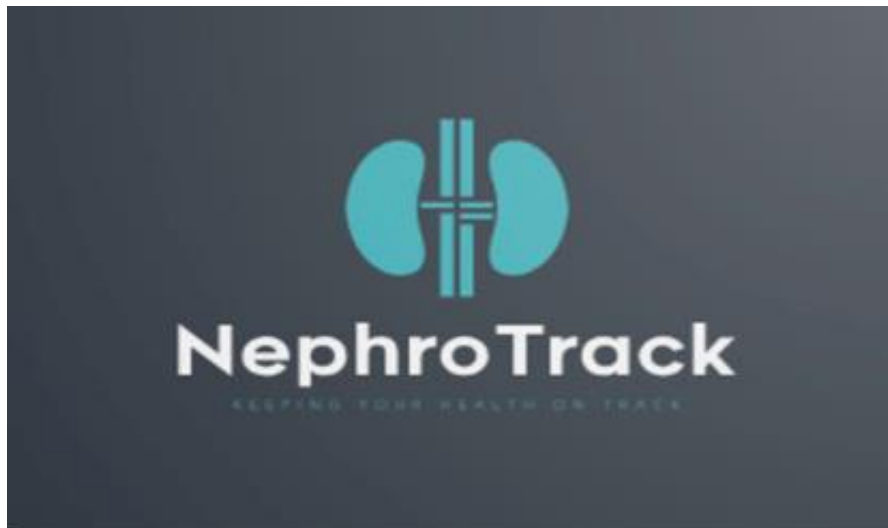


Analysis and Design Models

CKD Calculator

(Team 33)

NephroTrack



This document presents the analysis and design models developed for NephroTrack; a CKD risk calculator created by Team 33 for the SDP module. These models form part of the planning and architecture phase of the project and support the understanding, development, and communication of system functionality. The diagrams included cover mandatory UML models – Use Case, Activity, and Sequence – and are supplemented by user personas, navigation flows, and early-stage design thinking. Collectively, these artefacts illustrate how users interact with the system, how information flows through it, and how key decisions and calculations are handled. They also help validate that the system aligns with both user needs and client requirements.

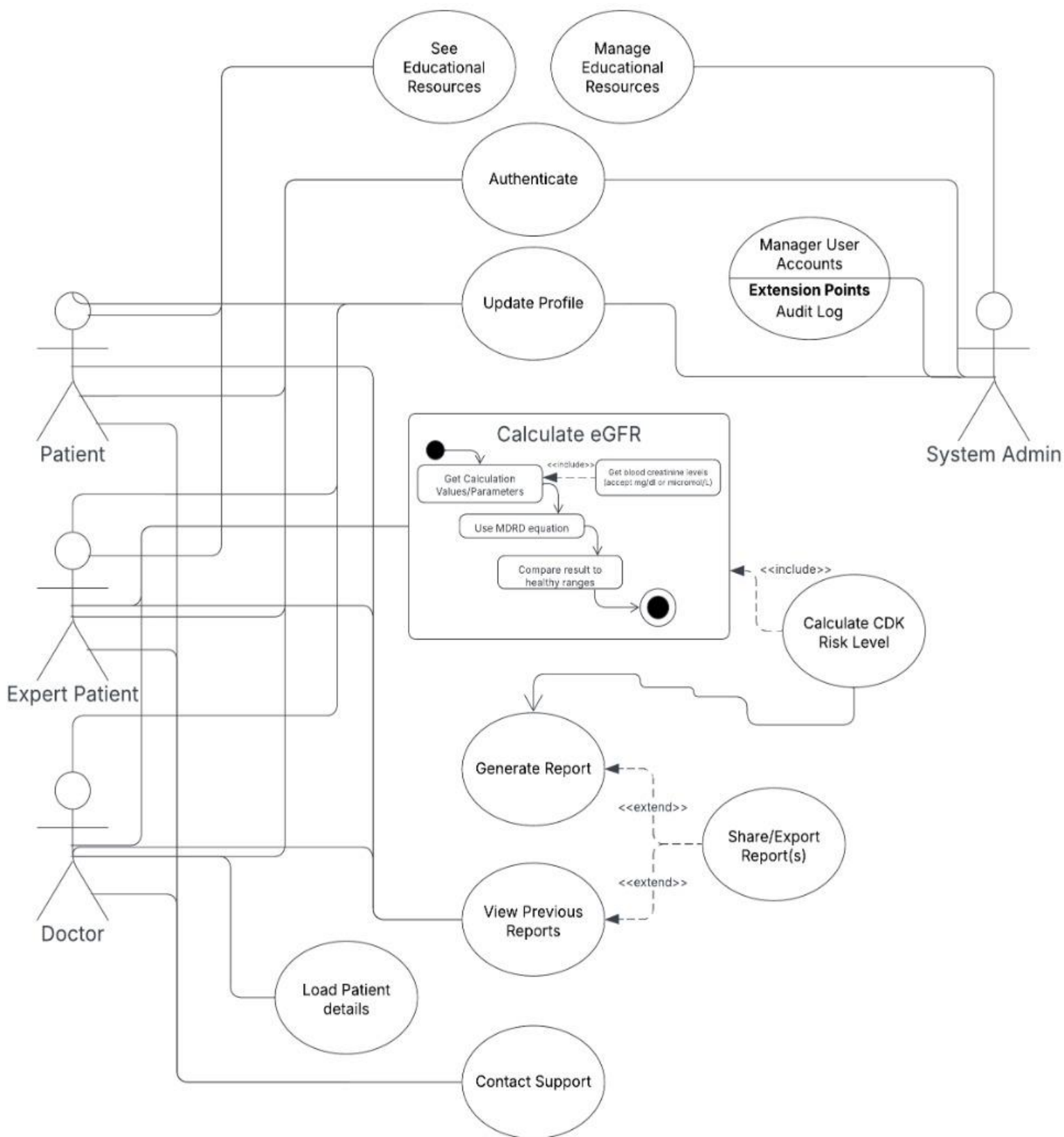


Figure 1: Use Case Diagram

This diagram illustrates the primary interactions between system users (Clinician, Patient, Expert Patient, and Admin) and the core features of NephroTrack. The use case includes actions such as authentication, profile update, eGFR calculation, report generation, and data export.

