

Appendix

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A Study in the use of Mobile Devices for Supporting the Care of Elderly Patients

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1. Interviews

1.1 Interview 1

Interviewee No.1 – Male, Hip Operation, Age 78 when operation took place

Question 1: When you were discharged from hospital, were you provided with home care support from the NHS? If so, please explain the type of support and the quality of care you received.

I did receive care – there was a gap of a few days before it took place. Not quite sure why that was. The actual social care itself was fairly good. You could tell that the social services were under great strain, because as I understood it, I should have been getting helpers from areas close by. But the helpers came from all over the place. They needed to travel distances, so they were worried whether they would get to the next place on time. Very rarely did anyone come from nearby. Obviously, the social services situation in the area, because of cutbacks they were having to rely on people from other areas to help. I didn't get any help from a physio, or very little of it. When I acquired why I wasn't getting it, the link between the hospital and themselves hadn't even taken place – they didn't even know who I was. The physio dept. in my area didn't know about me, and didn't have staff come and see me that often. There was no replacement when someone went on holiday. It meant that the step that enabled me to get outside of my house, it did not take me until 5 weeks after the operation. Which meant I was unable to get anywhere outside of the house for nearly 6 weeks. I was told not to get down the step. That was the worst thing- I like the make the effort, which made me feel restricted in the house. The service itself, they were very helpful. They are recruiting good people.

Question 2: Before you were discharged from hospital, did you find yourself waiting around before you could be sent home? If so, how long were you waiting for?

Although it wasn't really discussed with me (which I think it probably should have been), I did wonder why I was in for 8 days, and I think it was difficult for them to decide whether I should go home. All I can say is, that my family and close friend really helped. If I had to rely on social services exclusively, that might have been quite an issue.

Question 3: Did you ever feel you do not get enough support for your medical needs?

I think from the actual help around the house, and getting my clothes on, they were very helpful and understanding, they were very good. I was aware of the fact that things were a struggle for the people that came. They were under pressure. The relationship between the hospital and the people who are supposed to do the physio therapy – there was something wrong with the situation where they were unaware of my situation. There should be a connection between the departments. That may well have been the people in the offices that may have been unable to pass on information. Not actually the helpers or the physio dept.

Question 4: Did you ever have trouble receiving care on time?

They weren't always on time, but you could tell they were doing their best. I don't think I ever had to wait for hours. There was never a situation where they didn't come. If they said they were coming in the morning, they would come in the morning. They might have been an hour late, but they always turned up.

Question 5: What was the most difficult task you found to do on your own, after being discharged from the hospital?

Well I had great problems with getting my trousers on. Initially that was a real trouble. I had problems getting in and out of bed. That suggests that I was released a little too early.

Question 6: Do you think you would benefit from a system or application that would allow you to monitor your healthcare at home. For example, something that tracks your movement, allows you to monitor your vitals, and reminds you to take your medicine.

A lot of it is the human contact – the physical help is what you need most. If you live on your own, even though people are coming in, you do miss them when they have left. You feel quite isolated when you live on your own. Yes, I think this system may be fine, but after you come out of hospital and you don't feel too well, whether I would use a system like this straight after hospital, it's a bit too much. I think it would not be good initially, but maybe a few months on when you are better but when the helpers aren't coming in any more. The helpers get reduced over time, when you still need them a little bit – then yes this would gradually help. Still think it is too much to hope for.

Question 7: Would you feel more at ease alone at home if you had something that would remind you when to pick up your prescriptions, and send medical information to your social carer or GP if necessary?

Yes, I think that is true.

Question 8: Have you ever used any type of technology that allowed you to take care of your own medical needs?

No – It has never been offered.

Question 9: What is your opinion on the current strain the NHS is having in regard to lack of beds for patients?

