien omdat het ook licht is

#### Suggestion

P4 - in dit scherm (goals) mis ik wel een beetje visuals. Dan heb je gelijk zonder dat je iets hoeft te lezen zo "oh ja dit gaat over medicijnen".

P4 - . Heee een animatie, wat leukk.

P4 - De kleurenstelling over het algemeen vind ik heel leuk en heel aangenaam.

P5 - I also think, I really like the visual treatment, like these kinds of animations. The simple gradients and these kinds of vector images, I think it is really nice, but I do think there could be done more with the dashboard, so that it is a little more fun and inviting.

P5 - Its really interesting content and I think you did a nice job on the design.

P6 - Ik vind het echt leuk dat je die symbooltjes erbij hebt zitten. Oh leuk zo'n intro.

P6 - Ooh wat vet. Echt een leuke layout daar word ik echt gelukkig van. Gewoon lekker overzichtelijk. En ik hou gewoon lekker dat alles leuke kleurtjes heeft en ook gewoon overzichtelijk en rustig, dan vind ik altijd gewoon heel chill.

P6 - oh dat is wel leuk, heel leuk (animatie)

P6 - Ja dat vind ik echt leuk dat je die filmpjes ook erbij doet.

## Triggers

P2 - Oh dat is ook wel handig. In de zin dat je op een gegeven moment ook ziet dat je daar en daar last van hebt.

P2 - Ik denk echt dat het belangrijk is dat je aan het begin goed aan geeft wat die triggers zijn en waarom dat belangrijk is. Want ik heb nu 4 jaar astma en ik begin nu pas een beetje te ontdekken wat dan een beetje mijn triggers zijn en waar ik dus echt last van heb en waar ik dus eventueel rekening mee moet houden. En dat kan ook iets zijn waar je dan nog niet echt bewust van bent...En nu ik gewoon weet wat mijn triggers zijn, dan kun je er ook rekening mee houden.

P2- Oh dat zou ik ook wel heel fijn vinden. Want op een gegeven moment weet je zelf ook wel een beetje als het mooi weer is dan heb ik er last van. Maar dan heb je het idee dat er nog wat achter zit en dat is best wel lastig om dat voor jezelf in kaart te brengen wat dat dan is. En dan is het wel fijn als zo'n app je daar ook een beetje mee kan helpen.

P2- Het zou voor mij wel een goed ding zijn ik wil graag weten waar het in zit. Dat het ook een soort van energie geeft en zorg voor een soort doorzettingsvermogen dat je erachter wil komen wat het dan is.

P2 - Ik heb er in het begin ook best wel een tijdje over gedaan voordat ik door had, roken heb ik dus last van. Ik heb last van houtrook, ik heb last van warm weer. Dat zijn ook wel dingen waar je even over na moet denken, als je het dus de eerste keer hebt denk je, hmm zou dat het zijn, en eigenlijk pas als je het de 3<sup>e</sup> keer hebt kun je er echt iets van zeggen, dus als je die app dan heb kan je er misschien veel sneller iets van zeggen of misschien dat ie dan in ieder geval met je mee denkt en dat is wel fijn

P3- Het doel op zich vind ik wel heel chill. Zeker als je net begint met astma hebben of het is net geconstateerd. Dan weet je over het algemeen niet zo zeer waardoor je een astma-aanval krijgt en dan is dit best wel fijn.

P3 - Triggers ook in het begin en daarna niet echt meer. Op een gegeven moment heb je ze ook wel weer gevonden.

P4 - Hmm oh cool (over trigger doel)

P4 - Empowering, of empowered. Motivated, more in control. Ja omdat het toch voor mij een heel ongrijpbaar iets was nog steeds ook wel redelijk ongrijpbaar is, je kan er niet zo goed grip op krijgen wat het precies is. Het is niet zo recht toe recht aan als een gebroken arm bijvoorbeeld waarvan je weet van dit is er gebeurt. Je weet dat het een fysiek probleem is en je weet dat over een tijd weer gaat helen en dan is het klaar. Nee het is een ongoing iets, wat je niet precies begrijpt, wat heel ongrijpbaar is en je kan het moeilijk in die zin controleren. Ik denk dat op het moment dat je beter inzicht krijgt in wat een trigger kan zijn dat je meet het gevoel van controle krijgt en dat je er iets aan kan doen, dat je her kan beïnvloeden en dat lijkt me heel prettig dat gevoel.

P4 - Dus vandaar dat ik ook zei optimistisch, ik kan er toch wat mee, ik kan er meer mee dan wat ik nu doe. En ook gemotiveerd om beter hiermee aan de slag te gaan, dus om echt achter die triggers te komen, maar ook om beter voor jezelf te zorgen uiteindelijk. Omdat je dan weet wat er mee in verband staat en dat als je dat vermijdt dat je dan beter voor jezelf zorgt.

P5 - Super cool. I love it. I really like that it knows when you use your reliever and that you can keep track of that. It reminds me of Fitbit. The app tracks your heartrate and tells you about your activity. And you are able to see that over time. I use my Fitbit for example to track my sleep. And then I can track for example the days I had good sleep dan the days I had bad sleep and often it would be cause by something like exercise. Like if I exercise that day then I have good sleep. That is something it reminds me off, so you can keep track of your behavior so that over time you get an understanding of what is happening.

P6 - Oh dus hij geeft door aan de app "ze heeft net een inhalater gebruikt" oh dat is vet

P6 - Ik vind het wel handig het is wel chill om te weten waar het vandaan komt want anders ga je altijd in onzekerheid zitten wat was het nou, wat was het nou niet. Dus daarom vind ik het wel echt heel handig. Dat heb ik ook heel vaak dat ik denk van "oh, misschien komt het daardoor even onthouden" en dan vergeet je het weer gewoon. En dan denk je jah dat is wel weer jammer. Dus dit is wel handig dat het het gewoon onthoudt en er op een gegeven moment ook een conclusie uit gaat halen.

P6 - Want ik vind het gewoon gestructureerd en dat vind ik heel chill. Ik vind echt leuk ook dat dit erbij zit. Dus ook delighted, positief. **En ik zou zelf ook de app gebruiken**

## Suggestie

P3- Ik snap wel aan de hand van deze tekst dat er pollen kunnen zijn. Maar het is nog niet helemaal duidelijk als je het zo ziet. Misschien als er iets staat van "gevonden trigger" in bold. Nu zullen de meeste mensen het wel begrijpen. Maar niet iedereen zal het in een oogopslag direct begrijpen, zeker als iemand een taalachterstand heeft.

P3 - De opzet is wel een goede. Kun je ook dit allemaal skippen als je vermoed dat je een allergie hebt voor honden, kun je het dan ook gewoon zo invullen?(trigger questionnaire)

P3 - Dat je uit een lijst kan kiezen in plaats van dat je de vragenlijst door moet.? (trigger questionnaire)

P4 - Maar ik heb bijvoorbeeld nooit echt een asthma aanval, maar het is wel soms zo dat ik er meer last van heb dan anders. Want ik zou het wel heel leuk vinden om dit hele proces door te gaan. Ik ben niet zo goed met die ventolyn, ik gebruik eigenlijk meer die parse. Maar het is wel zo dat ik er af en toe meer last van heb...Het is meer dat wat het triggert dit gebruik, dat gebeurt bij mij niet zo vaak dus daarom zou ik niet in dat proces komen, maar ik zou het wel een leuk vinden erdoorheen te gaan. Ik heb zeker wel triggers alleen niet dat ik dan meer m'n medicijnen gebruik. Dus het is meer dat ik dan wel suffer maar dat gewoon zo laat. Dus ik zit te denken hoe ik ook alsnog wel dit zou kunnen doen.

P6 - Hier staat avoid these triggers. Maar ik denk dat het moeilijk is te avoiden. Het blijft je trigger altijd, het is meer dat je het kan herkennen. En dat je daar mee kan gaan werken om de dan misschien minder vaak tegen te komen. Het is meer dat je het kan herkennen en dat je er dan iets aan kan doen je kan het niet ontlopen

## See progress

P2 - Dat vind ik ook altijd wel leuk dat je dingen bij kan houden. Ik heb dat voor de longarts ook een tijd gedaan, met die ACQ, maar daar was ik na een tijdje wel een beetje klaar mee. Maar ik denk dat dat was omdat een soort gebruikersgemak er niet helemaal was. Ik vond dat altijd wel leuk, alleen je moest altijd op een website inloggen en dat vind ik dan gewoon irritant en op je telefoon deed ie het ok weer net niet goed.

P2 - Optimistisch omdat je ziet gewoon wat er gebeurt. Dat zou er voor mij wel voor zorgen dat je zegt van kom ik ga er mee aan de slag. Ook een beetje "motivated" en inderdaad als je dit allemaal ziet en je doet het goed dat het dan inderdaad ook een beetje kan zorgen voor wat optimisme, dat je denkt nou, he, het gaat goed.

P2 - En ambitious, dat is ook echt iets wat ik dan vind dat dat ik denk, ooh dan wil ik wel echt zorgen dat ze allemaal bovenaan zitten (weekoverzicht) of dat ik denk van ja ik wel het wel echt zo goed mogelijk doen.

P3 - Ik vind het wel chill dat dit erin zit, want je gaat het niet op papier zetten ofzo, of in Excel

p3 - Ik vind dit op zich best wel een goeie. Omdat eigenlijk vaak vergeet je hoe het ging twee maanden terug dus dan is zegmaar het verband tussen je medicijn intake en de controle over je astma is wel, dat  **motiveert**  ook zegmaar om consistent te blijven. Voor mij dan.

P3 - Verder optimistisch wel om dat je komt wel een stapje dichterbij een aantal oorzaken die je kunt vermijden of kunt verhelpen. Vastberaden is omdat je ziet wel direct resultaat. En dat is wat makkelijker om dan ernaartoe te streven.

P3 – dit zou ik elke keer gebruiken, vaak

P3 - Het is wel een soort eye opener of een bewustwording dat er een oorzaak is dat het minder gaat of juist beter.

P4 - Ik ben wel benieuwd, stel nou dat je je medicijngebruik goed doet voor een week of een dag, wat gebeurt er dan? Krijg je dan punten?

P4 - Ik vind het er gewoon heel netjes uit zien. Duidelijke visualisaties. Duidelijk ook dat dit gaat over de verschillende dagen van de week en hier dit ook dat het over de verschillende maanden gaat.

P4 - Ik vind het heel fijn om inderdaad gewoon continu een soort positieve feedback te krijgen. Op het moment dat je iets goed doet dat je gelijk weer iets terugkrijgt.

P4 - Ik heb "informed" opgeschreven. Het is gewoon je hebt informatie je hebt veel meer zicht en overzicht over de lange termijn. Het is meer  **tastbaar** . En knowledgeable dat je beter begrijpt wat gebeurt er nou, wat is er gaande, wat zijn de goede en de slechte tijden in het jaar, in de dag et cetera. Calm ga ik erbij zetten ik denk dat het inzicht ook wel wat rust geeft.

