

# **RUN-O2:**

## A Self-Management Tool for Runners with Asthma

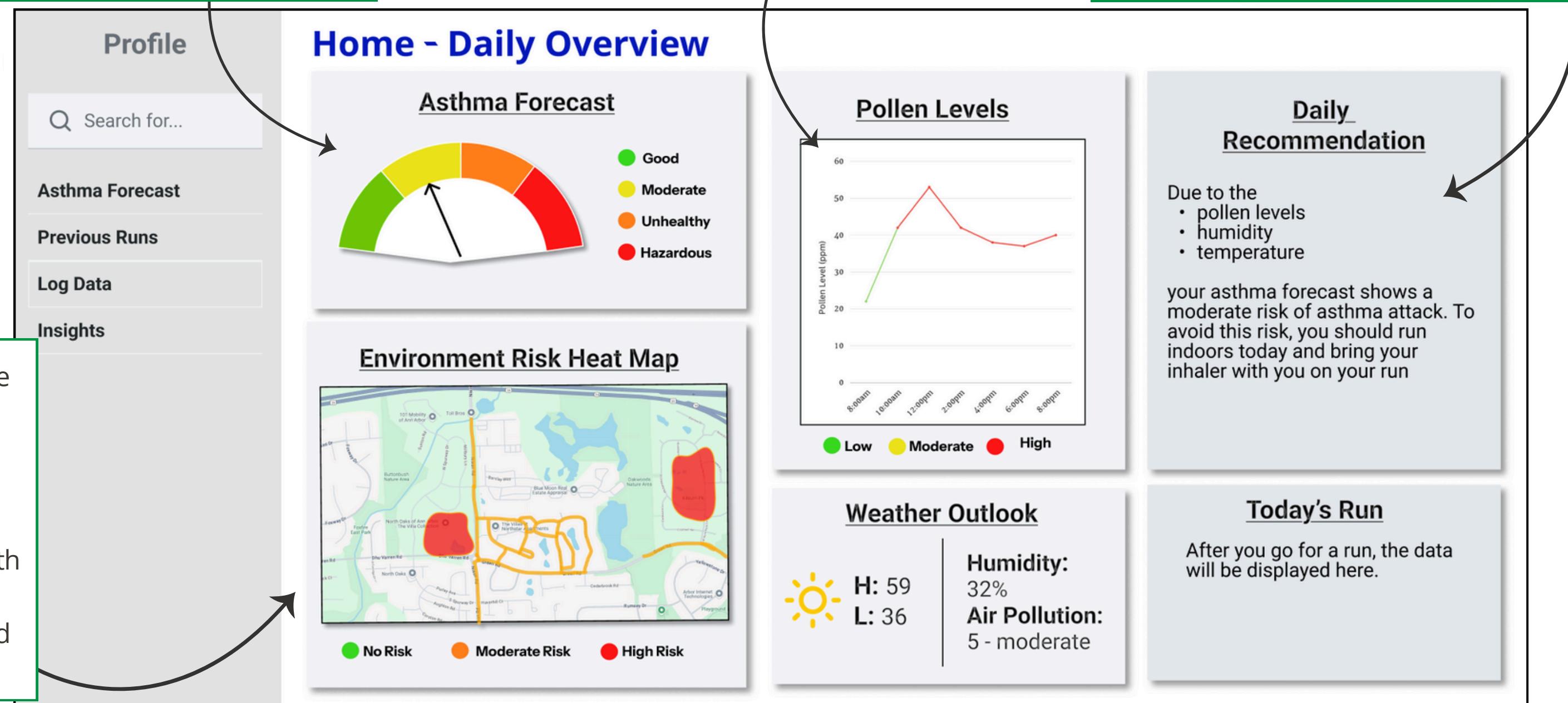
# Prototype Design: 1st Iteration

# Web Dashboard – ‘Home’ Page

The ‘Home’ page is highly personalized to each individual, with visualizations charting information about their particular triggers and geographic location. For example, this user (due to historical responses to pollen levels, humidity, and air quality) has an asthma forecast of ‘Moderate’, whereas another user may have ‘Good’ if pollen is not a common trigger for them.

This chart will show the top trigger for this individual (in this case, pollen) and how that trigger will change throughout the day, giving them idea of what time of day is best to run outdoors. For another user, this may show an allergen such as dust mites or smoke levels.

The daily recommendation section will provide a written summary based on key points from the visualizations and will inform the user of how they should plan to run this day given their data.



The ‘Environment Risk Heat Map’ will be visible on all user’s profiles, but will change based on their typical running routes. It maintains consistency in the color coding and legend for previous visualizations and provides the user with an idea of where to run, so they can adjust their route to avoid flare-ups and triggers.

# Web Dashboard – ‘Analytics’ Page

This page provides historical and predictive analytics to help the user understand their progress and any changes in their self-management. The first chart shows the users' breathing rates on previous runs, along with timestamped inhaler use. They can navigate to different runs on different dates using the button below the chart to see how using the inhaler helped relieve their symptoms.

This chart shows the predicted average inhaler use per month, based on historical trends. It will look different for each user, based on their reaction to seasonal changes and geographic location. The chart can be toggled by 'Existing' to show data from the months of the year that have already passed and 'Predicted' to show the upcoming months, giving the user the ability to plan ahead for more problematic months and also understand why their asthma fluctuates throughout the year.



The 'Top Triggers' chart will be updated based on which variables affect the user's breathing the most on runs. It can provide important information on what to avoid and look out for to mitigate and avoid future flare-ups.

This chart represents the average breathing rate experienced by the user in each season—this is helpful for those who experience allergic asthma flare-ups, so they can see what months they have their symptoms under control (within target range on the chart), and what months they require more effort.

The “Smart Training Suggestions” are similar to the ‘Daily Recommendations’ from the home page, but are tailored to long-term management. It tracks patterns over time and ensures that Run-O2 will have longevity and help the user long-term, past immediate use.

# Web Dashboard – ‘Log Data’ Page

The screenshot shows the 'Log Data' page of a web dashboard. On the left, a sidebar titled 'Profile' includes links for 'Search for...', 'Asthma Forecast', 'Previous Runs', 'Log Data' (which is highlighted in blue), and 'Insights'. The main area is titled 'Log Data' and contains the following fields:

- Title:** A text input field containing 'Morning Run'.
- Run Type:** A dropdown menu showing 'Easy Run' as the selected option, with other choices including 'Race', 'Long Run', 'Tempo', and 'Easy Run'.
- Environment:** A set of three buttons: 'Outdoors' (highlighted in blue), 'Treadmill', and 'Indoor Track'.
- Notes:** A text area with placeholder text: 'Include any notes you would like to remember about this run. This is only for your use.'
- Breathing Difficulty:** A horizontal slider scale from 'No difficulty' to 'Extremely difficult', with the cursor positioned between 'Some strain' and 'Extremely difficult'.
- Inhaler Use:** A dropdown menu showing '3' as the selected option, with other choices from 0 to 4.
- Save:** A blue button at the bottom right.

Users can manually log or edit exercise data collected by the wearable device in the dashboard ‘Log Data’ page.

This accommodates the product requirement of mitigating incomplete or inaccurate data collection from the wearable device (Huckvale et al., 2012).

Design and motivation inspired by Strava  
(Strava, n.d.)

# Prototype – watch interface

The Run-O2 watch is similar to the 'personal coach' aspect of the dashboard. It will monitor the user's symptoms and bio-signals while they run and provide real-time recommendations to assist them. The interface will account for their previous running data to differentiate between elevated breathing due to asthma or due to typical cardiovascular energy expenditure, and provide recommendations on pace or medication based on this.



The watch will monitor the user's heart rate and respiration, keeping track of any potential triggers or symptoms. If it detects abnormalities, it will vibrate with an alert and recommendation to mitigate the symptoms and continue running, rather than ending their run pre-maturely.