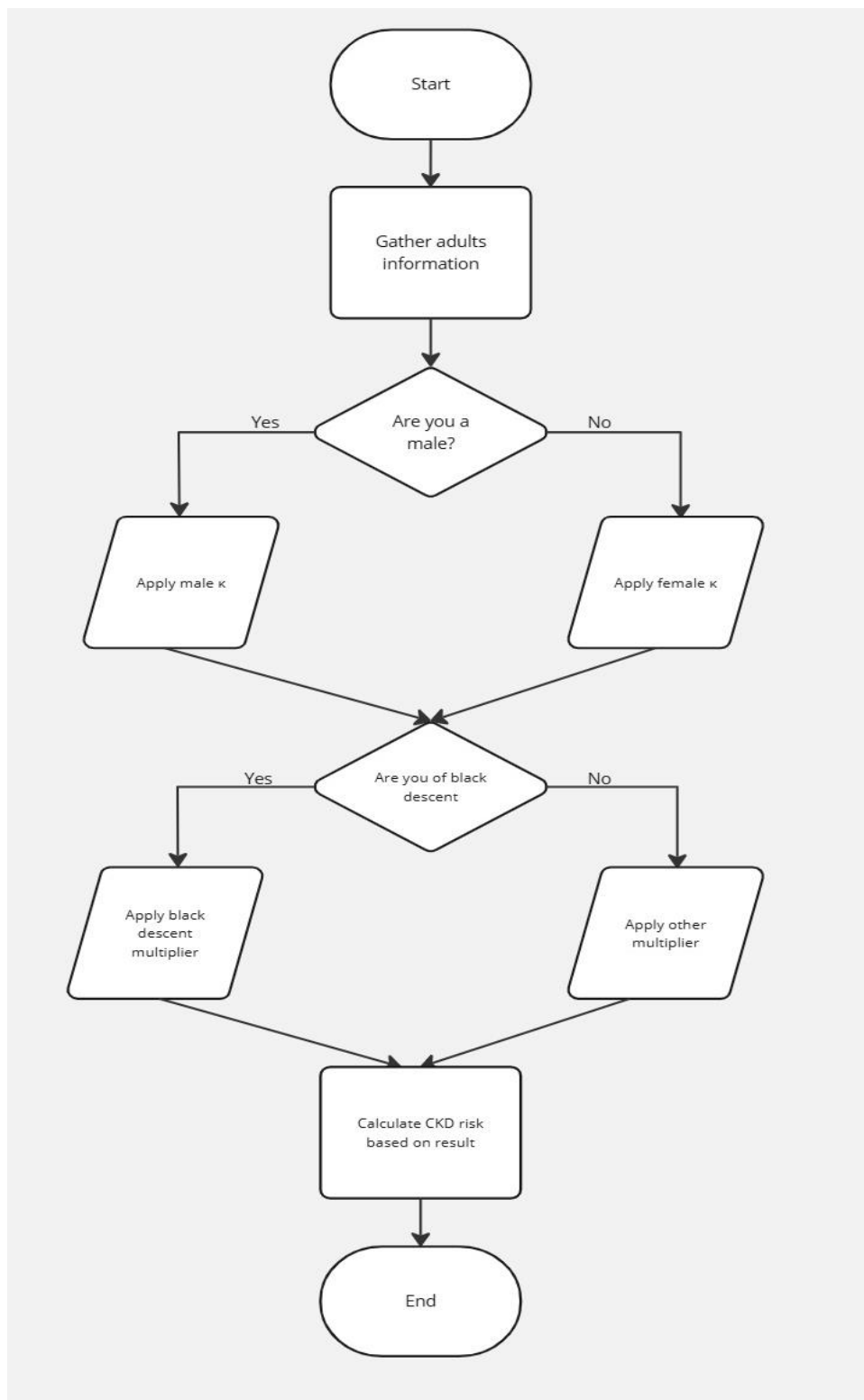


Figure 2:Activity Diagram - eGFR Calculation Flow

The diagram above represents the flow of logic when a user interacts with the system. It starts with user input and determines whether the adult or paediatric calculator should be used, based on age validation. It then routes the user accordingly and calculates the eGFR if applicable.