P4 - Beter gebruik van medicijnen. Omdat op de lange termijn, zou ik dan kunnen zien en terugdenken omdat ik inderdaad beter functioneer met medicijnen. Dus door het inzicht, door de data zegmaar. Ik zou ook het gevoel hebben dat ik er meer grip op had dus dat ik beter begrijp wat het is en dat het minder abstract is. Dus dat zou ik wel prettig vinden

P5 –(about discover triggers & later when seeing the “see progress” goal) I think something that could be cool, it would be nice to see when the app diagnosed you with pollen as a trigger for example. So, you don’t only see what the app diagnosed you with but that you can also see when it happened, like when it says oh we see you used your reliever, that somewhere you can see how many times you have used it that month or, like keeping track of the dates, that would be nice. That is also usefull to go to the doctor with. Like you can see I used it 20 times this month something is really wrong. And then you could see, oh its really wrong in winter or its really wrong in spring and that in summer you use it way less... Aah so it does that, you kind of have what I was talking about.

P5 - Yeah, I mean, to me it makes a lot of sense. I had not seen this yet when talking about the previous screens. But I was like ahh this is what I wanna see you know. A way to track what’s happening. I really like the two bars with the medicine intake and how you control your asthma. I think that’s super helpful. And yeah, I also like that you said that you don’t force reminders, but you can set them

P5 - Cool yeah super cool.

P5 - That’s awesome (about the graphs over the year)

P5 - Can I ask what is your target audience?...Jup cool, I was just thinking about the graphs and everything for people like \*P4\* and I this is perfect but maybe for someone younger, maybe something like more playful would be great. But if this is your target audience then this is perfect.

P5 - Yeah for me this section all makes a lot of sense.

P5 - Jup I would actually, I actually really would use it. To keep track. You know you have the numbers on the inhalers sometimes and thats supposedly a way to keep track. But for me for example I never know, because I have more than one inhaler that I use. So, it’s like, oh did I use 5 in a week or did I use 5 last month. You know I don’t keep track of which one I am using, I have maybe three of the same one in different bags, and one that I leave at home. So, I don’t know. And then also a lot of the time when I have to use it I am in a rush, or u just was exercising, and I am running for a bus and I am trying to do it discretely. That is not something I would like, write in a diary or record or.. but then if it happens for me automatically then that’s super nice.

P5 - The thing is that I would not care so much about it, but then twice a week in bed at night I would open the app and just see how I was doing generally, I feel it would be the same with this. I would care in the moment but then when I have a bit of down time or I’m not feeling well or if I feel like I should go to a doctor I would open it and try to analyze whats happening.

P6 - Wel handig ik vergeet wel eens mn medicatie in te nemen

P6 - Ik denk dat het vooral voor mensen die het net hebben het een fijn is dat je gewoon een overzichtje hebt dat je weet. Ok wat moet ik nou doen hoe laat moet ik het doen en gaat het goed, gaat het niet goed ben ik iets vergeten

P6 - Optimistisch omdat als iemand ziet dat als ie zijn medicatie in neemt dat het dan verbetert, dan zou ik er optimistischer van worden, van “oh het helpt laat ik het blijven doen”.

P6 - Misschien ook wel ambitious, omdat als je in het begin vergeetachtig bent en die app herinnert je eraan dat het steeds maar de helft is wat je neemt. Dan word je misschien wel ambitieus dat je denk van ok dan ga ik het wel echt gewoon goed doen, dat kan het natuurlijk ook in iemand omhoog brengen.

## People want proof

P4 – (medicijn gebruik delen) Liever niet denk ik. Ik wil liever dat ik zelf de controle heb. En zelf kan beslissen ook al weet ik dat het slechter voor me is. Ik zou dat veel liever leren uit resultaten van een app die mij kan laten zien: nu heb je een tijdje onregelmatig je medicijnen gebruikt dus werkt het minder goed. Ik weet bijna zeker dat dat bij mij beter zou werken dan dat mijn huisarts dat tegen mij zegt...Dat is namelijk wel vaker gebeurt, dat mijn huisarts dat zegt, het is echt goed als je wel consequent je pufjes gebruikt. Ik zag niet het resultaat ervan dus ik geloofde het in die zin niet direct dat het zo veel uit maakt. Ik dacht ik bepaal het zelf wel en ik zoek het zelf wel uit.

P4 - Het is een beetje als een dokter tegen jou zegt neem dit medicijn maar en je merkt zelf niet of het iets doet of niet dan heb ik liever dat ik het net gebruik. Maar als ik het dan uit de resultaten zie en uit mijn eigen ervaring wat ik zelf invul, merk als ik het niet gebruik gaat het minder goed, is dat voor mij een veel sterkere reden om mijn gedrag aan te passen.

P6 - Ik doe jaarlijkse longtesten en dan zie je gewoon echt dat het 10% beter is mijn longinhoud met medicatie, en als je dat dan ziet dat helpt zo erg. Dus dan weet je het is dus wel goed dat je die medicatie hebt. En dat je dat inzicht hebt dat is dus wel handig in de app

P6 - en vooral dit vind ik ook heel handig dat je kunt zien hoe veel effect het heeft. Dat je kan zien van oh ik neem mijn medicatie niet in en dan zie je gelijk een effect dat je meer benauwd word. Dus dat je het echt duidelijk ziet in een grafiek, dus dan is het **gewoon echt bewijs**. Dat vind ik wel slim

## Over reminders

P2 - Ik denk dat het wel heel erg belangrijk is dat dit erin zit en dat je dat dus ook inderdaad kan zien. Bij mij is het ook zo dat als ik me echt goed voel dan wil ik nog wel eens een puffje vergeten. Bij mij zijn de reminders bijvoorbeeld wel heel handig. En ook vooral als het goed gaat vergeet je ook gewoon soms of je die dingen nou wel of niet hebt genomen... en soms denk je er niet bewust bij na en als je er niet bewust bij na denkt dan weet je dus echt niet meer of je hem nou wel of niet hebt genomen... dus wat mij betreft zou ik het heel fijn vinden als die app mij daarin kan ondersteunen, dat je kan zien ik heb het wel genomen dat je dan denkt "ohh gelukkig". Of als je hem dan dus niet neemt dat je telefoon je daaraan herinnert.

P2 - Ik zat pas ook te denken misschien moet ik ook gewoon een herinnering in m'n telefoon zetten dat de die altijd blijft zien.

P3 - Ik zou liever niet voor elk medicijn een reminder krijgen (aan en uit zetten dan). Ik zou het wel in de app willen zien, dat is gewoon handig.

P6 - Hij geeft dan ook reminders toch dat je hem nog had moeten nemen? Het is wel een duidelijk overzicht van oh ik heb nog niet alles genomen vandaag dus dat helpt wel.

P6 - Ja reminders zou ik heel fijn vinden, want ik merk ook zelf dat ik 's ochtends mijn controller vergeet. Vooral ook omdat iedereen gewoon een druk leven heeft dus dat ze het dan wel goed nemen dat is wel handig. Dus ja die reminders dat zou wel heel chill zijn.

P6 - Maar vooral in het begin is het nog even wennen. En dan moet het in je systeem komen en dan vergeet je het soms en dan is zo'n reminder juist heel fijn, en als je het na een tijdje uit kan zetten dan is het ook prima. Of misschien dat die app zelf kan zeggen ik geef geen reminder als je het al genomen hebt.

## Acq

Waarvoor staat acq? Ik denk dat ik het nooit heb gedaan. Ik kan het me niet herinneren...Ja ik heb dit recent nog gedaan eigenlijk. Maar zonder de leuke icoontjes. Het ziet er goed uit, netjes.

## Suggestion acq:

P2 - Week schema: die ACQ wordt dan gebaseerd op deze vragen. Ik ben altijd wel benieuwd wanneer die dan zegt dat het in controle is. Want soms zit daar wel een verschil tussen wat je zelf vindt, en wat de app vindt. Want ik moest ook altijd een cijfer geven. En ik denk dat zoiets is misschien ook nog wel interessant is om toe te voegen naast de ACQ. Ik moest dan ook een doel invullen een eigen doel, en dan moest je invullen hoe ver je dat die week bereikt had en wat je daarvan vindt. En dat vond ik ook wel een hele leuke. Want soms kan het zo zijn dat je wel nachts bent wakker geworden, maar dat je dan toch wel tevreden er mee bent. En dan zal het misschien wel in control niet helemaal positief eruit komen, maar het kan dan wel gewoon zijn dat je vind dat het toch een goede week is geweest. Dus dat zou ik misschien nog toevoegen, dat je het zelf ook een cijfer kan geven. Hoe je vindt dat het gaat.

P2 Ik denk dat soms die score van controle ook niet alles zegt, over hoe je je op dat moment voelt. Want ik denk dat mijn astma hier wel uit komt dat ik hem bijna nooit op 100% zal krijgen. Dus als ik dan zo'n cijfer heb kan ik in ieder geval voor mezelf aan het cijfer zien of ik me wel gewoon goed voelde.

P3 - Maar kun je ook invullen hoe goed je controle over astma was? Ofja dat zat in die acq dingen. Maar dus inderdaad hoe vaak je last had van je astma. Je zou misschien nog een cijfertje kunnen plakken aan wat je persoonlijke perceptie is ervan... Maar in principe als je dit gaat invullen de app die plakt er dan een cijfertje aan en dat zie je dan? Ja misschien een eigen perceptie ervan dat dat een beetje mee weegt hoeft dan niet een absolute waarde te zijn.

## Suggestion see progress

P4 - Het is wel bij dit eerste scherm dat ik dan zie 75% en rood oranje, dan denk ik dat is nog niet helemaal goed, terwijl eigenlijk is dit heel goed dus misschien kun je werken met een vinkje, of met groen. Dat je in een opslag ziet dat je goed op

schema bent. Het percentage match ook niet helemaal, want voor mij is dan twee keer 100%. Want nu lijkt het alsof je ook 70% kan halen, terwijl in mijn geval is het gewoon 0/50/100. (Dag schema)

## Inhalator

P3 - Dat is opzich wel handig. Maar ik denk omdat bij progress ga je ook je inhaler gebruiken, dus misschien kun je dat dan integreren. Dus aan de hand van dat je dat hier zo in voert, je medicijn gebruik dat je aan de hand daarvan dan een reminder krijgt dat je medicijnen bijna op zijn. Wel heel handig want die spray puffers die hebben geen indicatie.

P5 - Maybe you could even have like a notification of your inhaler is running low.