The "Log Inhaler" button on the top left will allow users to track real-time medication use during their run. This data will be synced with the dashboard and can be used to understand how inhaler use during runs helps alleviate symptoms. It will also be used for historical insights to track notable changes over time.



During a run the interface will display typical metrics and color coded respiration rates - healthy (green), mild (yellow), and risky (red). This will allow the user to continuously monitor their breathing and have a frame of reference for if they want to slow down or use their inhaler.

# User Testing: Evaluation Goals & Methods

## Aims

- Determine if the visualizations are effective at communicating desired insights and information
- Discover strengths, pain points, and unintended effects of interacting with the watch while exercising
  - Is any of the information unnecessary or unclear?
  - Is there any information missing?
- Ensure that the manual data logging process is intuitive and none of the selection methods are confusing

## Methods

Following the Person Based Approach, the evaluation method will rely on further qualitative research—particularly, think-aloud interviews, as recommended by Yardley et al. (2015), to “gain immediate reactions to every element” and to directly observe its use. To achieve this, the following user tasks were outlined and user interactions with the interface to achieve these tasks were observed.

### User Tasks:

1. Explain the main function of each page in the dashboard - how are they different? How do they work together?
2. Explain each visualization and how you might use this information
3. Describe each watch face and how you might use this information

# User Testing: Findings

## General Feedback

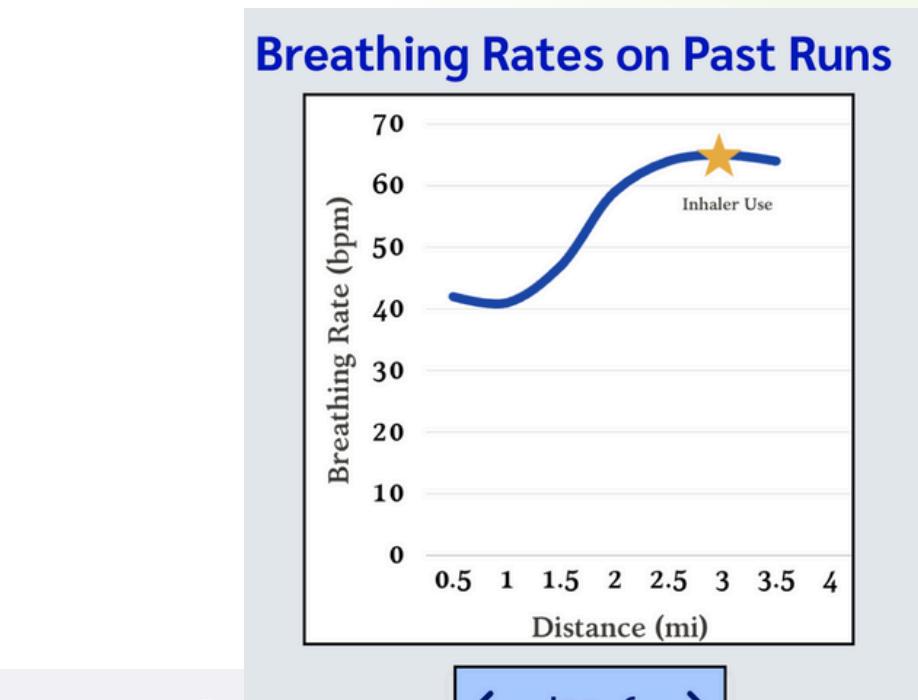
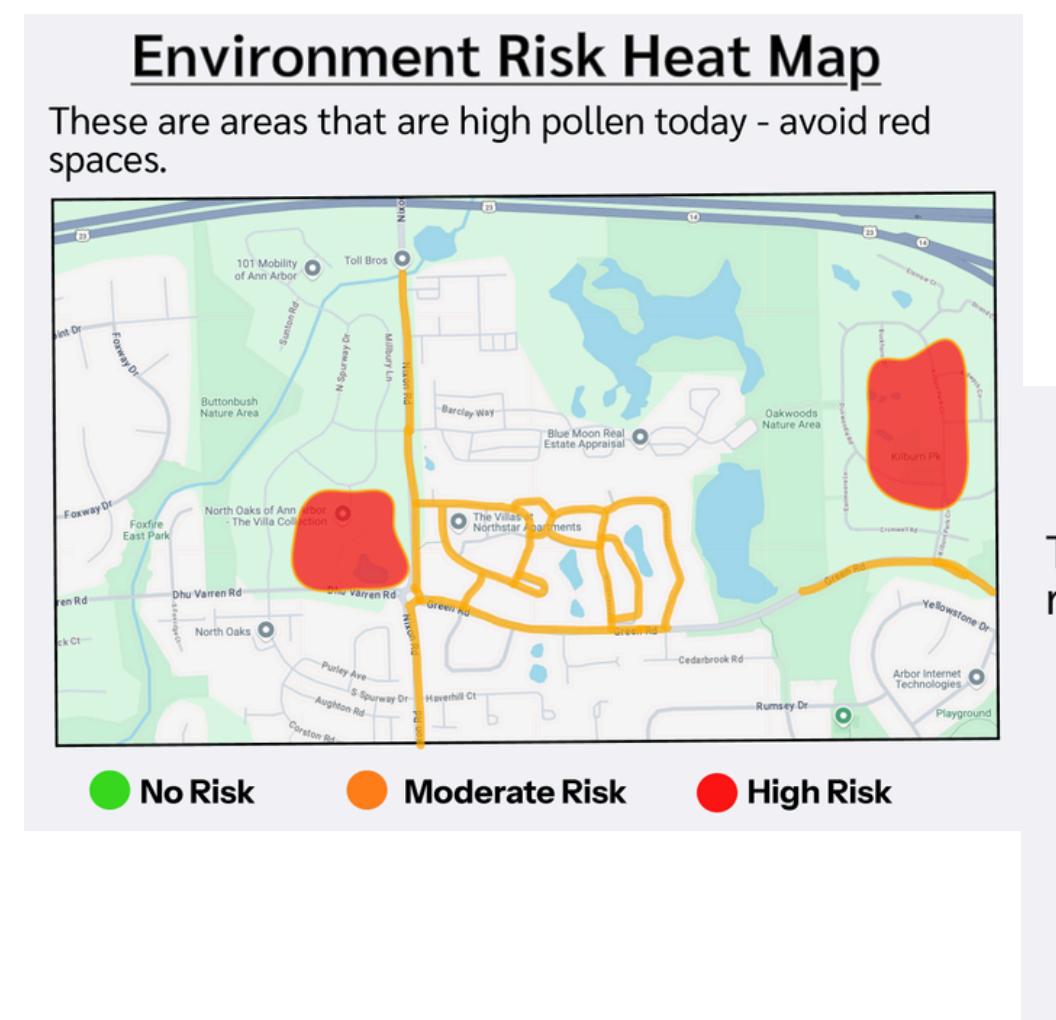
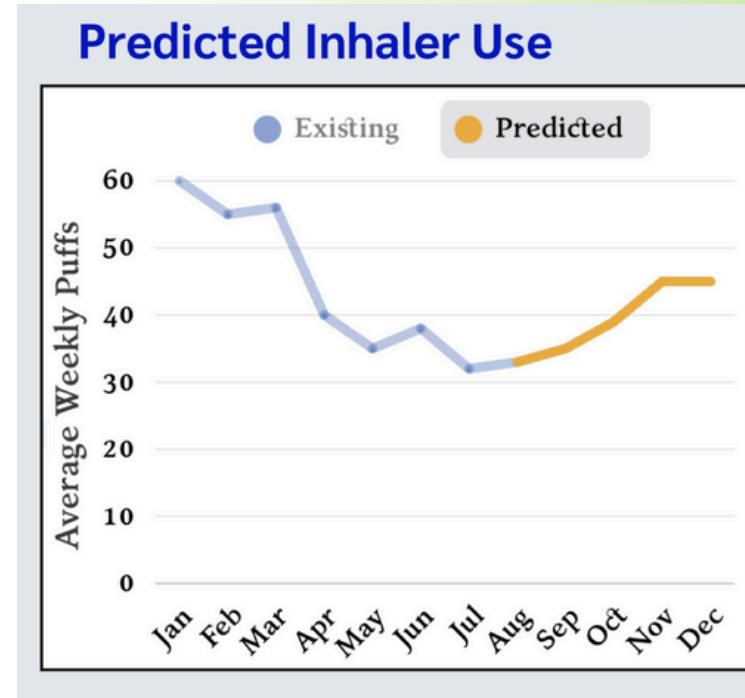
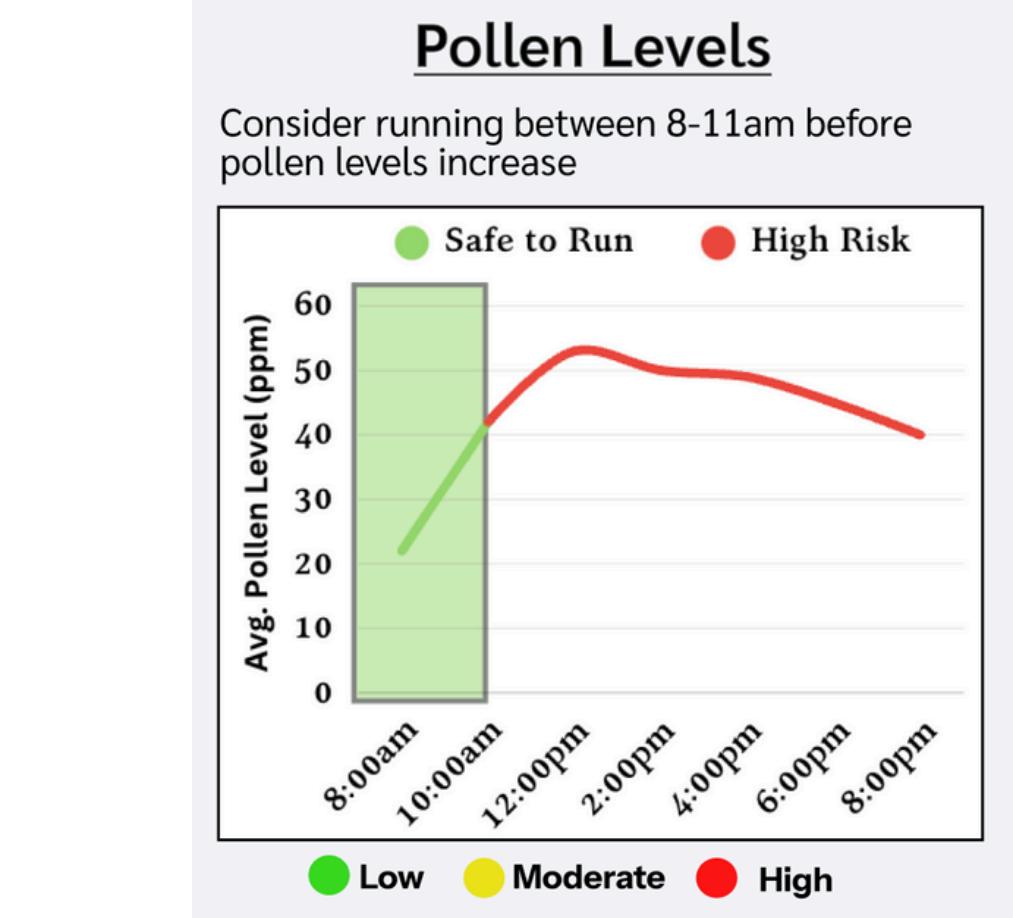
- In the “Seasonal breathing rate changes” graph: unclear as to whether this visualizes the average values or not
- In the watch interface, receiving a notification mid-run about having an unproblematic breathing rate may be distracting and too much information; to mimic a typical wearable for running reduce alerts where not needed
- In the “Breathing Rates on past runs” graph, make sure the star icon that indicates inhaler use is more prominent and that the meaning of it is explicit through a legend