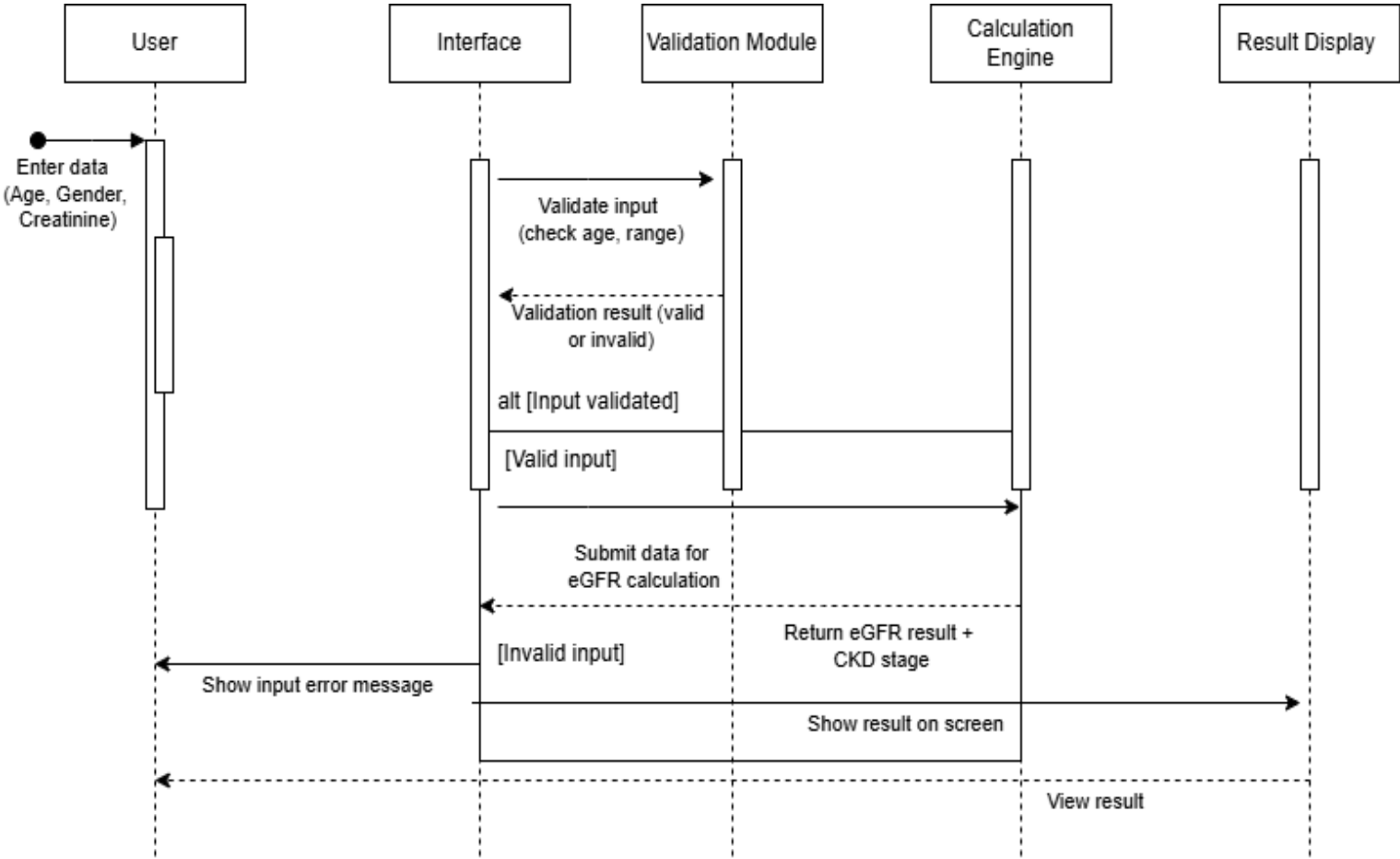


Figure 3: Sequence Diagram - eGFR Calculation Interaction

This sequence diagram illustrates the dynamic behaviour of the system during an eGFR calculation request. The process begins when the user inputs their age, gender and creatinine levels. This data is sent through the interface to the validation module, which checks for appropriate value ranges and age eligibility. If the input is invalid, an error message is then displayed to the user. If valid, the data is forwarded to the calculation engine which applies the MDRD formula to determine the estimated Glomerular Filtration Rate (eGFR) and Chronic Kidney Disease (CKD) stage. The result is then passed back to the interface and shown to the user through the result display. An ‘alt’ frame in the diagram captures the conditional logic for handling both valid and invalid input paths.

User Journey Mapping

These journey diagrams visualise the system from a user experience perspective, demonstrating how users navigate between key screens such as login, data entry, result display, and optional features like history or export. Each flow is tailored to a specific user role or persona, including clinicians, expert patients, and standard users. The flows support UX planning and interface logic for NephroTrack's mobile-first design.