Well it doesn't appear to be new. It has been growing for ages now. When I went to the GP to be referred for the operation that was on the 2nd July 2015. It took me from 2nd July 2015 to the 21st April 2016 to have the operation. Before I went to see the consultant in November, I had a number of cancellations and then I actually had 5 dates, 4 written for the operations, which were all altered. The final one (6th)

was successful. You are supposed to be seen by 18 weeks, after the consultation. I was initially booked in for 10th December 2015, and then they decided they had failed to look into my heart condition, therefore that was cancelled. All altered after that. Took till the April to have the op – that is well over 18 weeks! So, the situation is not new. Maybe it is just being highlighted further now, but this is not something that has just recently come upon the NHS in the last 12 months or so - it has been growing.

Question 10: Would you be willing to be contacted again to help provide further feedback, as this project progresses?

Of course.

1.2 Interview 2

Interviewee No.2 – Female, Knee Operation, Age 79 when operation took place

Question 1: When you were discharged from hospital, were you provided with home care support from the NHS? If so, please explain the type of support and the quality of care you received.

No I didn't get anything. Well, I had a cardiac arrest, so that kept me in hospital for a day or two longer. When my daughter tried to get me into respite care, there wasn't anything available. They kept me waiting over the weekend, said there could be possibly space in Tarporley (which I didn't want to go there), so the operation was on the Saturday and this was the following weekend and we hadn't got anything fixed up at all, and I wanted to come home. Thinking about it, the next day I was on my phone to a friend and she said, "I'm sure you will be able to manage on your own", and well, that is what happened. I mentioned it to my daughter, and she picked me up the following day. Somebody said, "did you discharge yourself" and I said no, I actually spoke to the physiotherapist on the Tuesday (when I said I was going home), and they said, "we're happy for you to go home", and the hospital was too, it was just that we were waiting for care. A few days later they did ring up and offer to get somebody to come and help me out the shower, and by that time it was useless. In between I tried to get somebody to come and help me get a shower (after I had come home), we couldn't get anyone to come, even though I was prepared to pay for it. So, I just managed on my own till I was ready to do it myself.

Interviewer input: "If you hadn't had the help from the family, do you think that would have been very difficult?"

It would have been, yes. I was expected to be in for 3 nights, and it turned out to be 11. If I had come home when I was supposed to, it would have been a lot more difficult.

Question 2: Before you were discharged from hospital, did you find yourself waiting around before you could be sent home? If so, how long were you waiting for?

Well, I'm not sure how long they would have kept me in with having had the CPR – they probably would have kept me a longer. I don't quite know when I should have been officially discharged, I think they were waiting for the NHS to sort something out for me. Generally, everybody waiting for everybody else.

Interviewer input: “Do you think the communication between the departments in the NHS was quite disorganised then?”

I think it is messy, it was over a weekend you see. Nothing happens in a hospital over the weekend. You can't get anything done on a Saturday or Sunday. If it's not fixed on the Friday, you have to then wait till the Monday, before you can even start again.

Question 3: Did you ever feel you do not get enough support for your medical needs?

I got the support in the hospital obviously, I didn't really get any support getting in the shower, so I just managed on my own. I had a strict wash till I was ready to actually use my own shower. So actually, I didn't get any help. Nobody actually ever came to help me shower, I waited till I felt ready myself.

Question 4: Did you ever have trouble receiving care on time?

The only thing I would have had; they had actually made arrangements for me to have physio, but I couldn't take that because I was still in hospital at the time. So, I did get it later on after being home a few days, so that was fine, but not the general care.

Question 5: What was the most difficult task you found to do on your own, after being discharged from the hospital?

I think probably getting up and down the stairs. You have to have one arm on the rail, one arm on the elbow crutches, and at the same time as having your hand on the elbow crutches, you had to hold the other crutch as well. So, that when you are upstairs, you got both crutches to use. So, that was the worrying part, that I could manage getting up the stairs myself.

Question 6: Do you think you would benefit from a system or application that would allow you to monitor your healthcare at home. For example, something that tracks your movement, allows you to monitor your vitals, and reminds you to take your medicine.