## Understanding & Information Availability

- Provide more context and description for visualizations to reduce misinterpretation and increase the benefit
  - Currently, it relies on some level of technical expertise or ability to read charts quickly and efficiently, where some users may learn, or comprehend, better through text
- The asthma forecast visualization is initially confusing until the rest of the visualizations have been digested; providing additional context or description for this can reduce initial confusion

# Iterations and Design Changes

- **First:** remove the notification of a 'good' breathing rate from the watch to alleviate unnecessary distraction
  - This highlights a tradeoff between reassurance of good breathing and less distraction to mirror a typical running experience
- **Second:** ensure clarity in the visualizations (seen among the figures on the right). This will involve:
  - Revising axes names
  - Revising graph titles
  - Incorporating descriptive captions
  - Incorporating legends where missing and necessary



## Asthma Forecast

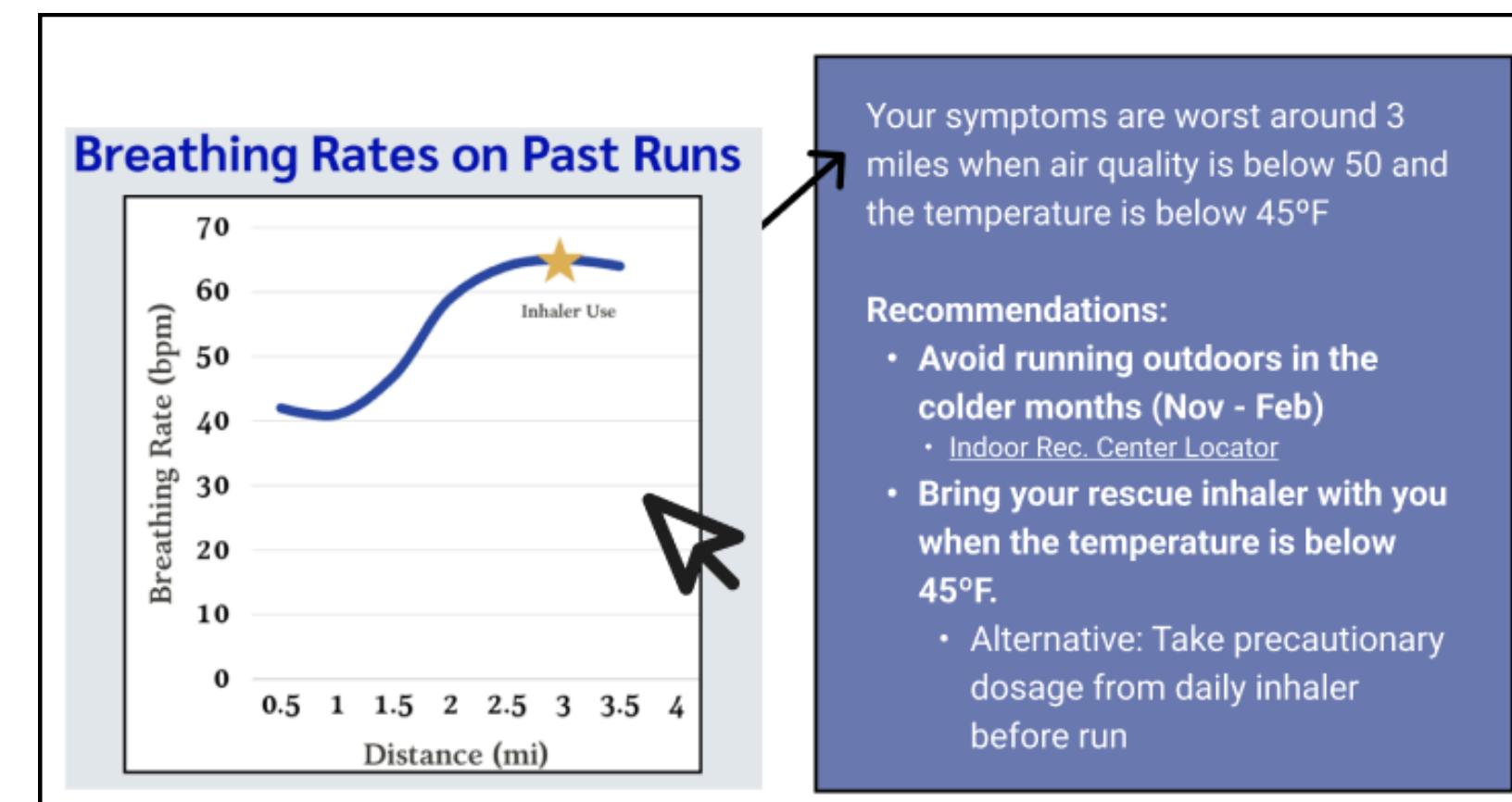
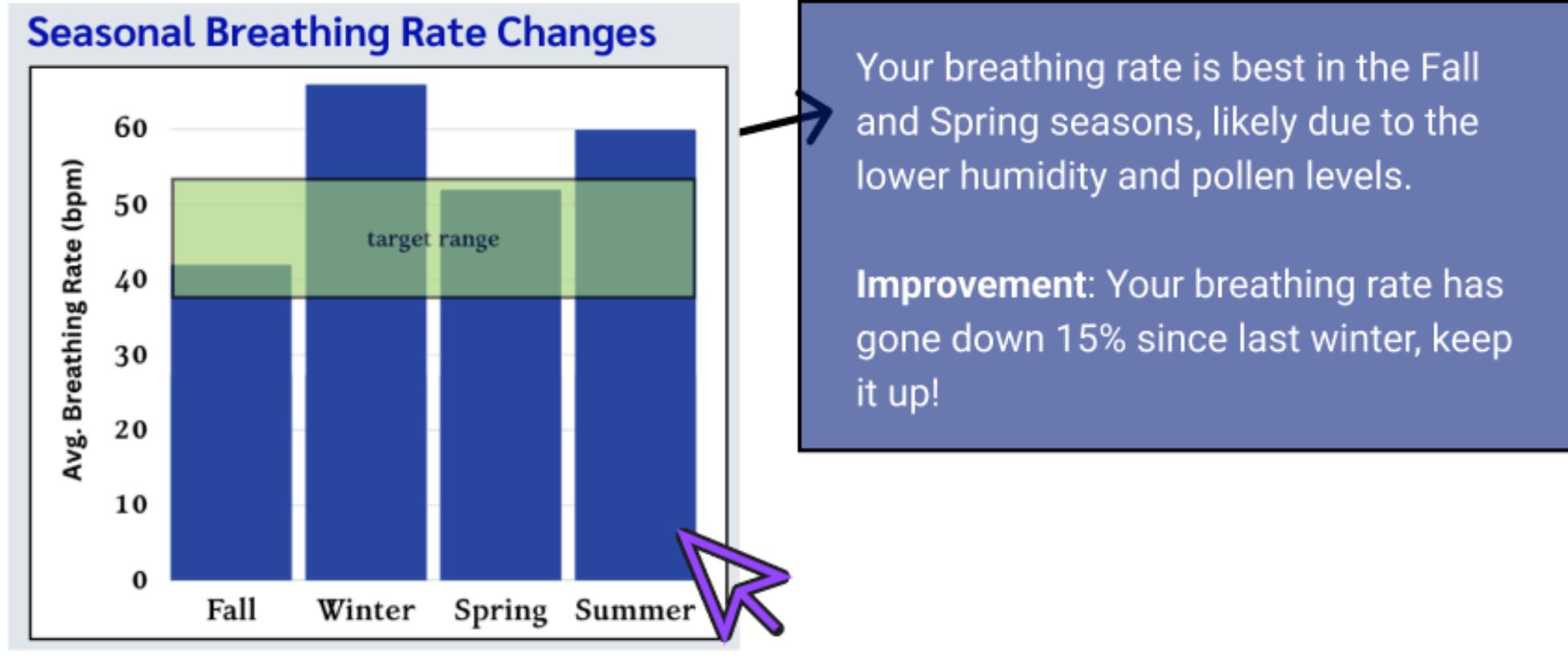
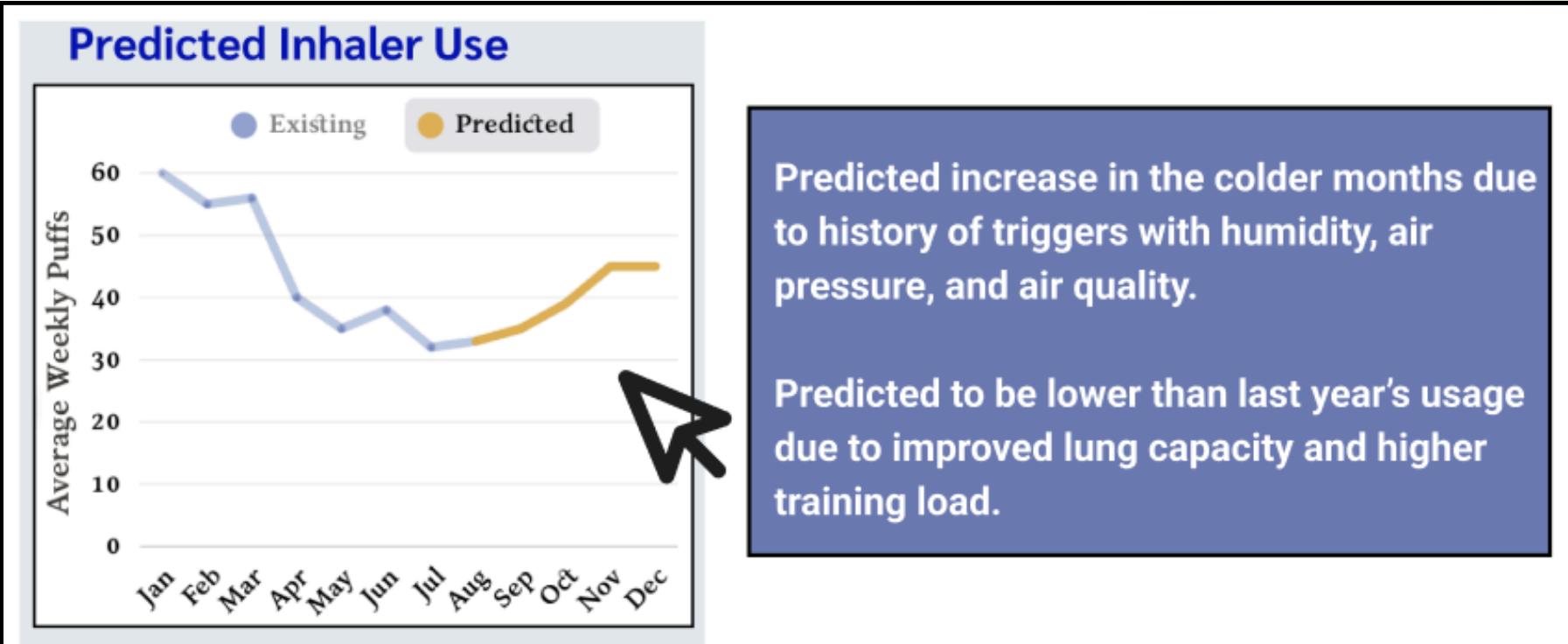
This is calculated based on today's environment and your recent bio-signals



# Iterations and Design Changes

**Third:** implement informational pop-ups for each visualization to make the visualizations more comprehensive and actionable and reduce risk of misinterpretation