## Setting goals

P2 - Ik vind het wel goed dat je doelen kan stellen omdat je dan ook wat actiever er mee aan de slag gaat. Het is dus toch ook wel iets waar je dan zelf ook wat mee hebt, ik bedoel je kiest zelf voor een doel en dat zal niet voor je bepaald zijn. En ik weet ook dat als ze zelf een doel stelt dan vind ik het toch ook altijd de sport om het dan ook uiteindelijk te halen of in ieder geval in de buurt te komen. Dus dat helpt wel. Ik heb natuurlijk ook zo'n smart watch, ik vind het heel erg leuk als ik die 10.000 stappen heb gehaald, dan komt er zo'n vuurwerkje.

P2 - Ik vind het best interessant om te zien en te kunnen volgen wat bepaalde keuzes die ik maak dan voor gevolg hebben. Dus daarom vind ik dan z'n app als deze ook heel interessant dat je inderdaad ook door af en toe eens wat in te vullen dat je dan toch wat meer ook kan zien hoe het met je gaat en hoe het over de tijd is gegaan. Want vaak weet je nog wel iets maar als je het eenmaal vast legt dan kan je er ook echt nog een keer naar terug kijken en er inderdaad ook wat meer aan koppelen

P2 - Want nu doe ik dat eigenlijk verder niet en dan ga je er maar gewoon op af wat je dacht dat ook alweer je ervaringen waren er mee. En ik denk dat als je dat gewoon vast kan leggen dat dat ook echt een toegevoegde waarde heeft.

P4 - Ik vind de doelen heel duidelijk, heel goed. Op het moment dat het alleen maar een lijst met informatie is dan kijk je er een keer naar en dan ben je er klaar. Doordat je het opbreekt in kleine stukjes kun je heel makkelijk door dat process heen gaan zonder dat het een enorme heuvel voor je is zeg maar. Dus dat vind ik heel goed en heel duidelijk. En ook met verschillende categorieën.

## Suggestions for setting goals

P2 - Ik denk dat dit wel de basis is waar iedereen wat aan heeft. Misschien kan je nog toevoegen dat mensen zelf nog een doel kunnen bedenken, iets wat nog bij jou past. Bijvoorbeeld mijn doel was de laatste tijd 2x per week sporten en afvallen, ik zou het wel leuk vinden als ik dat er dan ook nog in kwijt kan.

P4 - Ik denk dat ik gewoon door het proces zou gaan lopen. Heb je qua proces iets in gedachten van hoe vaak je een les of dingen doet? Wat is het tempo, elke dat iets doen? Ik zou het denk ik leuk vinden om een dagelijks touchpoint te hebben zeker in het begin.

## Journey

P2 - Ik denk wel dat het je kan stimuleren om er mee bezig te blijven om te kijken als je meer stapjes neemt wat er nog meer gebeurt. Ik denk dat het juist wel leuk is.

P4 - Ik vind dit echt een super mooi scherm met die mooi wit en dan die mooie achtergrond, heel aangename kleuren stelling, I like

P4 - Ik begrijp niet helemaal hoe dit past in de context van de app (journey blocks) discover new lotions, bedoel je dan lotions in de app of bedoel je dan fysieke locaties? En waarom zou ik nieuwe fysieke locaties willen ontdekken...Aah ja oke dus die locations dat zijn, het is zegmaar als een soort, ik kan even niet op het woord komen. Zo'n kaart dat je opzoek gaat naar een schat zegmaar, maar dat je dan telkens van die tussenpunten hebt dat je van die mijlpalen van "oh je moet eerst naar de brug" en dan "naar het water" en dan ben je er zegmaar.

P4 - Wat ik me wel gelijk afvraag is wat is je einddoel? En wat betekenen de tussendoelen. Ik ben vrij resultaat gedreven dus ik zou graag willen weten van waarom moet ik de tussenstappen doen om bij het einddoel te komen. Want wat is het einddoel? En ik gok dan dat het gaat om dat je 100% inzicht heb in je astma, maar dat moet ik nu raden.... Ik zou dat heel erg aan het begin in de introductie doen. Dus je hebt een paar van die schermen dat vind ik heel duidelijk. Misschien kun je daar nog iets aan toevoegen en dan zeggen, vea helpt jou om je doel te bereiken, jouw doel om 100% inzicht te krijgen in jouw astma situatie, zodat je beter voor jezelf kan zorgen of zoiets... Je zou het ook visueel kunnen maken dus dat je



letterlijk een landkaart ziet en dat je dan al het eindpunt kan zien. Dat als je daarop klikt dat je dan ziet "Full understanding of your asthma/", "your preferences", your risk factors to help you cope with your asthma, dus iets dat je ergens het einddoel kan zien lijkt me wel fijn.

P4 - Het is meer voor de leuk. Voor mij is het vooral heel waardevol omdat je dan ziet dat je misschien een andere categorie in stapt en dat is dan heel waardevol. Ik zou misschien proberen het landschap in elkaar te laten overgaan bijvoorbeeld...Ik vind eigenlijk de journey page veel leuker dan de home. Heel sferisch. Ik vind het er heel leuk uit zien, heel aangenaam. Maar de informatie is wel heel waardevol dat je direct kan zien hoe het weer is.

P6 - En dan is zo'n journey wel handig en dan kun je zien dat je steeds meer leert. Want ik kan best wel begrijpen dat je gaat heel lekker en dan heb je opeens een setback. En dan kun je wel op die journey zien maar ik weet al heel veel dus dit hoeft niet zo'n obstakel voor mij te zijn. En dat het ook een reminder is van "je bent al best ver gekomen". En het is gewoon best wel een goed overzicht van je bent hier begonnen. Je hebt dit al geleerd je bent hier wel goed in. Ik denk dat die positieve feedback best wel helpt bij mensen die teleurgesteld zijn of het jammer vinden dat ze deze diagnose hebben gekregen.

P6 - Ik denk dat ook als je steeds positieve feedback blijf geven dat je er op een gegeven moment ook meer positief over gaat zijn en dat je er dan ook meer mee gaat doen.

P6 - Leuk, afwisseling van spijs doet eten toch. En ook als je dan een andere locatie ziet dat je weet oh ik heb wel progress gemaakt. En de afwisseling is wel leuk.

## Share with GP

P5 - If its anonymous for research they could have all the information

P5 - 18 I think I would really enjoy the app for myself. Like I was saying that I can check it, and sort of self-diagnose what is going on, I think that is like the huge advantage, is you feel like you have control over your situation...And then I feel like also the scenario I would use this with a doctor the most is IF something is going wrong, go to them with the app, showing them the results, or like sending them part of the results, but not like that they are constantly getting my every move.

P6 - Voor onderzoek zou ik het willen delen want ik weet hoe moeilijk het is om onderzoeksgegevens te verkrijgen.

## Acq

P2 - So wie so die scores zijn wel echt belangrijk, dan kunnen ze daarbij mee kijken

P3 – dit mogen ze gebruiken

P6 - Acq zou ik prima willen delen

## Triggers

P2 - Triggers die kunnen ook wel heel belangrijk zijn en hetzelfde met astma type. Die zijn wel heel persoonlijk maar aan de andere kant denk ik wel het is belangrijk dat ie daarover kan mee denken.

P4 - Triggers zou ik prima vinden. Het is wel belangrijk dat ze die link met astma kunnen leggen zodat ze daar ook advies op kunnen geven.

P5 - But the triggers and stuff and the goals that would be really fine. I think for me it would be really useful to share this information, I just would not know if I would be willing to do it.

## Goals

P2 - Mn goals die zou ik niet zo heel snel delen, die vind ik echt heel persoonlijk. Dat is iets waar ik dan mee bezig ben, dus dat wil ik dan ook wel graag voor mezelf te houden.

P3- dit niet perse

P3 - Goals zou ik niet vervelend vinden maar ik zou het toch graag voor mezelf houden. Omdat het toch gaat om jou. En ik zou niet perse willen dat mijn huisarts zich daar mee bemoeit. Ik zie het echt als een app voor mezelf.

P5 - I would be totally fine with that.. well actually, goals.. yeah.

## Medicijnen

P2 - Voor mij helpt het wel dat als de huisarts dat dan ziet en hij daar weer over begint dat je dan wel gaat denken oké misschien is het toch echt wel belangrijk, dus in dat opzicht zou ik het dan toch wel delen (medicijn gebruik)

P2 - Ik kan me wel voorstellen dat mensen denken laat ik het dan maar niet meer delen, want ik doe het toch niet. Maar dat is voor de huisarts ook een teken om het daar dan misschien over te gaan hebben. Ik denk wel dat het belangrijk is dat een huisarts aan geeft waarom ie dat wil weten en waarom dat ook belangrijk is, dus dat ie dat dan ook duidelijk aan geeft.

P3 - Ja dit is een lastig puntje want aan de ene kant is het handig dat de arts het weet. Aan de andere kant denk ik niet dat het echt nodig is. Er zit een klein beetje schaamte soms dat je het niet goed hebt gedaan. En dat je het dan eigenlijk niet wil laten zien. Maarja als je je wel er gewoon aan houdt is het natuurlijk geen probleem. Het gevoel dat je gecontroleerd wordt.

P4 - Ik wil niet dat de huisarts het tijdstip kan zien waarop ik mn medicijnen neem, dat vind ik een stap te ver gaan. Dan zou ik me een beetje gecontroleerd voelen denk ik, er van uitgaande dat tijdstippen te zien zijn.

P4 - Liever niet denk ik. Ik wil liever dat ik zelf de controle heb. En zelf kan beslissen ook al weet ik dat het slechter voor me is.

P5 - Actually, part of me would be totally fine with it, because it would help. But another part of me would feel annoyed, like, uncomfortable, that they could see how often I use the reliever. Like sometimes I will either forget what they told me, or I would like have an issue and then almost over do it. So especially the one where it says use of the reliever, I would feel kind of nervous about it.

P6 - Medicijnen: dit is echt zo'n kwestie van als ie ziet dat ik het niet neem, dan kan ie boos op me worden. En dan kom ik met klachten en dan kan ie gewoon zien van "oh maar het komt omdat je je medicatie niet hebt ingenomen". Dus eigenlijk is het heel goed dat je het doet. Maar het is ook dat als het een week slecht gaat dat ik m'n medicijnen niet neem dan ziet hij dat ook gewoon gelijk. Dus opzicht is dat wel een controle die de huisarts dan ook informatie heeft. Van oh je komt nu met klachten naar mij toen, maar ik zie wel dat je de helft van je medicatie niet hebt ingenomen. Dus doe dat eerst en als je klachten dan nog aanhouden kom dan nog maar een keer terug.

P6 - Dus dat is wel een goede controle voor de huisarts, van "ok je hebt die klachten, neem je je medicatie?" "Nee?", dan moet je eerst je medicatie nemen. "Neem je je medicatie wel?" Ok dan gaan we een extra onderzoek inzetten.

P6 - De huisarts kan het tegen je gebruiken, maar hij kan je dan ook beter helpen.