No I don't think so, I've not got to that stage yet. I don't think I would like it. The only thing I did enquire about is when you have a thing around your neck and you can press it if you have any problems. That was very expensive. You couldn't just have it for a week or a few days, you would have to have it for 2-3 months. I did look into it but thought, no I will have to manage without that. It was £600 or something like that. It alerts someone when you need them. I was hoping it wouldn't be necessary anyway.

Question 7: Would you feel more at ease alone at home if you had something that would remind you when to pick up your prescriptions, and send medical information to your social carer or GP if necessary?

Not necessarily, no. Because all my medication all wants replacing at different times.

Question 8: Have you ever used any type of technology that allowed you to take care of your own medical needs?

No not medical.

Question 9: What is your opinion on the current strain the NHS is having in regard to lack of beds for patients?

Obviously, the more beds there are available, and the more staff, it is better for everybody. You can get the operations done, and people in and out. But it's the aftercare as well isn't it. Don't know the answer to that one, although don't think anyone does.

Question 10: Would you be willing to be contacted again to help provide further feedback, as this project progresses?

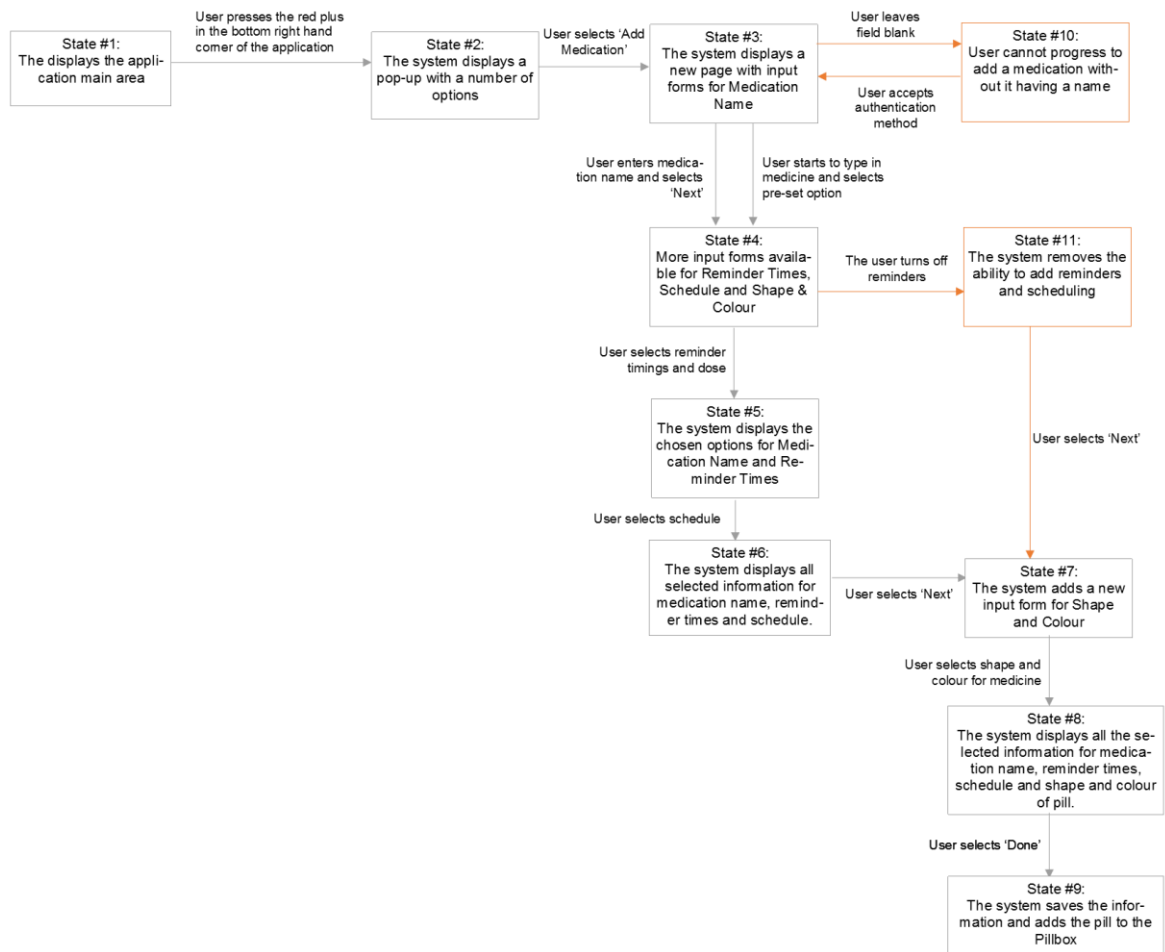
Yes.