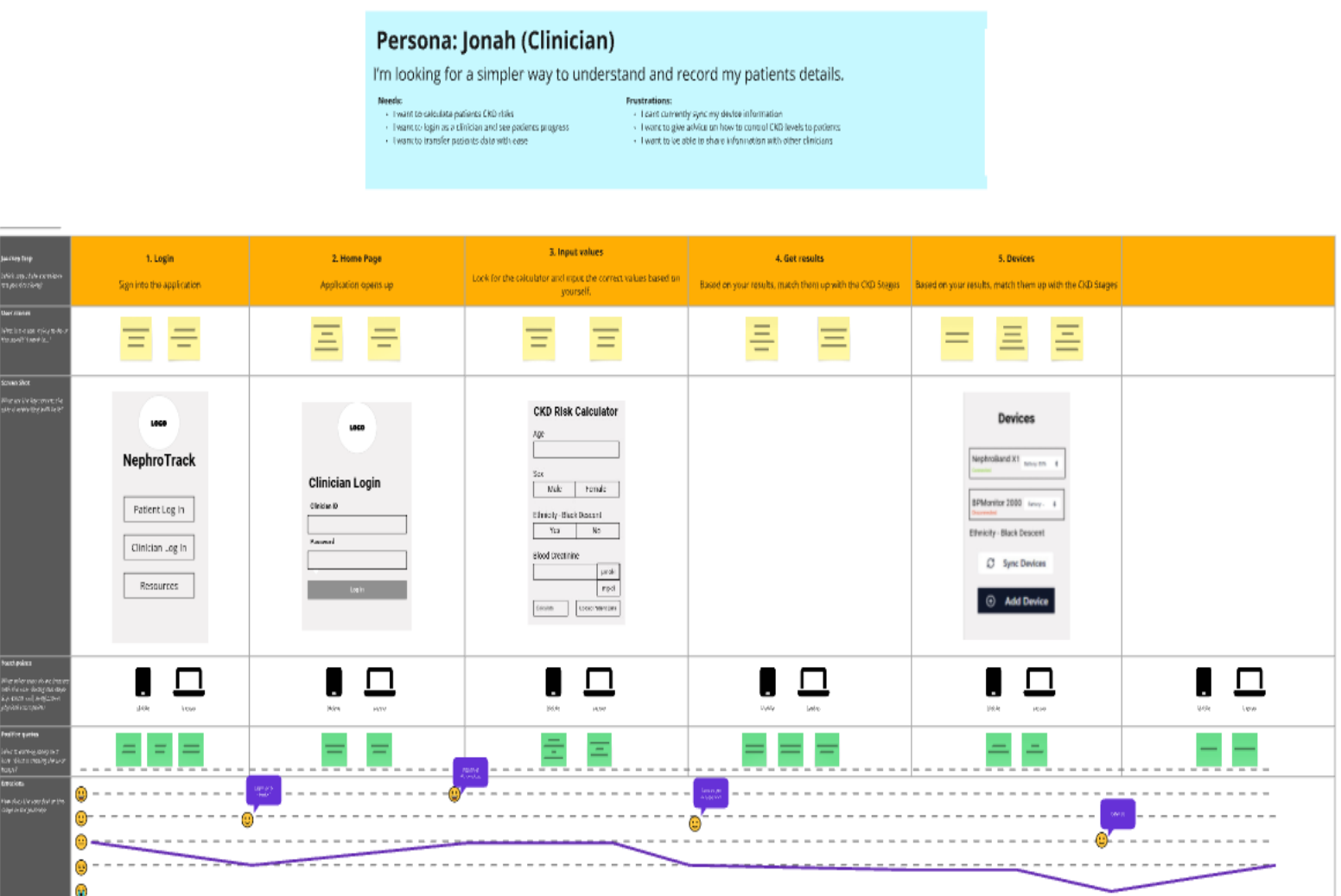


Figure 4: User Journey - Jonah (Clinician Persona)

This diagram outlines Jonah's typical navigation flow through NephroTrack, covering login, calculator input, result matching, and device syncing.

Full step-by-step journey diagrams for all personas (Jonah, Rebecca, and Trent) are provided in Appendix A, with one page per step for improved readability.

Persona: Rebecca (Patient)

I want a simpler way to understand my kidney health and take control of my future.

Needs:

- I want to track my kidney health over time and see how my risk levels change
- I need access to reliable information to help me understand how CKD and how to manage it
- I need my personal health data to be stored safely and privately.

Frustrations:

- I hate how complicated medical information can be
- I worry about my health but don't always feel like I am in control of it
- I am nervous about my levels in CKD

Areas of focus		
1. Discovery	2. Theme	3. Theme
We want to make it easy to use for all parents when accessing all features inside the application	Description	Description



Figure 5: User Journey - Rebecca (Patient Persona)

This diagram shows Rebecca’s navigation through NephroTrack from a patient’s perspective. It includes login, CKD risk calculator input, result interpretation, and access to supportive tools like device syncing and sharing outcomes with peers.

Rebecca represents a typical patient persona who wants to take control of her kidney health using NephroTrack. Her journey prioritises accessibility, clarity of medical information, and emotional support. This flow emphasises simplicity, privacy, and reassurance – all vital to the patient experience. Her pathway includes six key stages: login, homepage navigation, value input, result review, device syncing, and the optional sharing feature.

Persona: Rebecca (Patient)

I want a simpler way to understand my kidney health and take control of my future.

Needs:

- I want to track my kidney health over time and see how my risk level changes
- I need access to reliable information to help me understand how CKD and how to manage it
- I need my personal health data to be stored safely and privately.

Frustrations:

- I hate how complicated medical information can be
- I worry about my health but don't always feel like I am in control of it
- I am anxious about my levels in CKD

Areas of focus	1. Discovery	2. Theme	3. Theme
	We want to make it easy to use for all patients when accessing all features inside the application	Description	Description



Figure 6:User Journey - Trent (Under 18s Persona)

This flow illustrates how Trent, a younger patient, engages with NephroTrack to explore and understand his kidney health. It maps his experience across login, calculator use, and results, with special attention to simplicity accessibility, and educational guidance for under-18 users.

Trent’s user journey reflects the unique needs of younger users navigation medical information. The interface supports learning by simplifying terminology and visual steps, helping Trent track results without being overwhelmed. Emotional reassurance, device integration, and clarity are key components of this tailored UX. Although similar to the adult patient flow, Trent’s path minimises complexity while ensuring accurate CKD stage guidance.

Project Requirements Overview

(A mind map was created but it was completely illegible when included in this document so it will be summarised)

This section summarises the key information outlined in our original brainstorming mind map, including functional requirements, non-functional considerations, and app vision.