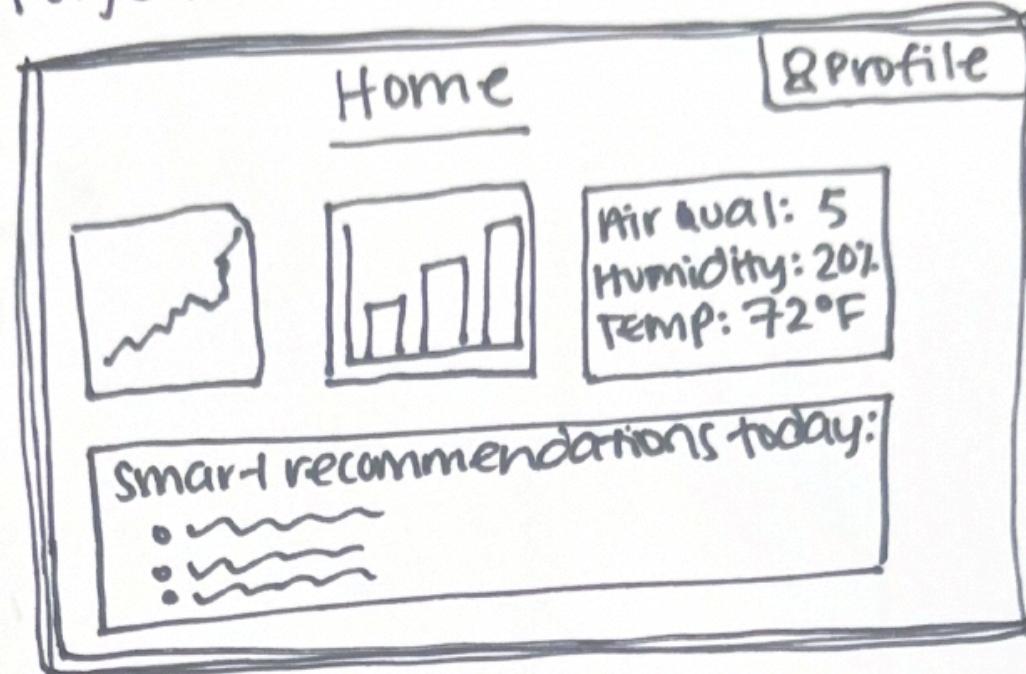
- When the user hovers over a graph, a short summary with action items and insights will communicate key takeaways.



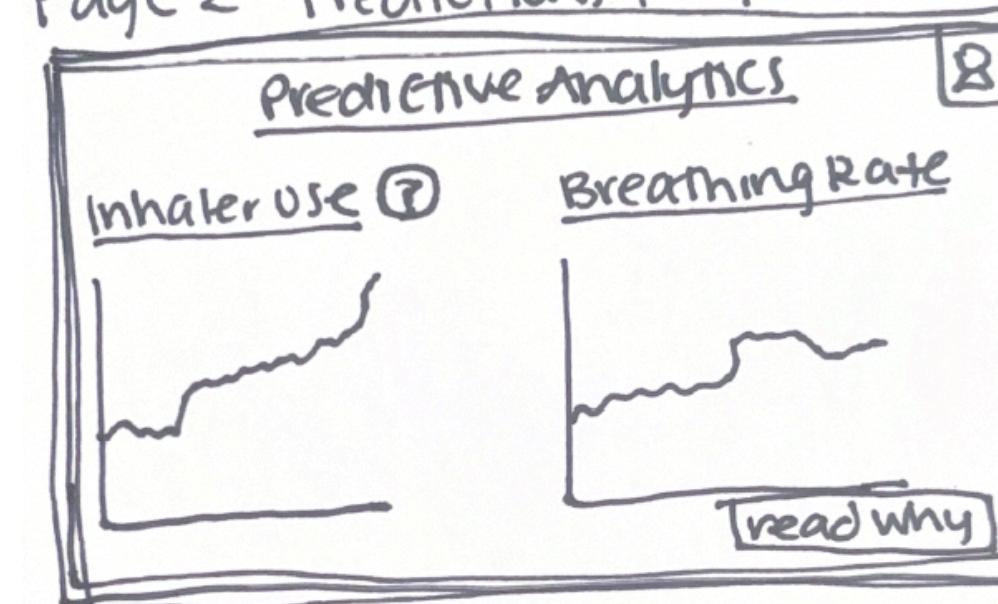
# Appendix

# Crazy 8 Design Sprint Sketches

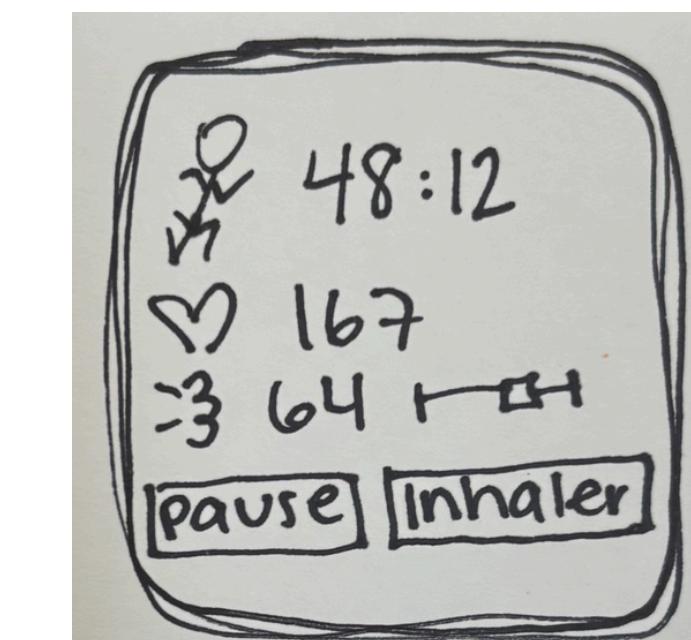
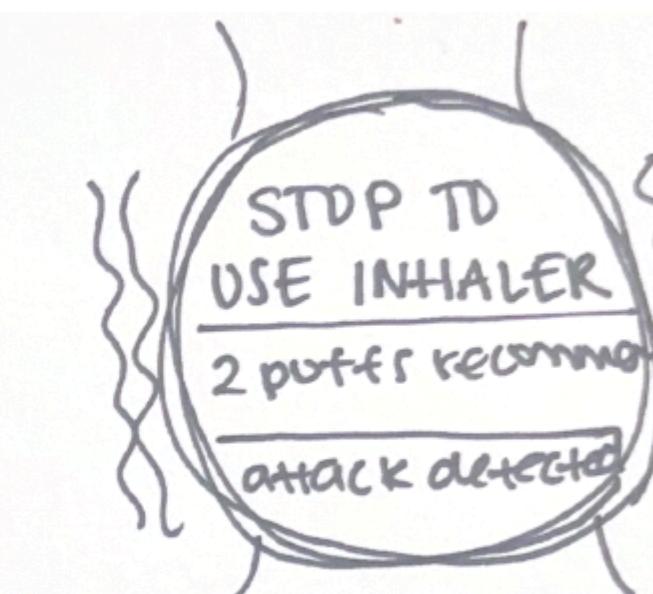
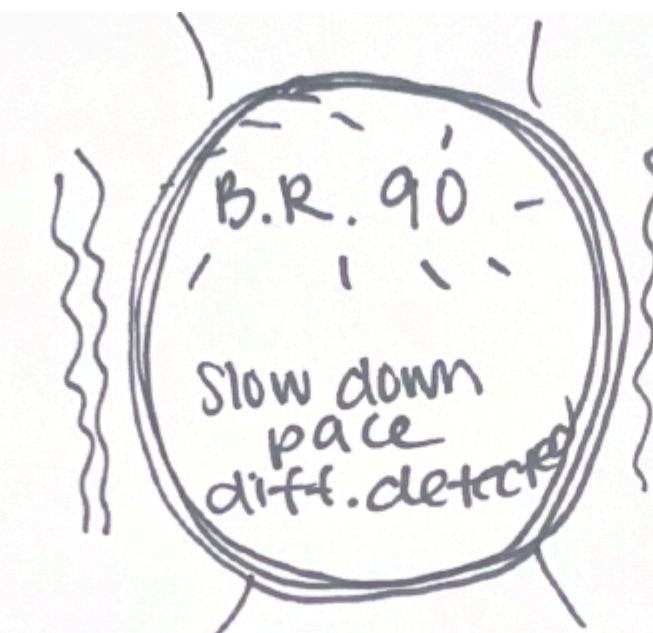
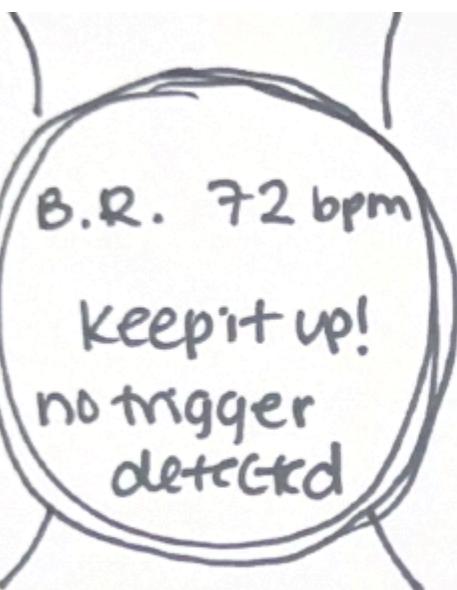
Page 1 - home