2. State Transition Networks

2.1. Medisafe: Add a new medicine/prescription

Medisafe

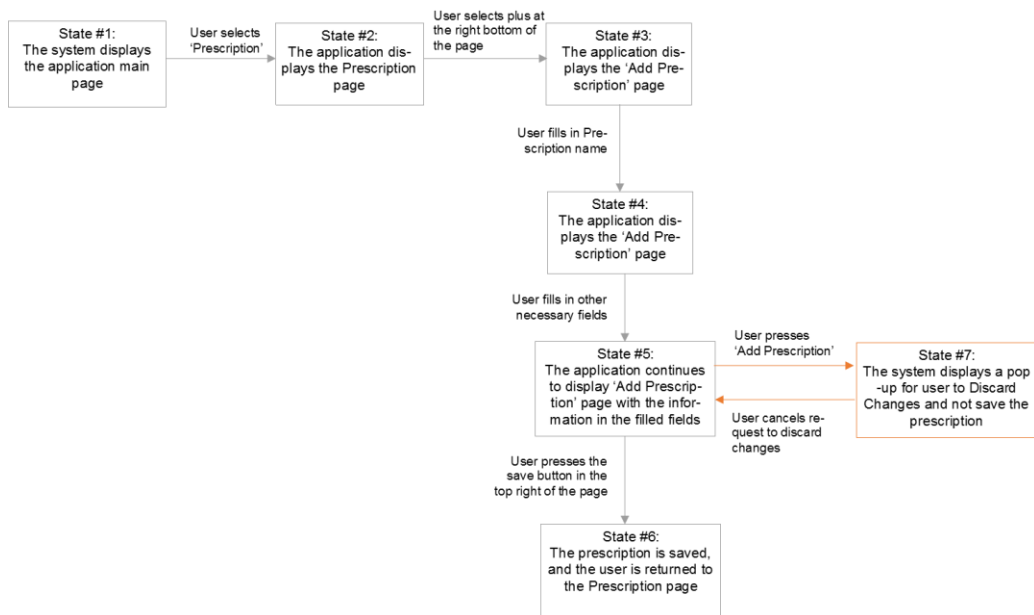
Task: Add a new medicine/prescription



2.2. Med Helper: Add a new medicine/prescription