Vision Statement

- To create an application that allows clinicians to send multiple data entries at once.
- To remember patient data across sessions to minimise repeated input.

Proposed App Names

- RenalCare
- CKDCare
- Renal360
- KidneyPath
- KidneyGuard
- CKDTrack

Functional Requirements

- Measure CKD risk (calculate eGFR and compare to healthy ranges)
- Shareable output
- Clinician/patient login authentication
- Patient and clinician database
- Input Creatinine in mg/dL or $\mu\text{mol/L}$
- Progress monitoring and report generation
- "Remember me" function for reusing data
- Import patient data file
- Access to educational resources
- No local data storage

Non-Functional Requirements

- Cross-platform compatibility
- User-friendly interface (target audience 18-100)
- GDPR compliance
- End-to-end encryption
- 24/7 availability
- Scalable infrastructure
- Actionable guidance after risk assessment

SWOT Analysis

This analysis outlines NephroTrack's internal strengths and weaknesses, as well as external opportunities and threats. It highlights where the app currently performs well, identifies areas for improvement, and considers potential developments and risk as the system evolves.

Strengths	Weaknesses
<ul style="list-style-type: none">- Tailored for CKD and eGFR monitoring- Dual focus on clinician and patient usability- Mobile-first responsive design- Instant eGFR calculation with CKD stage classification	<ul style="list-style-type: none">- Depends on correct user input (e.g., creatinine, age)- Limited NHS data integration in early stages- No offline access functionality- Data security must meet strict GDPR standards

Opportunities	Threats
<ul style="list-style-type: none">- Expand to include more renal health indicators (e.g., BP, urine results)- Potential for integration into NHS systems or HealthTech partnerships- Integration with wearable health tech and home monitoring devices	<ul style="list-style-type: none">- Other medical apps may offer more comprehensive functionality- Misinterpretation of clinical data without professional guidance- Cybersecurity risks due to handling of sensitive personal and health information

Conclusion

The diagrams and analysis provided in this document guided the early stages of NephroTrack's development. They helped ensure user needs, system behaviours, and technical goals with aligned throughout planning. This documentation forms the foundation for implementation and future iterations as the app continues development under Team 33.

Journey Step <i>Which step of the experience are you describing?</i>	1. Login Sign into the application
User stories <i>What is the user trying to do at this point? "I want to..."</i>	<div>I want to sign into my account</div> <div>I want the process to be simple</div>
Screen Shot <i>What are the key screens the user is interacting with here?</i>	
Touchpoints <i>What other ways do we interact with the user during this step? (e.g. email, call, notification, physical touchpoint)</i>	<div>Mobile</div> <div>Laptop</div>
Positive quotes <i>What is working really well here. What is making the user happy?</i>	<div>Easy to navigate</div> <div>Simple layout</div> <div>There are resources!</div>
Emotions <i>How does the user feel at this stage in the journey?</i>	
Negative quotes <i>What is getting in the way of the user achieving their goal?</i>	<div>[Negative quote]</div>
Insights <i>What does the data tell us at this stage in the journey?</i>	
Provocations <i>How might we address user needs and obstacles?</i>	<div>How might we...</div>
Ideas <i>What feature ideas do we have for each stage?</i>	<div>[Feature idea]</div> <div>[Feature idea]</div> <div>[Feature idea]</div> <div>[Feature idea]</div> <div>[Feature idea]</div> <div>[Feature idea]</div>

Figure 7: Jonah - Step 1:Login

2. Home Page

Application opens up

I want to find
input
patient's
information

I want the
process to be
simple



LOGO

Clinician Login

Clinician ID

Password

Log In



Mobile



Laptop

Responsive,
no delays

Simple but
effective

Login is so
simple !



[Negative
quote]

[Negative
quote]

[Negative
quote]

How might
we...

How might
we...

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

Figure 8: Jonah - Step 2: Homepage

3. Input values

Look for the calculator and input the correct values based on yourself.

3. Input values

Look for the calculator and input the correct values based on yourself.

Is the patient male or female?

Is the patient
of black
descent?

CKD Risk Calculator

Age

Sex

Ethnicity - Black Descent

Blood Creatinine



Simple
Buttons, not
so
complicated

Easy inputs,
very
responsive

Inputting
client's data

[Negative quote]

[Negative quote]

[Negative quote]

How might we...

How might we...

[Feature idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

[[Feature
idea]]

[Feature idea]

Figure 9: Jonah - Step 3: Calculator Input

4. Get results

Based on your results, match them up with the CKD Stages

Are the
patient
results high
or low?

Is the patient
in a good
health state?



Mobile



Laptop

Results can
very quickly

Can compare
to CKD scale

Applies to all
patients

Time to get
results and



[Negative
quote]

[Negative
quote]

[Negative
quote]

How might
we...

How might
we...

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

Figure 10: Jonah - Step 4: Result Display

5. Devices

Based on your results, match them up with the CKD Stages

Can I share my results?

Are other patients having the same results?

What can I do to increase my CKD stage?

Devices

NephroBand X1

Connected

Battery: 85%

BPMonitor 2000

Disconnected

Battery: -

Ethnicity - Black Descent

Sync Devices

+

 Add Device



Mobile



Laptop

Can add more devices

Very responsive

Device

[Negative quote]

[Negative quote]

[Negative quote]

How might we...

How might we...