## Air quality measuring

### general

P2 - Ja ik vind dat wel interessant om te weten. Zeker als je er zo simpel wat aan kan doen. Als je daar ook echt last van hebt dan is het wel heel fijn dat je door zoiets simpels eraan herinnert word en dat je het dan ook gelijk kan aanpassen. Dus ik vind dat wel interessant.

P2 - Ik denk wel dat je heel veel inzicht kan geven. En dat je daar ook rekening mee kan houden voor als je bijvoorbeeld naar buiten kan gaan.

P4 - fijn dat je een voorbeeld krijgt. Groen is goed, dat is binnen. Buiten minder want dat is een zes. Ik zou wel benieuwd zijn waarom dat het buiten een zes is, is dat door pollen of stof of lucht (homepage)

P4 - Ik zou wel benieuwd zijn waarom het buiten een 6 is of het pollen is of stof of luchtvochtigheid. Wat dat beïnvloed, want dan denk ik dat ik t fijn zou vinden om op een gegeven moment te leren. Van oja als t mistig word dan weet ik dat ik waarschijnlijk ..

P4 - Ik kan me voorstellen dat je een keer denkt is het wel een goed idee om nu hard te gaan lopen. En als je dan weet van, dit is wel een goede tijd van het jaar en de pollen factor is 1 dus het komt wel goed, dan zou ik me ook wat rustiger voelen. Van ik weet hoe het zit.

P4 - Ook als je binnen kan zien dat de luchtkwaliteit buiten slecht is dat je dan kan besluiten dat je de auto neemt in plaats van dat je gaat fietsen.

P5 - I would love that, I actually a few months ago bought a bit pineapple plant because it is supposed to increase oxygen level, and now we have work boing done in the hall of our home and I actually stuff the front door with a towel because I'm mindful of the fumes that come in. and then I am also using hypo allergen bedding and always worried about the dust that accumulates. So yeah, I would really like that, it would almost tell me when something is off or when I need to clean. Or if the air is changing because of keeping the windows open for example. So yeah it would be good. I think because you only actually notice it when something has gone wrong because of it, you know what I mean. You might have had your windows open for a week and then at the end of it you really don't feel well. And that's when you think oh I need to do something. But this could tell you like immediatly when something is like bad air quality.

P5 - But I like the white and the simplicity. And I like the shape as well. It feels very kind of apple, modern, yeah, neat. Its like something that I would not mind having on a table in my house.

P6 - Air quality score wat bedoel je daar mee? Hoe de kwaliteit van de lucht is? Oh dat is wel handig. Ooh en ook je huis erbij dat is heel chill. Ik heb best wel veel plantjes in m'n kamer staan. Ik vraag me dan altijd af hoe goed dat helpt voor de lucht kwaliteit. Helpt het nou helpt het nou niet.

P6 - Voor die goal related reminder, ik denk dat mensen sneller op hun telefoon kijken dan dat ze op dit dingetje kijken. Maar ik denk dat sommige mensen dit wel fijn vinden dat ze dan niet op hun telefoon hoeven en dat ze dan kunnen zien, oh de kwaliteit is niet zo goed, laat ik even een raampje openzetten.

P6 - Ik vind de temperatuur en de kwaliteit binnen en buiten wel handig. En ook als de luchtkwaliteit dan buit heel slecht is dat je dan juist denk oke laat ik het raam maar even dicht houden. Dus vooral die twee in combi zijn wel heel erg handig.

## People want to take the physical device with them

P4 - Ik zou het wel leuk vinden om hem portable te hebben. Ik zou het wel leuk vinden om het te kunnen testen of als ik in het bos ben ik dan ook echt beter kan ademen.

P4 - Ik zou het ook heel leuk vinden om het in mijn huis te hebben dat ik dan kan weten als ik dan een tijdje niet stofzuig bijvoorbeeld dan heb ik vaak het gevoel dat ik meer benauwd ben. Dus dat zou ik wel leuk vinden om ook bevestigd te zien ergens. Ja ik zou het wel leuk vinden ik denk dat ik hem in het begin dan ook mee zou nemen om een beetje te experimenteren. Idealiter als het 2/3 van dit formaat zou zijn zou ik hem makkelijk mee willen nemen

P5 - I would want this to be as small as possible. Because then you could take it on holiday. It would be cool to have and to see what the levels are and if opening a window would help or what rooms are better. But its also fine, its not that big that it bothers me, just that you know smaller is always better when taking stuff.

## People want control

P2- Ja dat zou ik wel willen weten wat erachter zit dan. Ik zou het wel interessant vinden omdat je dan ook een beetje een beetje het mechanisme begrijpt en je dat dan ook weer kan koppelen aan je astma. Het kan natuurlijk de temperatuur zijn, de lucht vochtigheid of stof. Er zijn natuurlijk heel veel dingen waar het aan kan liggen en ik denk dat het dan juist wel heel belangrijk is om te weten waar ligt het dan precies aan.

## Suggestion

P3 - Opzich vind ik dit wel goed. Of dat het groen is als het goed zit of oranje als het op het randje zit.

P4 - Het zou ook fijn zijn als je hierop een score kan zien van luchtkwaliteit of dat je een score kan zien van rood oranje groen.

## About the concept in general

P2 - Zou denk ik wel invloed hebben gehad. Ik heb nu best wel veel zelf moeten leren en zelf moeten ontdekken. Maar in het begin ben ik er ook niet echt naar gaan zoeken, welke informatie er ook was, ik dacht ik weet wel ongeveer wat asthma is, daar hoef ik niet over te zoeken. Maar er is gewoon veel meer informatie en ik denk dat als ik dat in een app had gehad dat ik daar veel eerder naar gelezen had. En ook inderdaad met die triggers dat je daar gelijk actief mee aan de slag gaat en dat je gelijk leert wat het belang is van de medicatie, ik denk dat dat wel gewoon heel belangrijk is om bepaalde dingen vol te houden. En ik heb dat nu wel gaandeweg geleerd, maar ik denk dat het ook wel goed is als je eventueel die informatie gelijk tot je beschikking hebt. En dan kan je er natuurlijk voor kiezen of je er op dat moment wat mee doet of dat je er later wat mee doet. Maar ik vond het in het begin ook heel veel informatie en ook best wel veel informatie waarvan ik dacht dit past ook weer niet helemaal. Net als hier in de app staat dan dat je kan leren wat voor type je asthma is en dan kan je waarschijnlijk ook over je type astma wat meer lezen.

P2 - Ik vind het heel goed dat je bewust wordt gemaakt van triggers en ook van je omgeving. Dat je denkt van hee hoe speelt mijn omgeving daarin een rol. Dat je bewust wordt gemaakt van dat medicatie toch ook wel heel erg belangrijk is. En ook inderdaad verschillende types vind ik ook wel belangrijk dat je daarop word gewezen. En dat je de informatie bij elkaar hebt, ik denk dat dat ook wel heel fijn is, zeker voor mensen die nog maar net astma hebben. En bij mensen die al langer astma hebben denk ik ook dat het wel inzicht geeft. Wat zijn nou de dingen waar ik dan last van heb.

P3 - Wat ik goed vind aan het concept is dat je eigenlijk het hele process van astma van je triggers tot je medicatie en je schema dat je dat in een app kan hebben. Daardoor heb je ook gewoon wat meer overzicht van je medicatie en hoe jij moet omgaan met je astma. En dat is wel beter dan. Je kunt er beter een gewoonte van maken op die manier dan als het gewoon op je nachtkast staat. Je telefoon heb je altijd bij je. En daardoor is het makkelijker om mee te werken...Het nadeel van zo'n app is dat je er elke dag aan word herinnert dat je astma hebt. Dat is zegmaar, ik vond dat vroeger nu nog steeds soms vind ik dat wel vervelend. En vaak merk ik er niks van, totdat ik benauwd word, dan krijg je een iets vervelendere herinnering dat je astma hebt. Wat dat betreft is zo'n app wel wat minder vervelende herinnering.

P3 - Het zou ook wel mooi zijn als het echt door ontwikkeld wordt. Want ik denk dat heel veel mensen daar wel baat bij hebben.

P4 - Goed dat het stapsgewijs is, dus dat het leer proces, het inzicht process opgebroken is in behapbare stukjes.

P5 - 18 I think I would really enjoy the app for myself. Like I was saying that I can check it, and sort of self-diagnose what is going on, I think that is like the huge advantage, is you feel like you have control over your situation...

P5 - Yeah, I mean like, I really, really like the connectedness to your inhaler I think that is super useful. I think that to me really the thing that stands out. It would be kind of cool if your inhaler was a nicer permanent material that you keep, and then you could just replace the tin. So, then you kind of have a permanent smart object that is yours that you own and you are just replacing the doses.

P6 - Ik ben positief. Ik wist niet wat ik moest verwachten en ik ben heel positief erover. Want ik vind het echt een goede app. Vooral voor mensen die nog niet zo gestructureerd er in zijn. En het kan denk ik ook wel helpen met de motivatie om het goed te nemen. Vooral ook als je ziet van "oh ik ben vergeten en daarom is mijn astma nu slechter", dan krijg je juist motivatie om het te blijven nemen. Dus dat je ook echt het ziet dat het slechter gaat in verband met dat je je medicatie niet hebt genomen. En ik denk opzich dat mensen ook optimistischer worden dat ze zien, het is helemaal niet zo erg, ik kan hier gewoon prima mee leven zolang ik mijn medicatie maar gewoon blijf nemen.

P6- Ik vind het wel echt een leuke app. Ik zou het zelf misschien nog steeds wel willen gebruiken, gewoon voor die overzichtjes.

P6 - Ik vind dat je best wel iets heel moois eruit hebt kunnen halen.

## Personalisatie

P2 - En je leest ook op internet toch Heel veel dingen over: "heel veel mensen hebben het van kinds af aan" ... ja dat heb ik niet "mensen hebben het als ze inspanning leveren"... ja dat heb ik ook niet.. Dus dat zijn al heel veel dingen waardoor je een soort van ontmoedigd raakt om verder te lezen.

P2 - Ik denk dat het wel goed is dat je gewoon in een oogopslag ziet, iedereen heeft dus blijkbaar zijn eigen type, het is in ieder geval belangrijk dat je je medicatie neemt, en leer wat jouw triggers zijn en hoe JIJ er mee om kan gaan. Ik denk dat

dat veel meer gepersonaliseerd is dan uiteindelijk en sneller gepersonaliseerd is dan wanneer je op internet maar gewoon wat gaat zoeken.

P3- En ook dit maakt het wel goed want je personaliseert het en dat vind ik wel een goeie dat dat erin zit (triggers)

P4 - Dat het gepersonaliseerd is dus dat je echt naar je eigen situatie kan kijken met jouw specifieke omstandigheden en allergieën. (goed)

## Autonomy & competence

P2 - Ik heb wel het idee dat deze app echt een hulpmiddel is voor jou, dus niet dat ie bepaald wat je moet doen, maar dat ie je probeert te helpen dus dat ie inderdaad een soort van ondersteunend is.