Med Helper

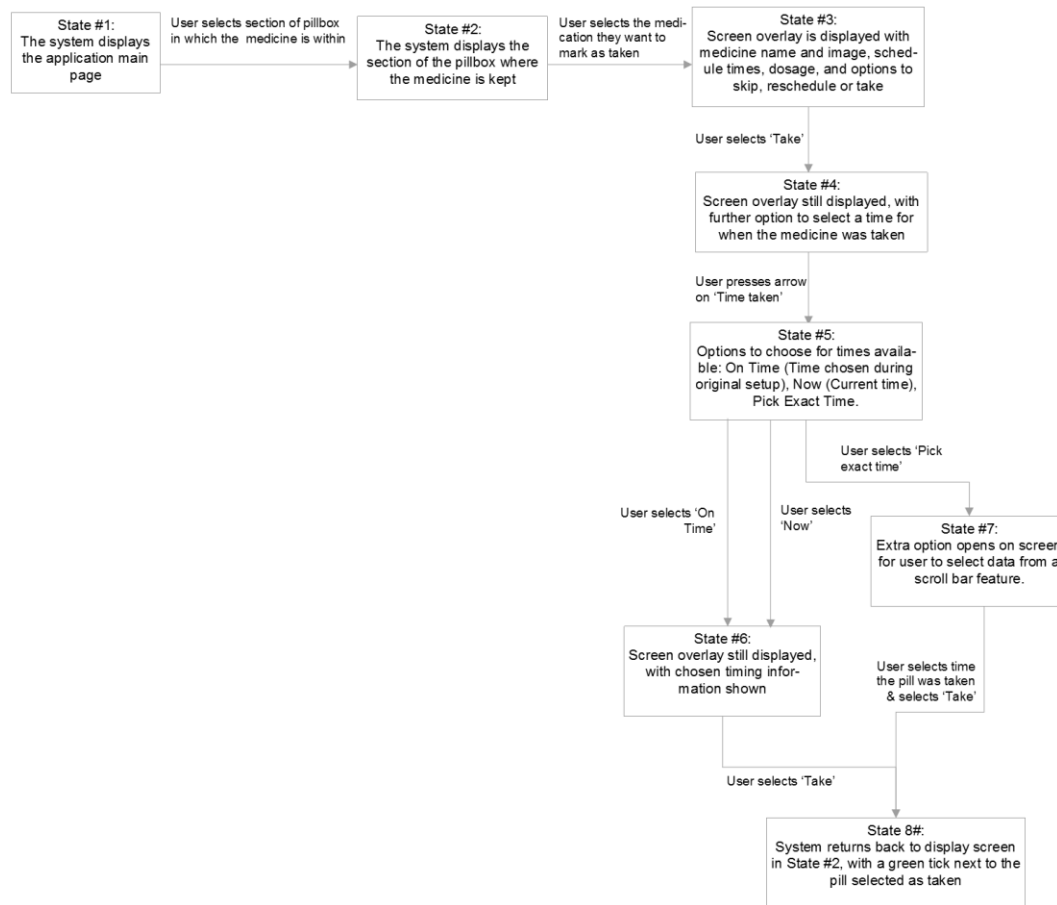
Task: Add a new medicine/prescription



2.3. Medisafe: Mark a medicine as 'taken'

MediSafe

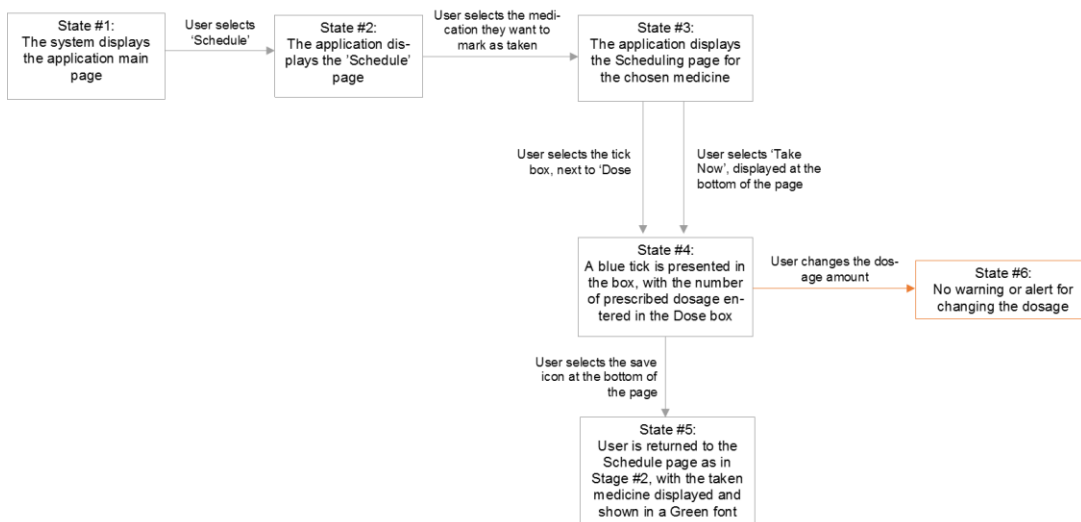
Task: Mark a medicine as 'Taken'