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

Figure 11: Jonah - Step 5: Device Integration

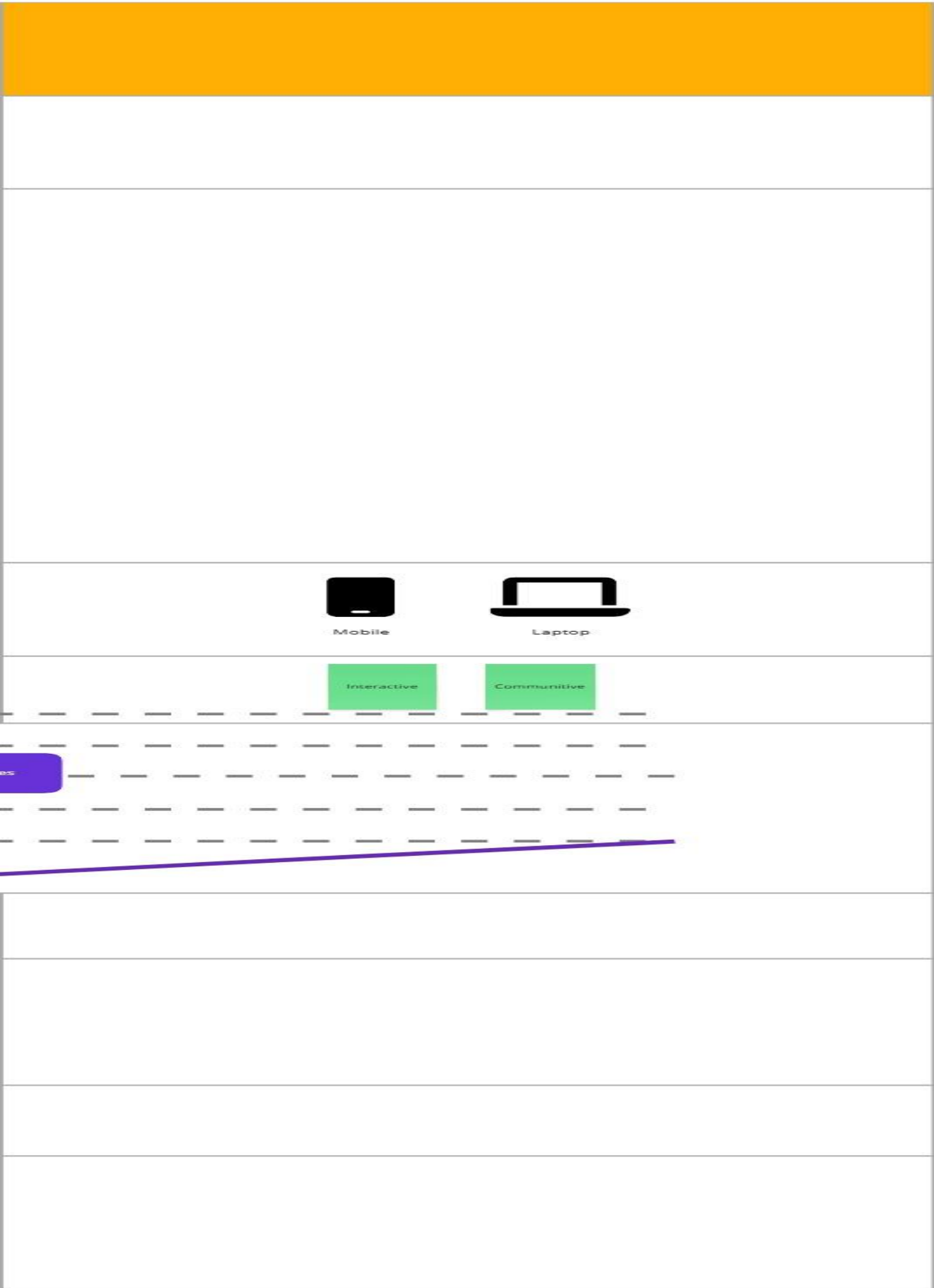


Figure 12: Jonah - Step 6: Export/Sync Options


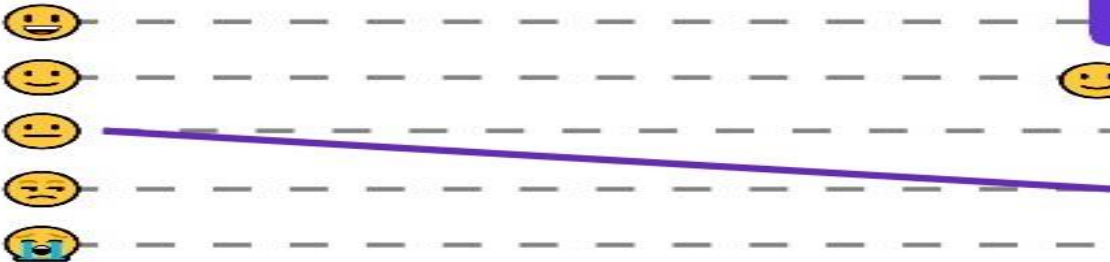
Journey Step <i>Which step of the experience are you describing?</i>	1. Login Sign into the application
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Touchpoints <i>What other ways do we interact with the user during this step? (e.g. email, call, notification, physical touchpoint)</i>	<div>Mobile</div> <div>Laptop</div>
Positive quotes <i>What is working really well here. What is making the user happy?</i>	<div>Easy to navigate</div>
Emotions <i>How does the user feel at this stage in the journey?</i>	
Insights <i>What does the data tell us at this stage in the journey?</i>	
Provocations <i>How might we address user needs and obstacles?</i>	<div>How might we get user to log in?</div> <div>How might we get user to use resources?</div>
Ideas <i>What feature ideas do we have for each stage?</i>	<div>[Feature idea]</div> <div>[Feature idea]</div> <div>[Feature idea]</div> <div>[Feature idea]</div> <div>[Feature idea]</div> <div>[Feature idea]</div>

Figure 13: Rebecca - Step 1:Login

2. Home Page

Application opens up

I want to find and learn information about CKD

I want to know the issues about CKD

Where do I input my own CKD levels

LOGO

Clinician Login

Clinician ID

Password

Log In

LOGO

Patient Login

Patient ID

Password

Log In



Mobile



Laptop

Easy to navigate

Great features

Login is so simple!