Page 2 - Predictions for Future

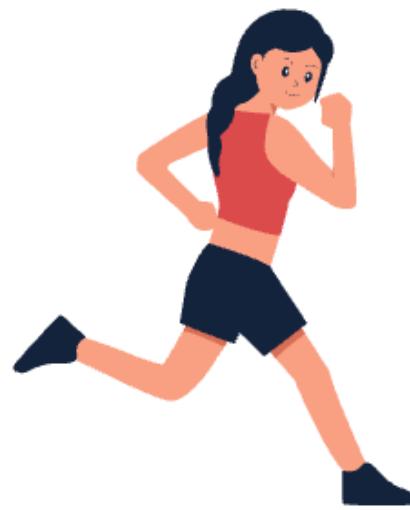


Page 3 - manual data entry

A hand-drawn sketch of a "Log Run" screen. It contains fields for "Length" (with a placeholder box), "Time" (with a placeholder box), "Inhaler use" (with a dropdown menu showing "4"), and "Breathing difficulty" (with a slider scale). There are also buttons for "outside" and "inside". The entire screen is enclosed in a border with the number "8" in the top right corner.

# Persona Development

## Persona and Scenario #1



### Maya

Age: 21

Location: Utah

Occupation: Student

Activity Level: Recreational

DESCRIPTION		SYMPTOM MANAGEMENT
Maya is a 21-year-old female and recreational runner with exercise-induced asthma. She resides in Utah, where there are frequent seasonal and weather changes. Her asthma is triggered when she does any form of cardio. With running as a hobby, she wants to find a way to manage her symptoms to enjoy her runs.		<ul style="list-style-type: none"><li>• Daily inhaler</li><li>• Rescue inhaler</li><li>• Has tried using an iPhone diary app to track medication and symptoms as well as a custom self-made Excel spreadsheet</li></ul>
GOALS	PAIN POINTS	NEEDS
<ul style="list-style-type: none"><li>• Enjoy running as a hobby with fewer asthma flare-ups</li><li>• Gather insight into asthma symptom and trigger patterns</li></ul>	<ul style="list-style-type: none"><li>• Has attempted using an iPhone diary app to track her symptoms but was unable to draw useful insights, and felt restricted to the limited data logging options</li><li>• Carries her rescue inhaler on every run and often stops runs short due to flare-ups</li></ul>	<ul style="list-style-type: none"><li>• Predictions of 'good' vs 'bad' running days based on daily symptoms</li><li>• Adaptive workout suggestions based on symptoms or recommendations on when to carry an inhaler</li></ul>

**Maya wants to run a faster 5k time this year** and decides to do an interval workout at the park. She starts a dynamic warm-up, but **after a few minutes of jogging, she feels tightness in her chest.**

She checks her smartwatch, which alerts her that **her breathing rate/pace has increased significantly faster than usual**, which is an early **sign of an impending asthma attack**. Her watch suggests that she slows down on her warm-up and increases her intensity more gradually. She follows the suggestion and continues her intervals at a modified pace. Halfway through, **Maya's watch detected another spike in breathing strain and sends a short vibration to prompt her to take a longer recovery break** before the next interval.

She realized that without these real-time insights, she would've assumed that her breathing was only attributed to the intervals pace, not her asthma. **Had she not listened and modified her workout, she would've had an asthma attack, forcing her to stop entirely.** After her workout is complete, Maya reviews her post-run analytics on the dashboard, noting that adjusting her warm-up and pacing helped her complete the session without any major issues.

Reviewing her training trends, her dashboard points out that short warm-ups in colder air trigger her symptoms much faster, which she will remember for her next workout.

## Persona and Scenario #2



### Carson

Age: 27

Location: Massachusetts

Occupation: Athlete

Activity Level: Professional

#### DESCRIPTION

Carson is a 27-year-old professional post-collegiate track and cross country athlete. He has allergic and seasonal asthma, leading to symptoms all-year-round and severe flare-ups in the Winter and due to allergens (pollen and mold). He regularly trains in high-intensity environments, racing both indoors and outdoors.

#### SYMPTOM MANAGEMENT

- Daily inhaler
- Rescue inhaler
- Works with a physician during training and races to navigate flare-ups in real-time

#### GOALS

- Perform competitively without negative impacts from asthma symptoms and flare-ups
- Predict asthma attacks before starting a workout or race to mitigate the situation before it occurs

#### PAIN POINTS

- Flare-ups negatively impact his performance despite working with a coach and physician
- Races both indoors and outdoors, and cannot predict allergens such as mold indoors or pollen levels outdoors

#### NEEDS

- Real-time breathing feedback during training to navigate worsening symptoms
- Personalized predictions of asthma attacks based on real-time training symptoms
- Better understanding of what triggers cause the worst reactions

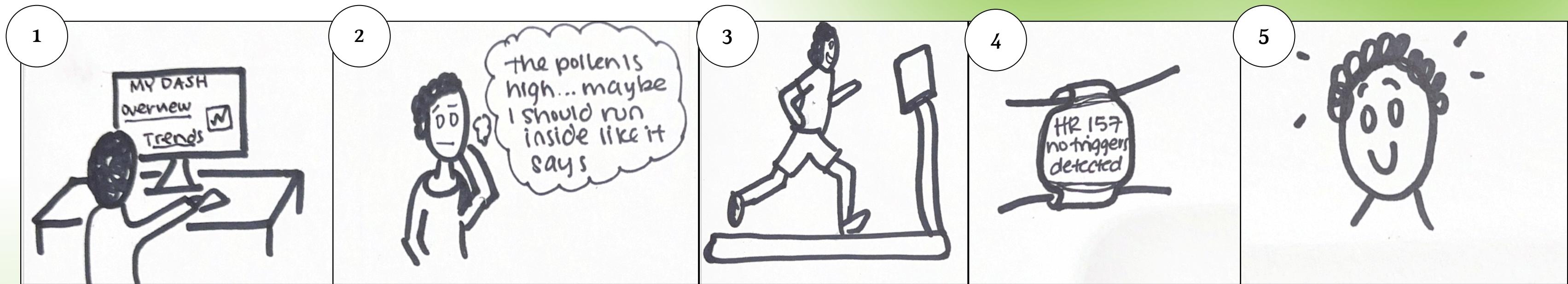
Carson is in training season for his upcoming race, but his **seasonal asthma has been unpredictable**. He checks his wearable's daily asthma risk forecast, which **warns him of high pollen counts and dry air**, both of which are triggers for him. Carson debates whether to train indoors or outdoors and checks the personalized workout suggestion on the dashboard.