2.4. Med Helper: Mark a medicine as 'taken'

Med Helper

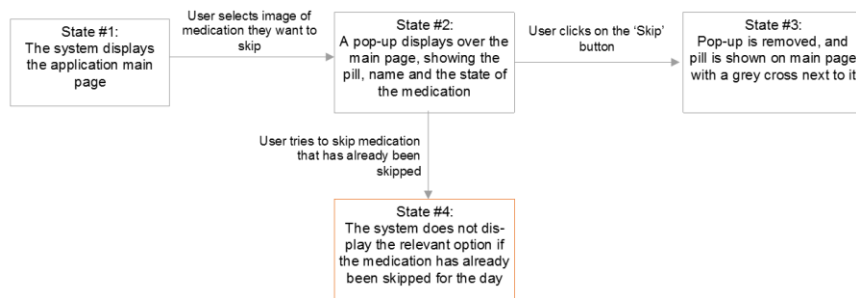
Task: Mark a medicine as 'Taken'



2.5. Medisafe: Skip a dosage

MediSafe

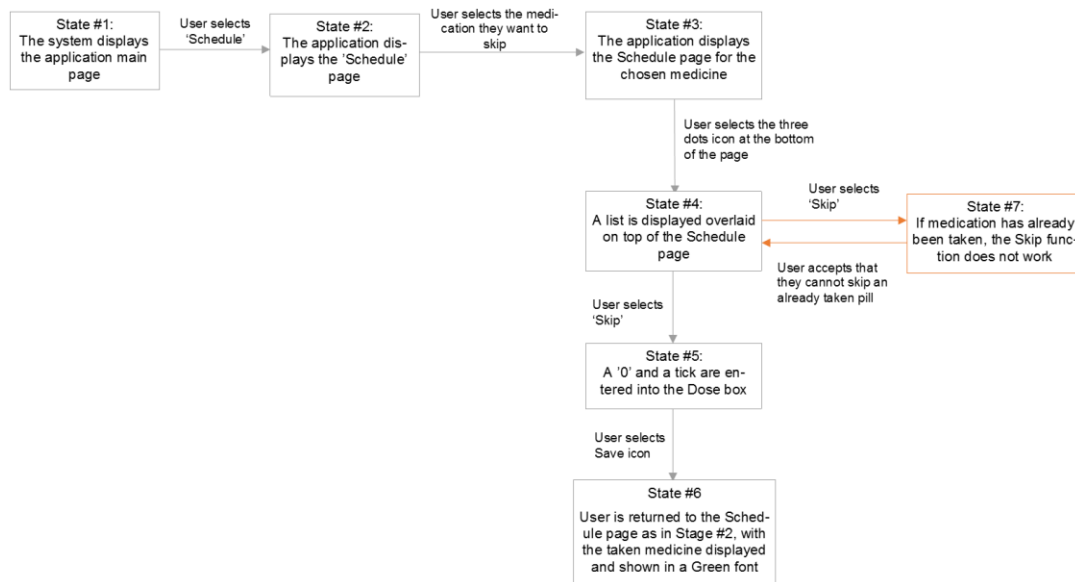
Task: Skip a dosage