P2 - Ik denk dat het je heel veel **inzicht** kan geven. En ik denk dat inzicht je uiteindelijk verder kan helpen... dus ja dat zijn wel allemaal dingen die je moet leren en die je moet weten en dat je je dan ook daarop kan aanpassen. Dus ik denk dat daarom ook die app heel belangrijk is om jou te helpen om inzicht te geven in wat betekent het nou dat je astma hebt en wat betekent het voor jou en hoe kan je er het beste mee om gaan.

P3 - Ik heb het idee dat je wel autonomie hebt. Je hebt wel het stukje dat je een soort van gecontroleerd wordt. Maar je wordt eigenlijk alleen gecontroleerd als je echt een herinnering krijgt dat je wat moet doen. En volledige autonomie is dat je niet per se een herinnering krijgt bij elk medicijn, maar bijvoorbeeld als je de hele dag niks hebt gedaan.

P4 - Ja, omdat, sowieso is die app voor jou alleen. In principe heb jij alleen toegang. Er wordt gekeken naar data die jij invoert. Dus je wet dat er wordt gekeken naar dit is mijn input mijn gegevens. En voor de dingen die je niet weet die ontdek je met die app.

P4 - Ja ik denk het wel, ik denk dat ik daardoor echt beter om zou kunnen gaan met mijn astma

P6 - Ik vind het een combi van autoriteit en autonomy, de app herinnert je wanner je iets moet doen. Maar aan de andere kan, JIJ houd alles bij, JIJ ziet je triggers.

## Controle

P3 - Maar omdat je zelf de statistieken in kan zien heb ik meer het idee dat je zelf controle hebt er over.

## Suggestion

P2 - Het enige wat ik dan inderdaad mis, maar dat had ik al aangegeven is dat het belangrijk is dat je je eigen doelen er in kan zetten en dat er ook bij progress ruimte moet zijn om bijvoorbeeld je eigen cijfer van hoe je je voelt te geven.

P3 - Ik zou kijken of er in die app een stukje is waar je alle verschillende medicijnen zou kunne vinden. Gewoon een hele lijst van astmamedicatie, omdat je daardoor ook wat meer inzicht hebt in eventueel andere medicijnen. Want het ene medicijn werk beter dan het andere. Dut als het niet heel goed gaat ook al zit je wel op schema dan is he wel fijn als je weet dat er nog andere opties zijn. Dan zou ik dat met de dokter bespreken

P3 - En dat die lessons ook bij een kopje "info" kan. Ik zou dan GP vervangen met een kopje informatie.

## Personalisatie

P2

| Curious screen   | Passive screen     |
|--|--------------------|
| Deze. Het gaat toch over jouw astma, dus daarom vind ik hem ook wel mooi geformuleerd dat JIJ kan ontdekken. Dit spreekt mij meer aan omdat ik de gene ben die dat wil weten en ik degene ben die er uiteindelijk ook belang bij heeft. Dus IK moet ook ontdekken wat mijn triggers zijn | Want we help you.. |
| Curious screen   | Passive screen     |

|  |  |
|--|--|
| Deze (1) ze kunnen mij niet helpen. Ik moet het uiteindelijk doen. Dus dan heb ik veel meer aan tips waarmee ik zelf wat kan doen.   | (1)Omdat hier staat we can help you avoid this trigger |
| Curious homepage   | Passive homepage                                       |
| Ik vind deze wel interessant omdat je dan gelijk ook kan zien waar het in zit. Maar ik mis hier dan wel bijvoorbeeld dat cijfer dat bij die ander gegeven word. Dus ik vind dat cijfer heel goed omdat je daarmee uit duidelijk iets ziet en ook qua kleur. Ik wil dat gelijk zien waar het in zit dat je dan niet hoeft door te klikken |  |

P3

|  |   |
|--|---|
| Curious screen   | Passive screen  |
| Links omdat het leest makkelijker en eeh. Het geeft een soort van ehm, idee dat jij dit doet, dat jij dit kan zegmaar. Dat je zelf de kunde hebt (1). Hier is het wat duidelijker dat je zelf dit kan  | (1)want hierzo is het we helpen jou. Voor mijn gevoel is het hier dan nog niet helemaal zeker dat je er zelf achter komen omdat het help is |
| Curious screen   | Passive screen  |
| geen toelichting..   |   |
| Curious homepage   | Passive homepage  |
| Deze, ik hou van cijfertjes en een beetje, zegmaar het detailbeeld. Dat je kunt zien. Oke dit is er aan de hand. Dus je weet dat de luchtvochtigheid hoog is. En dat er kleurtjes bij zitten is ook goed. Maar dat je aan de hand daarvan zelf kan bepalen wat voor cijfer je het zou geven. (1) (willen weten waarom je een 6 krijgt) zeker als je weet dat je trigger bijvoorbeeld door hoge luchtvochtigheid komt dat je dat dan ziet (hypothese: app kan wel triggers vinden maar je weet zelf hoe je daarop reageert die intelligentie heeft de app niet, dus dat willen mensen zelf kunnen inschatten) | In plaats van hier is het onzeker wat je, waardoor je hier een 6 krijgt bijvoorbeeld. Dan van alles zijn en hierzo is dat duidelijker       |

P4

|  |   |
|--|---|
| Curious screen   | Passive screen  |
| Dit is ietwat onpersoonlijker  | In eerste instantie, ik vind dit vriendelijker. Ik denk wel wie, wie dan? Op het moment dat het dus een persoon is of iemand die jou gaat helpen dan zou ik |
| Curious screen   | Passive screen  |
|  | Ik vind die aangenamer, omdat het door het word help wat vriendelijker is   |
| Curious homepage   | Passive homepage  |
| Ik heb hier een voorkeur voor. En ik dacht misschien kan je wel de journey als achtergrond hier integreren. Want die stijl is heel prettig en aangenaam. Ik zou graag al die kleine dingetjes ook er bij zen, zodat je gelijk inziet oh het zit zo en zo. En ik zie hier niet het cijfer, want dan zou ik misschien dat er bij willen hebben.<br>Ik wil het graag zien omdat ik weet dat ik allergisch ben voor pollen en dat luchtvochtigheid ook invloed heeft dus dat wil ik wel zien. En het is opzich ook heel handig als het weer er bij zit, want als het mistig is dan heeft dat ook nog invloed |   |

P5

|   |                |
|---|----------------|
| Curious screen  | Passive screen |
| I like the first one better because it feels more like I am in control, like I can discover. On the left it sounds like |                |

|  |   |
|--|---|
| doctors and they are holding my hand through this process. and on the left it feels like an awesome app that is giving me control of my situation  |   |
| Curious screen   | Passive screen  |
| Can I suggest something. "this is important to know because then you can receive tips on how to avoid these triggers". Then you remove the "we" I tend to not like the word like "helping" because it feels like dependent. And I also prefer when there is not the "we" because then who is the "we". You know this company or the doctor. If you have it like "then YOU can receive tips, then it's again all about you you you" |   |
| I like the imagery, it's nice  |   |
| Curious homepage   | Passive homepage  |
|  | Well I actually would really like both, it would be nice if it was maybe like a drawer, so if you have the overview, and then if you tap it. It would be nice to have the quick glance. And then also the detailed. |

P6

|                  |  |
|------------------|--|
| Curious screen   | Passive screen   |
|                  | Mij trekt deze tekst me iets meer. Omdat er iets van een samenwerkingsverband staat. Zo van iemand helpt mij, ik sta hier niet alleen voor.<br>Dat je niet alles in je eentje hoeft te doen. Deze app is er echt om je te helpen   |
| Curious screen   | Passive screen   |
|                  | Deze dat ze zeggen dat ze tips geven. En dat is wel handig.  |
| Curious homepage | Passive homepage   |
|                  | Als je even snel wil kijken zou ik dit fijner vinden. Dit is een goed overzicht van groen goed, oranje, minder. En dat als je dan meer wil weten dat je er dan gewoon op klikt en dat ie dan zegt waarom is het slecht. Dus dat je weet is het pollen, is het misschien niet zo handig om te gaan sporten. Maar als bijvoorbeeld luchtvochtigheid is, en je weet daar heb ik niet z'n last van dan is het prima. Dat je dan als je meer wilt weten dat je dan er dieper in kan gaan. |

## Interaction ACQ

Interaction with the ACQ is clear for all users

Every participant says they have no idea what an ACQ is, once they have seen it each of them remembers they have actually filled it out several times before.

## Interface Physical device

Clear to all participants

Overig:

P4 Ja ik vind de basics opzich wel heel duidelijk. Ik dacht je kan ook understanding gebruiken of iets van begrijpen zou ook kunnen. Maar dat is een kleinigheidje. Ja als je zegt "all you need to know" dan vind ik het minder de basics zegmaar. Als je zeg basics, dan zou ik het in de omschrijving ook wat luchtiger houden iets van eh, "a few essentials on understanding asthma" ofziets.



# Appendix 16

## Healthcare provider evaluation

### 16.1 Research set-up

#### User test with GP / POH

##### First impression GP design

#### 1. Goals for the user

Apparatus: overzicht van de doelen + uitleg

1. what do you think of the goals the user can set
2. are there goals missing?
3. which goals are most usefull?

#### 2. Discover triggers

Apparatus: scenario + uitleg

1. wat vind je van het doel "discover triggers"

#### 3. See progress

Apparatus: scenario + uitleg

1. wat vind je van het doel "see progress"

#### 4. GP interface

Apparatus: uitleg van de interface

1. wat vind je van de interface
2. Wat vind je van het idee om gegevens van de gebruiker te kunnen zien?

#### 5. general evaluation

1. Wat vind je van het concept als geheel?
2. Wat vind je goed aan het concept?
3. Wat denk je dat er verbeterd kan worden aan het concept?
4. Wat denk je dat je invloed van het concept zou zijn op de behandeling van astmapatiënten?
5. Wat denk je dat de invloed van het concept zou zijn op het self-management van de astmapatiënt?
6. Wat zijn volgens zou de limitaties van het concept?

## 16.2 Results healthcare provider evaluation

### Layout

GP1 - Leuke kleurtjes

GP1 - Heel overzichtelijk en duidelijk

GP1 - Het ziet er prachtig uit

GP1 - Niet te veel tekst meteen duidelijk wat je gaat doen

GP1 - Ik vind het er prachtig uit zien met die kleurtjes, heel overzichtelijk en niet te veel tekst

GP1 - Ik vind het een fraaie app qua lay out. Eenvoudig en toch chique.

GP2 - Ja ik vind het er heel mooi uit zien, overzichtelijk uit zien.

GP2 - Ik vind het een hele leuke opzet.

GP2 - Volgens mij is het heel inzichtelijk. Verschillende kleurtjes en die kleurtjes komen ook terug. En ik vind die reis ook echt heel leuk.