**Based on his past symptom history, Run-O2 recommends: (1) an indoor treadmill session to minimize pollen exposure and (2) if running outdoors, a pre-run inhaler dose.** Wanting to simulate race conditions but stay safe, he runs outside but takes a puff from his inhaler. Carson also plans his route to avoid pollen exposure by checking the heat map on his dashboard to determine where pollen levels are high in his neighborhood.

Midway through his run, **his smartwatch detects an increase in his respiratory rate and abnormal wheezing**. His watch vibrates and **prompts him to slow down** for two minutes to recover. By following the guidance, **he avoids a full asthma attack and finishes his workout strong**.

Later, reviewing his post-run analytics, Carson sees how his allergens negatively impacted his breathing efficiency. He notes that his wearable helped him adjust in real-time to make a better decision about when and where to train.

# Storyboards



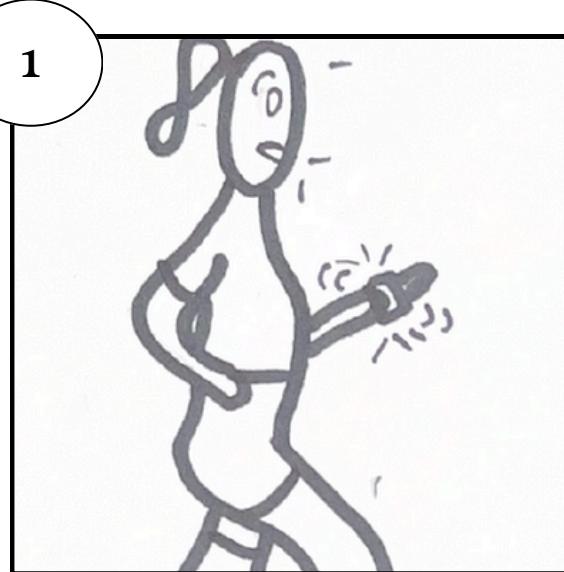
Carson's coach scheduled a long tempo workout today. Carson checks his dashboard to know what to expect from his asthma during the day. He sees that the pollen levels are high and that the last time the pollen levels were high, it led to him stopping his outdoor run and finishing it in the indoor track.

The dashboard gives him a recommendation to run on the treadmill today and to bring his inhaler just in case.

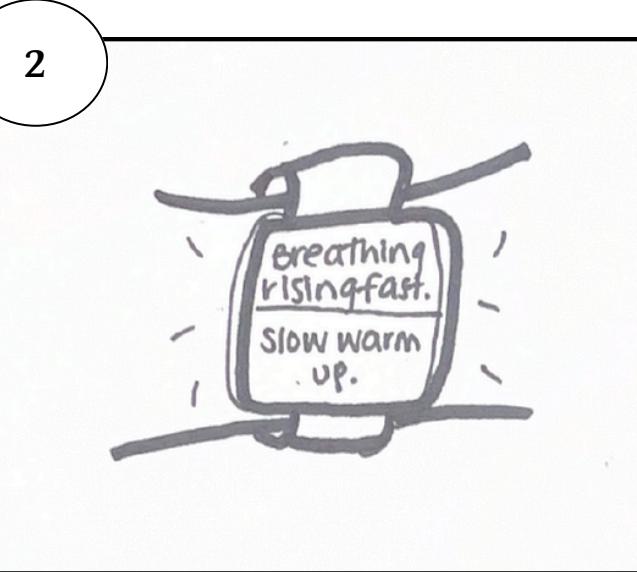
Carson decides to run on the treadmill and feels great. He finishes the tempo workout without any breaks or flare-ups.

His watch gives him feedback about his breathing and heart rate during the run, which are positive, so he continues without using his inhaler.

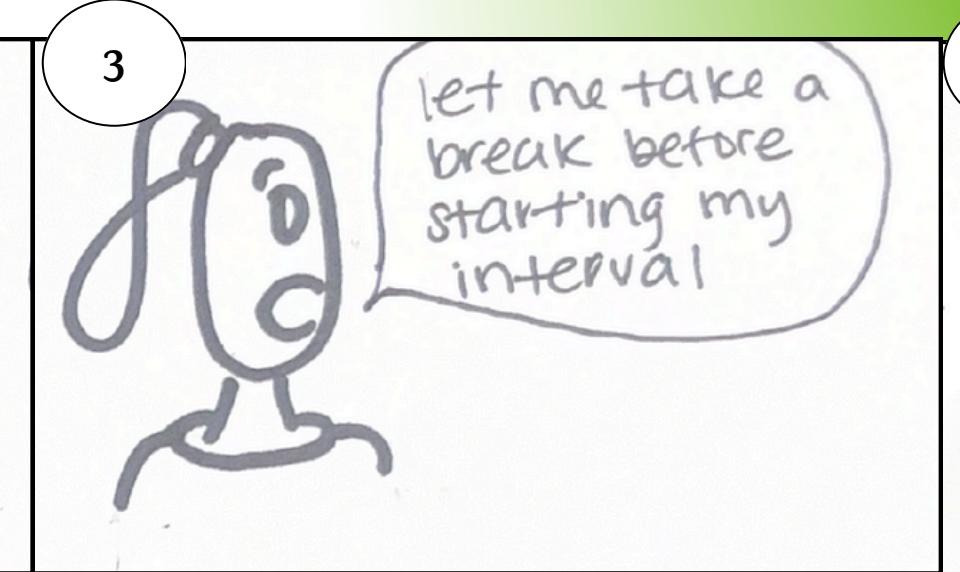
Once his workout is complete, Carson is ecstatic. If he had done this workout outside like he planned, he likely would've had to stop or take breaks, making it a less efficient speed workout. He knows how useful his dashboard was and makes sure to listen to its recommendations more.



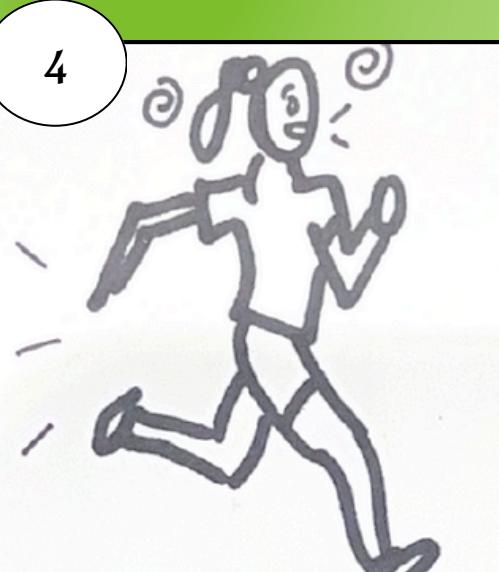
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2



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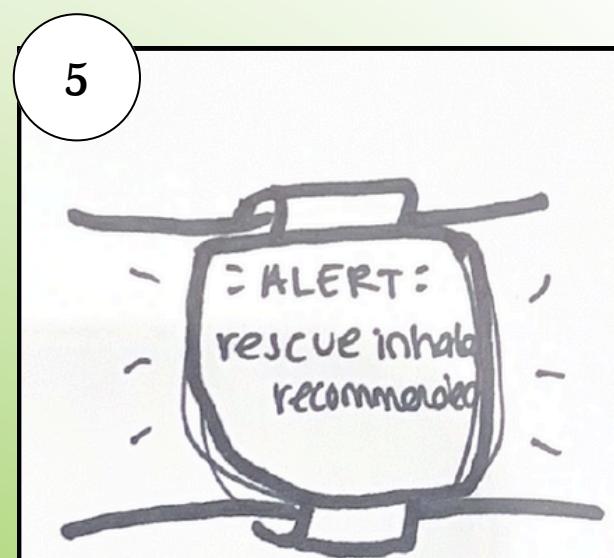
4

Maya starts a slow warm-up to prepare for her interval workout. These faster sprints usually trigger her asthma, so she proceeds carefully and brought her inhaler like her dashboard recommended.