2.6. Med Helper: Skip a dosage

Med Helper

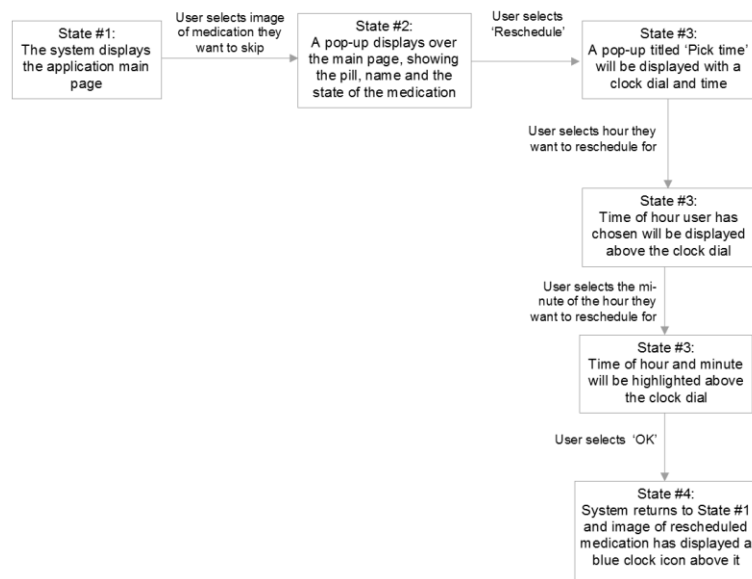
Task: Skip a dosage



2.7. Medisafe: Reschedule a medication reminder time

MediSafe

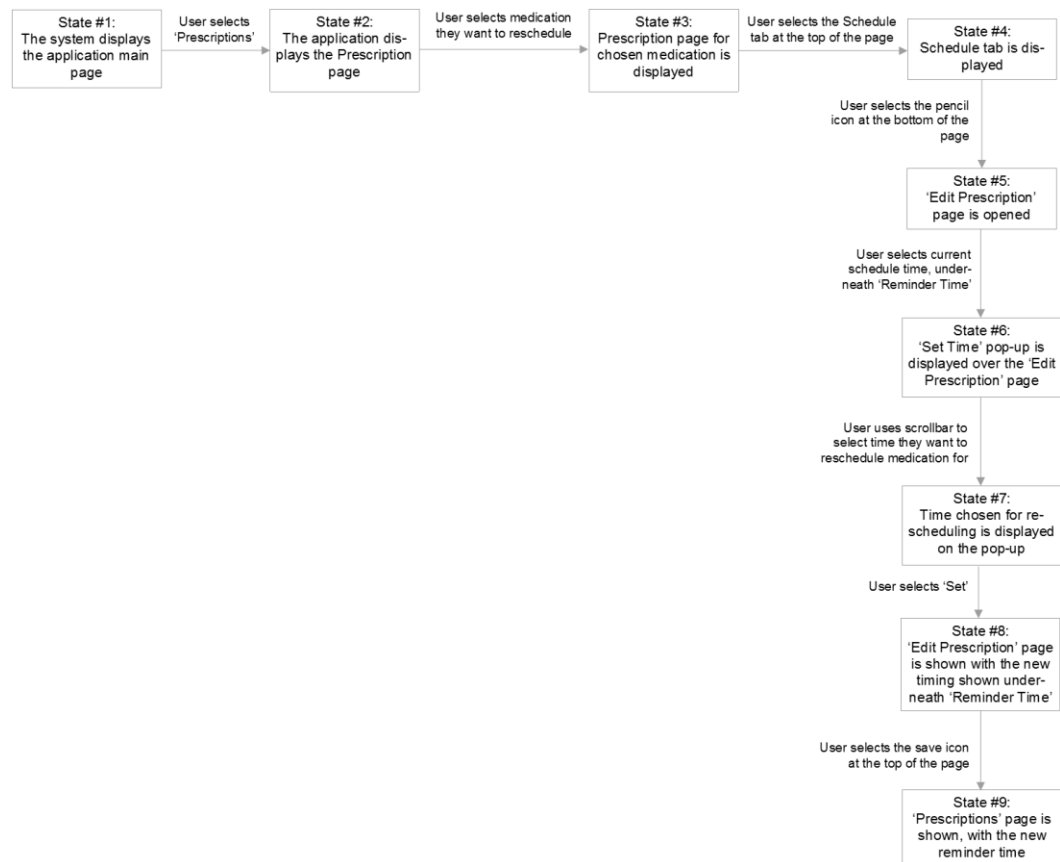
Task: Reschedule a medication reminder time