How might we get users to interact?

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

Figure 14: Rebecca - Step 2: Homepage

3. Input values

Look for the calculator and input the correct values based on yourself.

Without complications, I want to get my own results

Now I want to find my CKD levels

CKD Risk Calculator

Age

Sex

Ethnicity - Black Descent

Blood Creatinine



Mobile



Laptop

Information about CKD

Time to finish it my

How might we...

How might we...

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

Figure 15: Rebecca - Step 3: Calculator Input

4. Get results

Based on your results, match them up with the CKD Stages

Is my results high or low?

Am I in danger of a potential CKD?

Copy

Results

Risk Level

eGFR Number

Next steps

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat.

🍴

Diet Recommendations

- Reduce sodium and processed foods.
- Choose fresh fruits and vegetables wisely (low potassium).
- Maintain a balanced protein intake (lean meats, eggs, tofu).
- Limit phosphorus-rich foods like dairy and nuts.

🌿

Healthy Lifestyle Tips

- Stay hydrated but avoid excessive fluid intake.
- Engage in light physical activity like walking.
- Monitor blood pressure and stress levels.
- Avoid smoking and excessive alcohol consumption.



Mobile



Laptop

Simple but effective

Easy to access

Includes all patients

Depending on their

In this case, Rebecca is

How might we...

How might we...

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

Figure 16: Rebecca - Step 4: Result Display

5. Devices

Based on your results, match them up with the CKD Stages

Am I in a good health state?

Are other patients having the same results?

What can I do to help my CKD levels?



Mobile



Laptop

Straight to the point

Quick response

How might we...

How might we...

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

Figure 17: Rebecca - Step 5: Device Sync

6. Share

Share outcome with other patients

Know other
patients
struggles and
suggestions

Share my
own
struggles and
suggestions

Learn more
from other's
experiences



Mobile



Laptop

Interactive

Communitive



I can share
with


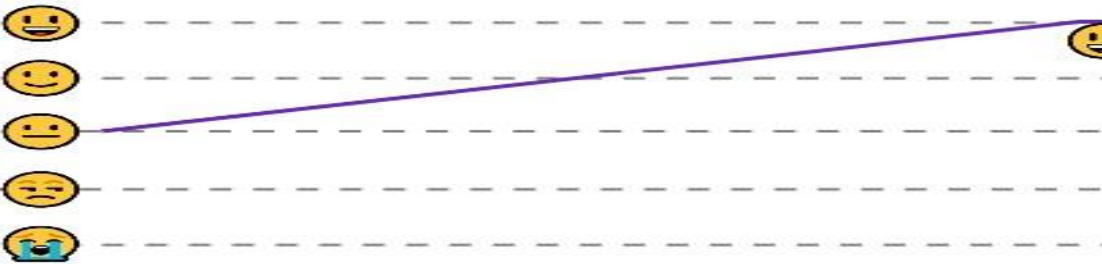
Journey Step <i>Which step of the experience are you describing?</i>	1. Login Sign into the application		
User stories <i>What is the user trying to do at this point? "I want to..."</i>	<div>I want to sign into my >18 account</div> <div>I want the process to be simple</div>		
Screen Shot <i>What are the key screens the user is interacting with here?</i>			
Touchpoints <i>What other ways do we interact with the user during this step? (e.g. email, call, notification, physical touchpoint)</i>	<div>Mobile</div> <div>Laptop</div>		
Positive quotes <i>What is working really well here. What is making the user happy?</i>	<div>Easy navigation</div> <div>Simple layout</div>		
Negative quotes <i>What is getting in the way of the user achieving their goal?</i>	<div>[Negative quote]</div>		
Emotions <i>How does the user feel at this stage in the journey?</i>			
Insights <i>What does the data tell us at this stage in the journey?</i>			
Provocations <i>How might we address user needs and obstacles?</i>	<div>How might we...</div>		
Ideas <i>What feature ideas do we have for each stage?</i>	<div>[Feature idea]</div> <div>[Feature idea]</div> <div>[Feature idea]</div> <div>[Feature idea]</div> <div>[Feature idea]</div> <div>[Feature idea]</div>		

Figure 19: Trent - Step1: Login

2. Home Page

Application opens up

I want learn a
basic
understanding
of CKD levels

I want the
process to
not be so
complicated

LOGO

Clinician Login

Clinician ID

Password

Log In



Mobile



Laptop

Responsive,
no delays

Simple but
effective

[Negative
quote]

[Negative
quote]

[Negative
quote]

Easy and
simple to use

Easy
and
simple
to
use

How might
we...

How might
we...

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

Figure 20: Trent - Step 2: Homepage

3. Input values

Look for the calculator and input the correct values based on yourself.

Is the patient
male or
female?

Is the patient
of black
descent?

Is the patient
under the
age of 18?