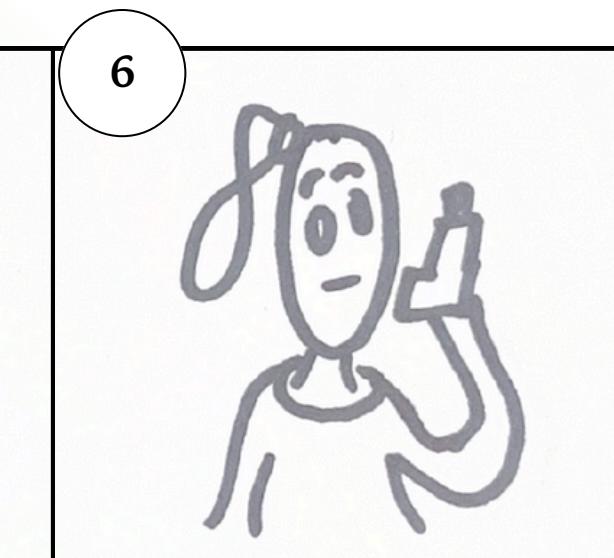
Her watch vibrates and alerts her that her breathing rate is already faster than usual, indicating her asthma may be flaring up.

Maya follows her device's recommendation to slow down to prepare before starting her sprints.

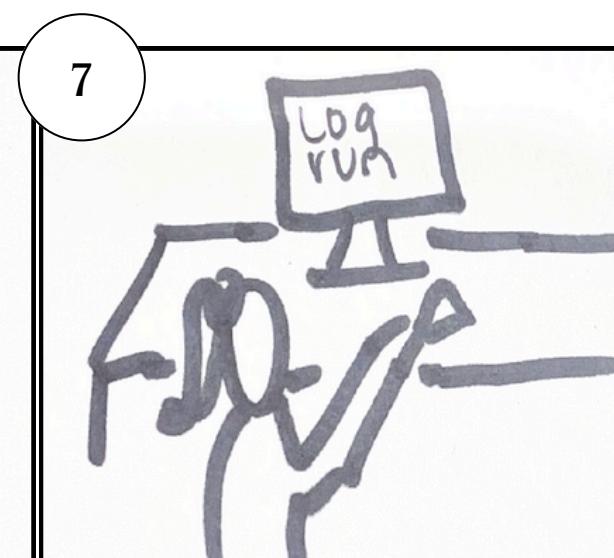
She starts her first interval and struggles to regulate her short breaths.



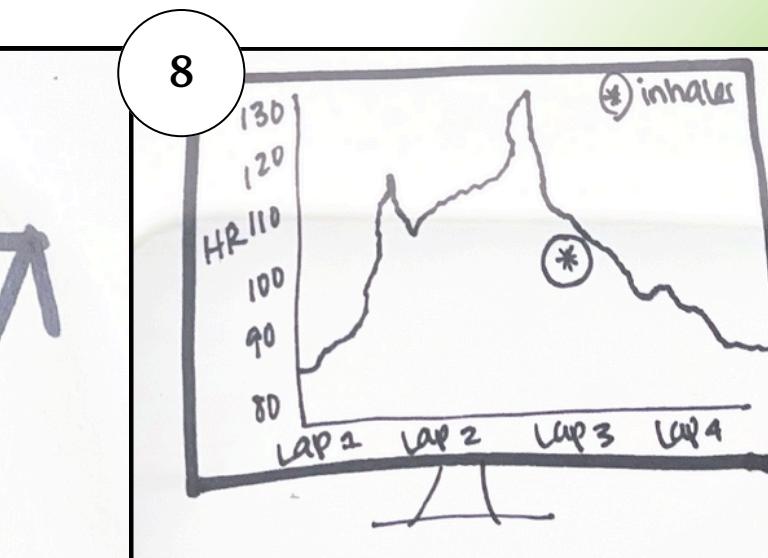
5



6



7



8

Her watch vibrates to alert her of a potential asthma attack and recommends taking a dose from her rescue inhaler.

She listens to the recommendation and begins to feel better.

After she completes the rest of her intervals at a modified pace, she logs the asthma symptoms she experienced into her dashboard so her watch can continue to give her helpful suggestions during her runs.

Later, she can check her dashboard to see how using her inhaler helped her recover and continue her workout. She can use this information for future similar workouts.

# Revised Prototype - Watch Interface & Notifications



# Revised Prototype - Dashboard Home Page

## Profile

Search for...

- Asthma Forecast
- Previous Runs
- Log Data
- Insights

## Home - Daily Overview

### Asthma Forecast

This is calculated based on today's environment and your recent bio-signals

- Good
- Moderate
- Unhealthy
- Hazardous

### Pollen Levels

Consider running between 8-11am before pollen levels increase

Time	Avg. Pollen Level (ppm)
8:00am	22
10:00am	58
12:00pm	45
2:00pm	55
4:00pm	48
6:00pm	50
8:00pm	42

- Low
- Moderate
- High

### Daily Recommendation

Due to the

- pollen levels
- humidity
- temperature

your asthma forecast shows a moderate risk of asthma attack. To avoid this risk, you should run indoors today and bring your inhaler with you on your run

### Environment Risk Heat Map

These are areas that are high pollen today - avoid red spaces.

- No Risk
- Moderate Risk
- High Risk

### Weather Outlook

**Humidity:**  
H: 59  
L: 36

**Air Pollution:**  
5 - moderate

### Today's Run

After you go for a run, the data will be displayed here.

# Revised Prototype - Dashboard Data Log Page

Profile

Search for...

Asthma Forecast

Previous Runs

Log Data

Insights

## Log Data

Title

Morning Run

Run Type

Easy Run ▾

Race  
Long Run  
Tempo  
Easy Run

Environment

Outdoors ✕  
Treadmill ✕  
Indoor Track ✕

Notes

Include any notes you would like to remember about this run. This is only for your use.

Breathing Difficulty

No difficulty   Some strain   Extremely difficult

Inhaler Use

3 ▾

0  
1  
2  
3  
4

Save

# Revised Prototype - Dashboard Insights Page

## Profile

Search for...

Asthma Forecast

Previous Runs

Log Data

Insights & Personal Coaching

## Personal Coaching & Historical Insights

### Breathing Rates on Past Runs

Distance (mi)	Breathing Rate (bpm)
0.5	42
1.0	45
1.5	55
2.0	60
2.5	63
3.0	65
3.2 (Inhaler Use)	65
3.5	65

< Jan. 6 >

### Predicted Inhaler Use

Month	Existing Average Weekly Puffs	Predicted Average Weekly Puffs
Jan	60	-
Feb	55	-
Mar	58	-
Apr	40	-
May	35	-
Jun	38	-
Jul	32	-
Aug	32	35
Sep	35	38
Oct	40	42
Nov	45	45
Dec	48	48

### Seasonal Breathing Rate Changes

Season	Avg. Breathing Rate (bpm)
Fall	40
Winter	62
Spring	52
Summer	58

target range

### Top Triggers - Last 6 months

Trigger	Value
Pollen	3
Temperature	8
Air Quality	5

### Smart Training Suggestions

- You tend to have fewer symptoms when you warm up for at least 10 minutes before running.
- Hills exacerbate your symptoms - avoid heavy inclines when asthma forecast is moderate or severe.
- You've used your inhaler more than usual this month. It may be time to check in with your doctor.

[Downloadable PDF](#)