### See progress

GP1 - Met elke exacerbatie zien we dat de longfunctie achteruitgaat, en dit zorgt er misschien voor dat mensen het op tijd door hebben dat we het ook kunnen voorkomen dan

GP1 - Dit is precies wat je nodig hebt. Dan mensen inzicht krijgen. Ik denk dat dit echt heel handig is.

GP1 - Heel handig dat ie die progress bij houdt, dan kan ik meteen zien wat er aan de hand is en dat dan uitleggen

GP1 - Vooral voor jonge mensen die zijn slecht compliant dat is een enorme aanvulling

GP1 - ik denk dat het goed is dat mensen kunnen zien of ze hun medicijnen gebruiken en dat ze gestimuleerd worden om dat te doen. En misschien stoppen ze dan nog steeds wel maar ik hoop dat het inzicht ze dan helpt om dat daarna dan niet meer te doen.

GP2 - Ja heel duidelijk en heel leuk dat je het zo grafisch kan zien. Oorzaak gevolg komt hier meteen uit. En dan krijg je nog tips erbij, nee ik vind dit eigenlijk heel goed.

### Triggers

GP1 - Ja ik denk dat dat heel handig is, want er zijn zo veel triggers dat mensen dat helemaal niet door hebben. En mensen willen er ook niet continu aan worden herinnerd dat ze astma hebben dus dan is het superhandig dat die app dat voor ze bijhoud.

GP1 - goed, omdat juist astmapatiënten hun triggers doorgaans niet goed herkennen of kennen. Triggers bestaan alleen uit meer dan alleen pollen of inspanning. Kan ook de vriezer bij de AH zijn.

GP2 - Maar dit is wel al heel persoonlijk. Ik zou achterwegen laten om het allergisch te noemen ik zou zeggen dan ben je daar blijkbaar overgevoelig voor. Tussen allergisch en overgevoelig zit een wereld van verschil en dat is ook heel moeilijk aan te tonen.

GP2 - En dat is niet verder een gevalideerde lijst toch die met die triggers. Dus daar zouden we dan nog naar kijken of er nog iets anders voor bestaat wat dan gevalideerd is

GP2 - De opzet is leuk. Dat je zo erdoorheen gaat. En je gaat eigenlijk van een soort basisgegevens en langzaam merkt die patiënt dan dat ie het overzicht zelf gaat hebben. En ik denk dat dat heel leuk is

GP2 - Ik denk dat het kan helpen om inzicht te krijgen. Want als jij geen inspanningsastma hebt dan wil je niet zo een hele pagina over instpanningsastma lezen. Dus als je dat bij je triggers iets niet aan klikt neem ik aan dat je daar verder geen informatie over zal krijgen. Dus ik denk dat dat heel werkzaam is.

GP2 - Mensen zien als ze roken niet als trigger dan zeggen ze, ja roken doe ik altijd, dus dat is niet mijn trigger.

## Share data with GP

GP1 - Ik vind het handig dat ik het ook kan zien, dan kan ik het bekijken en uitleg geven. En we kunnen er dan samen naar kijken.

GP1 - In de basis is het zo dat patiënten geen verantwoording hoeven af te leggen dat moet natuurlijk nooit zo zijn dus het is alleen maar handig dat ik dan mee kan kijken

GP1 - Je moet het egt samen doen, zo zie ik het ook

GP1 - Het meekijken in de app vind ik als zorgverlener prettig, maar patiënt moet vrije keus hebben omdat uit te kunnen zetten.

GP2 - Maar ja wij huisartsen hebben natuurlijk een ongelofelijk scala aan ziektebeelden die we behandelen en astma is maar een minionderdeel. We kunnen niet voor ieder ziektebeeld een appje hebben die je telkens maar moet openen en doen dus dat vind ik nog wel heel lastig, he als het nou geïntegreerd is in een huisartsen informatiesysteem dan zou ik dat heel handig vinden. Maar ook daarin denk ik dat is een jaren plan voordat dat is. De patiënt heeft zn app en die zou dan een printje moeten maken van dat blad. Dan hoeft ik geen app op m'n telefoon te hebben en dan heb ik gewoon een printje en daar kan ik dan gewoon op kladderen en die geef ik dan weer terug aan de patiënt en die kan dat dan bijwerken. Dan blijft het zijn appje en zijn verantwoordelijkheid.

GP2 - Ook heel overzichtelijk. Ik zie daar boven die patiënten namen. Ik zou dat wel lastig vinden om die zo dicht bij elkaar te hebben staan in een overzicht, dan ben ik bang dat ik op de verkeerde klik. En als ik in het dossier van een patiënt zit dan moet ik ook alles afsluiten en hier schiet ik misschien heel makkelijk heen en weer.

GP2 - Het is handig dat die doelen er staan en gelijk er achter het resultaat dan weet ik gelijk waar ik moet kijken

GP2 - En wat betekent die 10 bij expected triggers? Ja en ik vind z'n grafiekje vind ik heel erg leuk. Ik vind het heel lastig om in te schatten, je kan ervan uit gaan dat misschien mensen die appjes kunnen lezen een brein hebben die grafiekjes kunnen lezen. Maar in mijn spreekkamer, dat is een andere groep mensen vooral ook de oudere mensen, voor een hele grote groep mensen is het lastig te zien.

GP2 - Dus ik ben er nog niet van overtuigd dat dit het meest optimale grafiekje is, maar voor mij is het heel simpel hoor. Als we daar echt verder mee willen zouden we dat eens moeten voorleggen aan mensen die daar echt verstand van hebben.

GP2 - Maar voor de rest vind ik hem heel duidelijk en een leuk. De ene gaat omhoog de andere gaat omlaag, ja heel duidelijk.

## Expected influence on treatment

GP1 - Dat mensen minder exacerbaties hebben

GP1 - En dat als je kan zien hoe het gaat misschien dan wel de medicatie naar beneden kan bijstellen. Het kan echt zorgen voor een optimale behandeling.

GP1 - Ik vind het heel erg leuk en het ziet er ontzettend mooi uit. Ik denk ook dat het ervoor kan zorgen dat mensen beter hun astma onder controle krijgen en dat het kan zorgen voor een betere kwaliteit van leven.

GP2 - Longartsen hebben de app asthmaatje met kinderen die dingen bij houdt en dat schijnt goed te werken. En als ik het zo zie dan denk ik yes dat is reuze handig.

GP2 - nou ik denk dat mensen gewoon goed inzicht krijgen in. Eerst moeten mensen eigenlijk leren van goh wanner is mijn astma nou in controle. En hier hangt gelijk ook al meteen aan van wat je nou moet doen of wat de oorzaken zijn dus dat is al weer een stapje verder. En ik denk uiteindelijk als mensen dit vaak gaan gebruiken en zien dat ze daar patronen in gaan herkennen. Ja dat ze gewoon meer grip op hun leven hebben. Dus dat die astma minder onvoorspelbaar voor ze is. En ik denk zeker dat dat positief effect heeft op de kwaliteit van leven, want dat doet het gewoon goed. Ja en uiteindelijk hoop je daarmee ook echt astma aanvallen te voorkomen

## Shortcomings

GP1 - Ik denk wel dat over het algemeen is het zo met apps dat er snel de klad in komt. Maar zeker in het begin is het heel nuttig om mensen te helpen waar ze op moeten letten

GP1 - smart inhalers die zijn nog niet op de markt en gaat ook nog wel even duren

GP1 - Ja dat in het begin is het natuurlijk heel leuk en willen mensen dat allemaal invullen en dan op een gegeven moment hebben ze daar misschien dan geen zin meer in. Mensen willen ook niet altijd bezig zijn met hun ziektes. Dus misschien dat ze dan bepaalde functies or reminders uit moeten kunnen zetten dan.

GP1 - Als zorgverlener vind ik het zeker een toevoeging om mensen meer inzicht te kunnen geven in hun eigen astma-beeld en hopelijk hierdoor compliance te verbeteren, maar zoals ik zei: zelfs de meest enthousiaste gezondheidsapps/portaal gebruikers haken sneller af dan ik had gedacht.

GP2 - Ook daar je kiest heel erg voor die smart en dat dat weer terugkoppelt, ja dat bestaat nog niet. Ze zullen nooit voor 1 device gaan kiezen. Dus willen we dit op de markt krijgen dan zit daar nog wel een bug... Ze zullen het in de beginfase handmatig moeten neer zetten als je het neemt. Dus dat zou een makkelijk dingetje moeten zijn. Want voordat we een smart inhaler hebben die echt zo gekoppeld is, dat gaat denk ik nog wel jaren duren.

GP2 - Want het hele medische ICT is echt een drama, daar moet je zeker niet op gaan wachten als je iets nieuws wil

GP2 - En wat in z'n algemeenheid is bij appjes is dat als het nieuw is dan vinden mensen het leuk he, maar ook daarin is de vraag hoe therapietrouw blijven mensen aan hun app... maar ja dat is in z'n algemeenheid denk ik met appjes.

# Appendix 17

## Evaluation list of requirements

Green = requirement is met

Light green = requirement is met according to user research but cannot be proven with current state of the project

Light blue = criteria is met but based on personal opinion

Light yellow = cannot be determined in the current state of the project

Grey = explained below

## Requirements

R1 The design should be personalized based on the kind of asthma that a patient has

R1.1 The design should be personalized based on type of asthma

R1.2 The design should be personalized based on severity of asthma

R1.3 The design should be personalized based on triggers of the asthma patient

R1.4 the design should personalize based on persona

R1.4.1 The tone of voice should be adjusted to the persona

R2 The design should allow patients to keep track of changing conditions over a longer time.

R2.1 The design should implement the ACQ

R3 The design should stimulate adherence to medication

R3.1 The design should stimulate adherence to anti-inflammatory medication

R3.2 The design should stimulate adherence to reliever medication

R3.3 The design should provide the functionality to track adherence

R3.4 The design should enable the user to set reminders for their medication

R3.5 The design should provide feedback on medication use

R3.6 The app should allow the patient to fill out their medication schedule

R4 the design should create awareness on the patient-side that they can actively participate in their treatment

R4.1 The design should encourage the patient to become more active in their treatment

R5 The design should motivate the user to better self-manage their asthma

R5.1 The design should provide positive feedback

R5.2 The design should stimulate a feeling of progress

R5.3 The design should give insight in positive trends

R5.4 The design should motivate by means of increasing a feeling of competence

R5.5 The design should motivate by means of giving the user autonomy in the choice of their approach to self-management

R6 The design should give the patient autonomy

R6.1 The design should give the user options and freedom to make choices in their approach to self-management

R6.2 The patient should be in charge of his or her data

R7 The main focus of the design should be on medical self-management

R8 The design should support patients in obtaining asthma control through enhanced self-management.