CKD Risk Calculator

Age

Sex

Ethnicity - Black Descent

Blood Creatinine



Mobile



Laptop

Simple
buttons, not
so
complicated

Easy inputs,
very
responsive

Clear
instructions,
not
complicated

[Negative
quote]

[Negative
quote]

[Negative
quote]

Inputting
patient's data
is never

How might
we...

How might
we...

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

Figure 21: Trent - Step 3: Calculator Input

4. Get results

Based on your results, match them up with the CKD Stages

Is my results
worrying for
my age?

Can this
affect me in
the future?



Mobile



Laptop

Responsive
answers

Can compare
to CKD scale

[Negative
quote]

[Negative
quote]

[Negative
quote]

Time to get
results and



How might
we...

How might
we...

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

[Feature
idea]

Figure 22: Trent - Step 4: Result Display

5. Devices

Based on your results, match them up with the CKD Stages

Can I share my results?

Are other patients having the same results?

What can I do to help my health before it is too late?

Devices

NephroBand X1

Connected

Battery: 85%

BPMonitor 2000

Disconnected

Battery: -

Ethnicity - Black Descent

Sync Devices

+

 Add Device



Mobile



Laptop

Can add more devices

Very responsive

Can find other >18 I can share results with

[Negative quote]

[Negative quote]

[Negative quote]



How might we...

How might we...

[Feature idea]

[Feature idea]

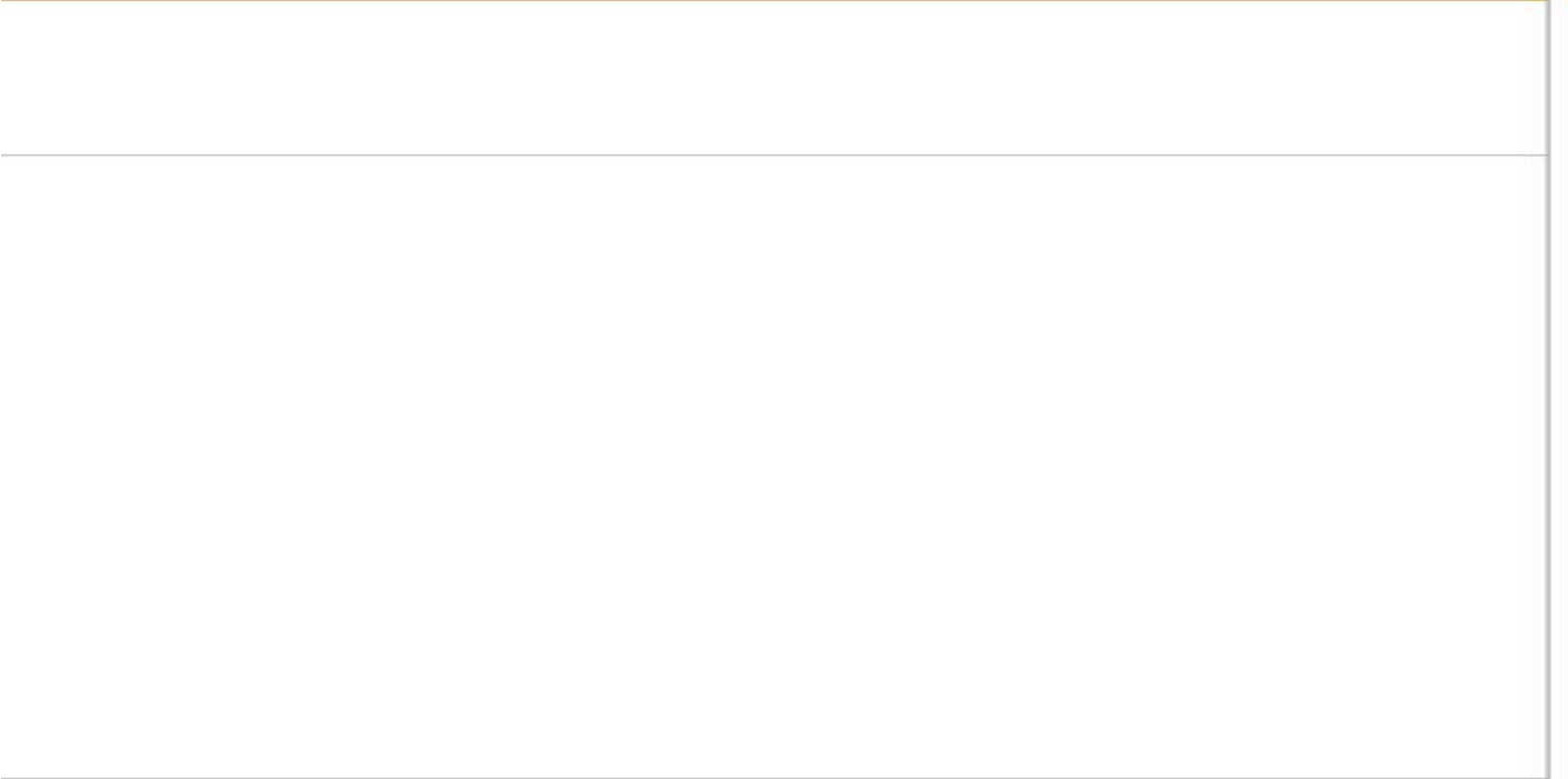
[Feature idea]

[Feature idea]

[Feature idea]

[Feature idea]

Figure 23: Trent - Step 5: learn About CKD



Mobile



Laptop



Figure 24: Trent - Step 6: Parental Guidance or Exit