R9 The design should educate the user

R9.1 The design should support the development of self-knowledge

R9.1.1 The design should support the discovery of triggers

R9.1.2 The design should provide users with the tools to act upon discovered triggers

R9.1.3 The tool should support patients to recognize complaints

R9.2 The design should provide knowledge on medication

R9.3 The design should educate the user on what asthma

R9.4 The design should educate the user on asthma treatment

R9.5 The design should educate the user on self-management tasks

R9.6 The design should spread the process of gathering knowledge

R10. Patients should be supported to use their inhaler correctly.

R11 The design should translate gathered data into insight

R11.1 The design should provide insight in level of asthma control

R11.2 The design should provide insight in triggers

R11.3 The design should provide insight in progress of asthma control

R12 The design should activate the user

R12.1 The design should provide action-oriented information

- R12.2 The design should provide action-oriented feedback
- R12.3 The design should enable patients to turn the gathered data into action
- R13 The onboarding of the app should prepare for personalization
  - R13.1 The patient name should be filled out
  - R13.2 The patient attitude/persona should be defined
- R14 Reminders should become more persuasive over time
- R15 The design should not be stigmatizing
  - R15.1 The design should be a support or buddy rather than an authority
  - R15.2 The design should not have a medical look
  - R15.3 The design should not openly display personal information

## Digital design requirements

- R16 The digital design should personalize based on persona
  - R16.1 The digital design must be able to identify persona
  - R16.2 The digital design must adjust the tone of voice based on persona
- R17 The digital design must personalize knowledge
  - R17.1 The digital design must learn from user data
  - R17.2 The digital design must personalize knowledge to type of asthma
  - R17.3 The digital design must personalize knowledge to severity of asthma
  - R17.4 The digital design must personalize knowledge on triggers
  - R17.5 The digital design must personalize knowledge on asthma control
- R18 The digital design must include the GP of the patient
  - R18.1 The digital design must ask for approval to share insights
  - R18.2 The digital design must include a portal for the GP

## Physical design

- R19 The physical design should serve as a reminder
  - R19.1 The physical design must be able to remind user of actions
- R20 The physical design should be discrete
  - R20.1 The physical design should be quiet
  - R20.2 The physical design should not display any personal information
  - R20.3 The design should have a not medical appearance
- R21 The physical design should support the functionality of the digital design

## Feasibility

- R22 The design should be cost effective
- R23 The design should demonstrate feasibility of general, digital and physical design requirements
- R24 Technological development of the design as a whole should be feasible within 5 years

## Viability

- R25 The design should be ethically justified
- R26 The design should be an addition to traditional care
- R27 The design should be innovative
- R28 The design should be time effective for the GP

## Wishes

- W1 Besides focusing on medical self-management, the design should also take into consideration emotional self-management and behavioral self-management
- W2 the design should prevent the development of beliefs
  - W2.1 the tool should tackle beliefs by providing knowledge on the topic at hand.

|    |   |
|----|---|
| W3 | The design should collect data as efficient as possible to minimize the effort required by the user.                |
| W4 | the design should be understandable at a glance   |
| W5 | the design should use gamification  |
| W6 | the design should be aesthetically pleasing   |
| W7 | the design should support patients in finding specific information that applies to their specific need at that time |

## Desirability

|     |  |
|-----|--|
| W8  | The design should create value for asthma patients   |
|     | W8.1 The design should be beneficial for the self-management of asthma patients                            |
|     | W8.2 The design should provide a feeling of support  |
| W9  | The design should fit the context of use   |
|     | W9.1 The design should be usable independently by asthma patients  |
|     | W9.2 The design should be suitable for patients that recently got asthma diagnosis (no required knowledge) |
|     | W9.3 The design should be desirable for well literate patients   |
|     | W9.4 The design should provide insight for the GP  |
| W10 | The digital design should support the development of self-knowledge  |
|     | W10.1 Design should support discovery of triggers  |
| W11 | Logging of data should be time efficient   |
| W12 | The design should meet the wishes of all stakeholders  |
|     | W12.1 The design should support the GP in treatment of the asthma patient                                  |
|     | W12.2 The design should support the asthma patient with their self-management                              |
|     | W12.3 The design should create meaning for CAHAG as an organization  |
|     | W12.4 The digital design should function both in combination with the physical design and independently    |

R22 the design should be cost effective

Within the scope of this project, it is not possible to determine whether the project will be cost effective. It was, however, demonstrated that with funding, the project is feasible. An evaluation of the cost of the design can be found in the report in the section "implementation plan". Or in appendix 13.

R25 the design should be ethically justified

During the design process, quite some attention was paid to the ethics of the design. Through putting the user in charge of their data, the concept tries to prevent unethical sharing of data. Also, it was consciously chosen not to implement a profile picture of the user, as it was mentioned several times that patients found the data very private and they prefer not to share their picture in relation to their data. For the final design, data security will be an essential issue. Data on adherence and asthma control should be protected at all times, and should not come in the hands of insurance companies, for example.

R28 the design should be time effective for the GP

Making the link to the GP in the design will still require quite some development. Due to regulations and restrictions related to their computer system, implementation into their system will likely take years. For the first versions of the app, it is recommended to add a function for the patient to export their data so they can take it to the GP by themselves.

At the beginning implementing a discussion on the gathered data by the app might take some extra time during a consult. However, this extra time will decrease when it becomes more of a routine to discuss the app. Also, the discussions between GP and patient might become more fruitful because they are based on facts and provide more insight into a patients condition. Besides that, it could support patients to obtain asthma control more efficiently, meaning that they might require less frequent visits to the GP.

W3. The design should collect data as efficient as possible to minimize the effort required by the user.

This wish is ensured by linking the design to a smart inhaler. However, as mentioned several times, this development might take some years. Therefore, the app must be designed in a way that either tracking medicine intake becomes unnecessary. Alternatively, logging medicine intake by the patient should be easy and fast.

W4 the design should be understandable at a glance

It was attempted to make the design as intuitive as possible. Also, to make the layout clear and easy to grasp. However, as I am a product designer, I have little experience with designing apps and visual representations of data. It is recommended to have an expert at this in this field go over the design. This could improve the usability of the design and might make the app usable for a larger target group.

W7 the design should support patients in finding specific information that applies to their specific need at that time

The design is intended to provide the right information at the right time. However, since only two goals were worked out, it is difficult to say if the complete app fulfills this requirement. The function "discover triggers" and "see progress" do so by providing information related to the gathered data, and having this data always at hand by one click on a button. Supporting patients to find the right information at the right time should also be the case for each of the other goals that get developed.

# Appendix 18

## Project brief

### INTRODUCTION \*\*

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

This project is initiated by CAHAG (COPD & Asthma General Practitioners Advisory Group) and Leiden University Medical Centre (LUMC) / National eHealth Living Lab (NeLL).

Asthma is a chronic infection of the airways that leads to narrowing of the airways. This makes the lungs easily irritable and can lead to coughing, wheezing and shortness of breath (Astma-COPD.nl, 2018). Worldwide 399 million people suffer from asthma (Global Asthma Network, 2018) and in the Netherlands alone 640.000 people suffer from asthma, it is expected that in the near future these numbers will only increase (Longfonds, 2018). When suffering from asthma self-management is of a significant importance in treating the disease. Factors that are important for example can be the regular intake of medication. Only when taking anti-inflammatory asthma medication regularly complaints can decrease and other medication such as bronchodilators are needed less (Thuisarts.nl, 2015). Other factors that can help giving insight in the disease and improve conditions are monitoring the disease, avoiding irritation of the lungs and regular exercise.

The main objective is to develop a digital and/or physical application that supports newly diagnosed asthma patients in their self-management, in order to help them to improve their own condition.

According to Lorig and Holman, self-management consists of three main tasks, these are: medical management, behavioural management and emotional management (Lorig and Holman, 2003). Because self-management is a rather complex and multidimensional concept the main focus within this project will be on medical management (see figure 2 for a schematic overview of self-management).

The main opportunities:

An interesting opportunity of medical self-management is to address poor adherence. Poor adherence can be manifested in two ways; intentional and unintentional non-adherence. Research has shown that poor adherence is the main reason for poor asthma control (Horne and Weinman, 1999). By empowering the patient to improve their adherence they can get their asthma under control. In the long term asthma control will lead to a normal life expectancy, on a societal level higher asthma control will lead to more cost effective treatment.

Main limitations: There are a lot of interrelated elements that have to do with self-management, it is important to keep the scope of the project in mind and not to try and solve all problems in one project. Besides that most patients are not aware of their problems and the fact that their asthma condition could and should improve, it can be challenging to reach these people and to design for a problem that they themselves do not recognize.

Stakeholders:

CAHAG is a group of general practitioners with a special interest in the diseases COPD and Asthma. Their main interest is to improve the treatment of asthma in the first-line (Hogendoorn, 2015), meaning the treatment by the General Practitioner without a referral.

Besides the CAHAG LUMC and NeLL there are four other main parties involved in the project, these are GSK, Boehringer Ingelheim, Astra Zeneca and Novartis. These four pharmaceutical companies together are the market leaders of asthma medication in the Netherlands. Their main interest is in therapy compliance and improvement of asthma management.



### Mentoring

|                                     |
|-------------------------------------|
| TU Delft                            |
| Sonja Paus-Buzink<br>Natalia Romero |
| VanBerlo                            |
| Vincent Laagland                    |

### Project

|                    |
|--------------------|
| Graduation Project |
| Iris               |

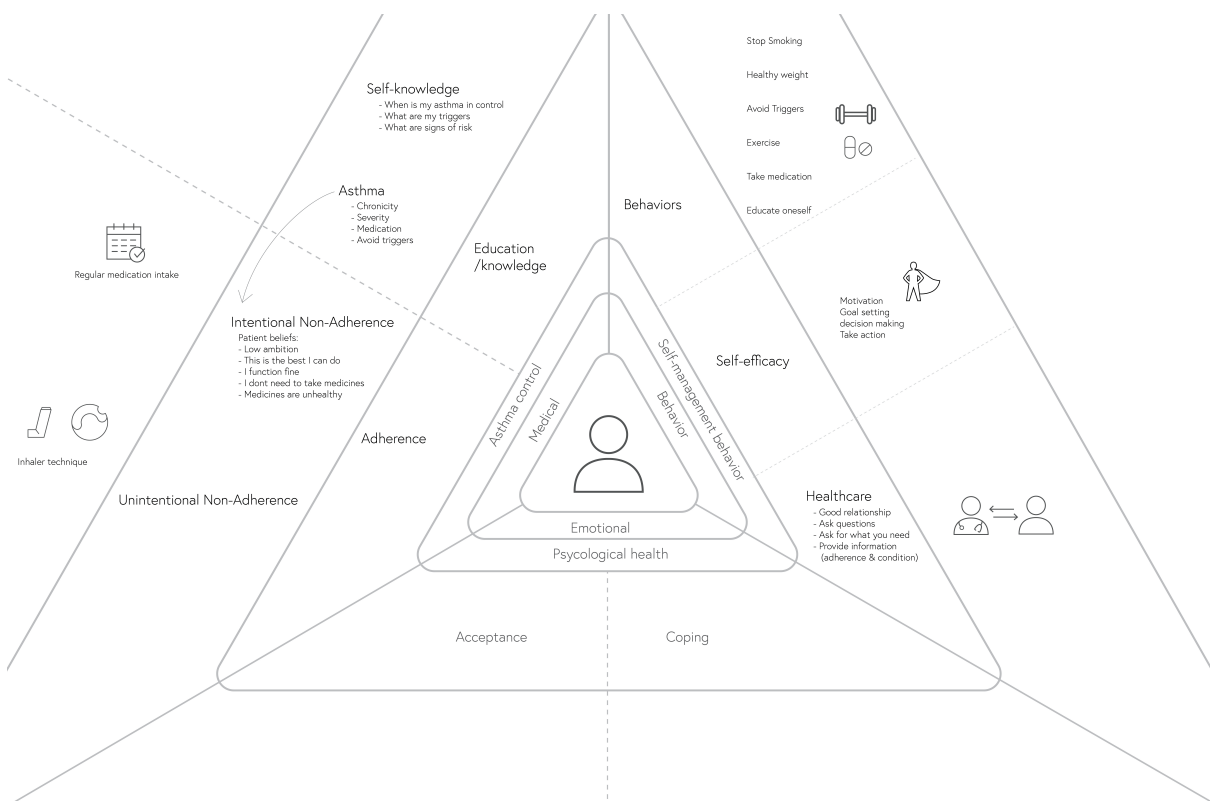
### Primary stakeholder (Client)

|   |
|---|
| CAHAG   |
| CAHAG is the client                             |
| Primary contact person:<br>Cynthia Hallensleben |

### Secondary Stakeholders

|                             |
|-----------------------------|
| LUMC / NELL                 |
| Co-initiator of the project |
| Pharmacists                 |
| GSK                         |
| Novartis                    |
| Boehringer Ingelheim        |
| Astra zeneca                |

image / figure 1: Stakeholder analysis



## PROBLEM DEFINITION \*\*

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

The main problem in the current situation is that many asthma patients do not take care of their disease optimally, which leads to unnecessary uncontrolled asthma. In most cases asthma control can be achieved by adherence to treatment.

As mentioned before, there are two types of/reasons for non-adherence; intentional non-adherence and unintentional non-adherence. Intentional non-adherence is related to the patients beliefs about the treatment, based on these beliefs patients consciously decide not to adhere to treatment. Unintentional non-adherence, on the other hand, is related to people's inability to adhere to treatment. These are aspects such as forgetfulness, poor inhaler technique and incorrect use and application of information.

The target group for the project are young adults who have recently been diagnosed with asthma. The focus will be on patients that should be capable of proper self-management with the tools that are available to them (well literate, access to online information), however they somehow lack in doing so.

The primary goal of this project will be to increase patient adherence, and thus to decrease both intentional and unintentional non-adherence.

Research questions:

How can design for increased competence improve therapy adherence?

- What does self-management in asthma comprise of?
- What are reasons for unintentional and intentional poor adherence?
- How can asthma patients' adherence be enhanced/supported?
- How can different aspects of adherence be implemented in one holistic self-management system that improves the therapy adherence of patients?

## ASSIGNMENT \*\*

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... . In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

Design an asthma self-management system that increases asthma patients' competence to adhere to their therapy. \_\_\_\_\_

As stated in the introduction within the multidimensional concept of self-management the focus of this project will be on the medical aspect of self-management, which means increasing the therapy adherence of asthma patients.

The goal is to design a holistic system that increases the competence of the user in adherence. In order to do so both intentional non-adherence and unintentional non-adherence need to be addressed.

It is expected that a combination of a digital tool and a physical tool will be developed. The digital tool could mostly focus on decreasing the intentional non-adherence. This could be done through personalised storytelling, meaning that the app should provide the right knowledge or insights at the right moment. The physical element will then likely be a redesign of the inhaler that focusses on increasing the users' competence of medication use.

Also both tools should log information about the adherence of the patient to support the general practitioner in their treatment of the patient.

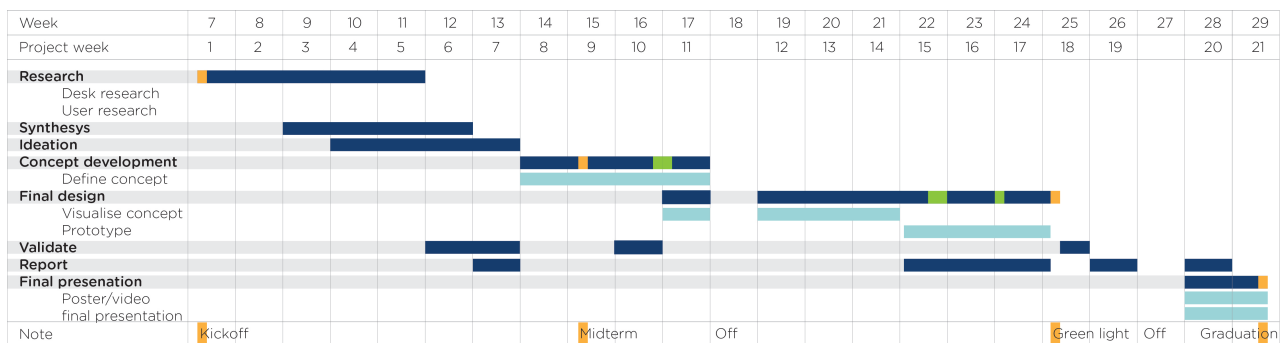
## PLANNING AND APPROACH \*\*

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 12 - 3 - 2019

18 - 7 - 2019

end date



This project will last 21 weeks, however when excluding the green days it counts up to 100 working days exactly

**Research:** I will start the project with a research phase in which I want to educate myself in what asthma is and what the role of therapy compliance and self-management is. I will do so by desk research in the first place.

After I have a basic understanding of what asthma is I want to do user research, this will consist of qualitative research with a few asthma patients to get to know the context better and to find out what their problems related to self-management are. Also I want to talk to general practitioners to find out how I could support them in better helping their patients.

**Synthesis:** In this phase I will synthesise my research findings, based on the findings will set the design parameters and create a list of requirements.

**Ideate, create, iterate:** The next phase will be ideating, in this phase I will brainstorm on concepts. I will verify my ideas with users using MVP's (minimal viable prototypes). At the end of this phase I want to have three concept directions.

**Concept development:** After an evaluation I will continue with one of the concept directions and elaborate and iterate on it.

**Final design:** In week 11 I want to finish my last iteration of the concept and start on the final design. I want to visualise the concept, and work it out in detail using flowcharts and wireframes. Also I want to make a CAD model and aesthetic prototype of the physical product and a demonstration of the app.

**Validate:** In this phase I want to do a user validation with the final concept. I don't expect to have a fully working physical product, but I could use an aesthetic prototype, imagery and movies to test both the app and the physical product.

**Report and deliverables:** Throughout the whole process I will be working on the report as can be seen in the visual and in the last weeks I will focus on the final presentation and end deliverables.

**Note:** due to RSI 2 weeks of holidays are planned for recovery of my arm, in these weeks I will not work on the project

## MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... . Stick to no more than five ambitions.

For my graduation I am very passionate about designing a medical consumer product. This because I believe that in the medical world there is still a lot of room for improvement in patient care especially in the comfort of people's own home. I believe that with design we can achieve a lot of improvement in the quality of the life for patients, which I would love to contribute to.

I chose to do this project because asthma is a large problem in the Netherlands that is still growing. In recent years there has not been much innovation in the asthma sector and with this project I hope to stimulate for more innovation and attention for the problem. As the project is in cocreation with motivated individuals from CAHAG, GSK, Boehringer Ingelheim and Novartis I am hoping we can achieve something that can eventually be produced.

As I have been studying both Interaction- and Product Design at four different universities (TU/e, RMIT, UID and TU/Delft) I would like implement both competencies into my thesis project.

I have obtained some basic knowledge in interaction design, especially in the field of designing physical interactions. In the design of the physical product I want to demonstrate my competencies in this area. A learning goal for me is to improve my skills in digital interaction design (the design of an app). I want to learn how to make use-flows and a wire-frame for the digital application.

As I am studying IPD I also want to want to make a physical product. What I want to focus on especially is developing an aesthetically pleasing product, non-stigmatizing and pleasant in interaction. I want to think about the CMF (colour, material and finish) of the product. And in the design of the product I would like to touch upon production as well. I want to think of the different elements that are needed to make a working product, I want to think of production techniques and make a proposal that contains these aspects.

My ambition is to develop a complete product service system. What I mean with this that I would like to deliver a complete design package including an app and a physical product design that are well-integrated. More in depth this means that I would love to have a wire frame for the app including a working demonstration of the app designed in adobe XD or sketch. Besides that I would like to have a well-designed physical product, and an aesthetic model. Lastly I would like to create a consistent design language in all elements of the product service system.

Sources(1):

Astma-COPD.nl. (2018). Astma - Astma-COPD.nl. [online] Available at: <https://www.astma-copd.nl/astma/> [Accessed 11 Dec. 2018].

Global asthma network. (2018). [online] Available at: <http://globalasthmareport.org/Global%20Asthma%20Report%202018.pdf> [Accessed 8 Dec. 2018].

Hogendoorn, A. (2015). Wat houdt eerstelijnszorg en tweedelijnszorg in? - Independer.nl. [online] Independer.nl. Available at: <https://weblog.independer.nl/huisartsen/wat-houdt-eerstelijnszorg-en-tweedelijnszorg-in/> [Accessed 4 Dec. 2018].

Horne, R. and Weinman, J. (1999). Patients' beliefs about prescribed medicines and their role in adherence to treatment in chronic physical illness. *Journal of Psychosomatic Research*, 47(6), pp.555-567.

Inhalatorgebruik.nl. (n.d.). Inhalatorgebruik.nl. [online] Available at: <https://inhalatorgebruik.nl/nl/home> [Accessed 11 Dec. 2018].

Lorig, K. and Holman, H. (2003). Self-management Education: History, Definition, Outcomes, and mechanisms. *The society of Behavioral Medicine*, [online] pp.1-7. Available at: [https://www.researchgate.net/publication/10657284\\_Self-Management\\_Education\\_History\\_Definition\\_Outcomes\\_and\\_Mechanisms](https://www.researchgate.net/publication/10657284_Self-Management_Education_History_Definition_Outcomes_and_Mechanisms) [Accessed 10 Feb. 2019].

## FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

Sources(2):

Longfonds. (2018). Wat is astma?. [online] Available at: <https://www.longfonds.nl/astma/alles-over-astma/wat-is-astma> [Accessed 8 Dec. 2018].

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