2.8. Med Helper: Reschedule a medication reminder time

Med Helper

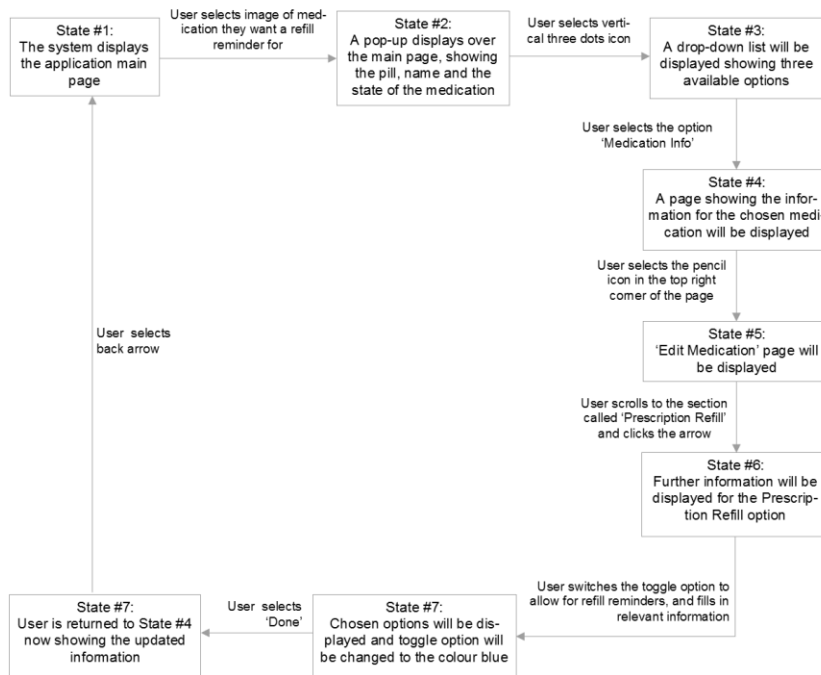
Task: Reschedule a medication reminder time



2.9. Medisafe: Set up a refill reminder

MediSafe

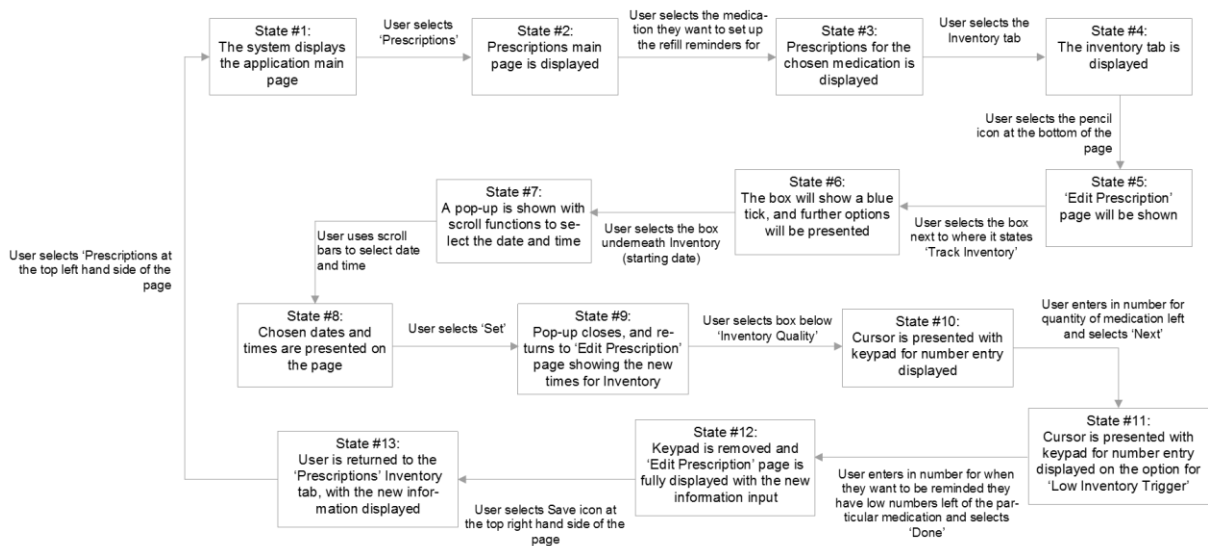
Task: Set up refill reminder



2.10. Med Helper: Set up a refill reminder

Med Helper

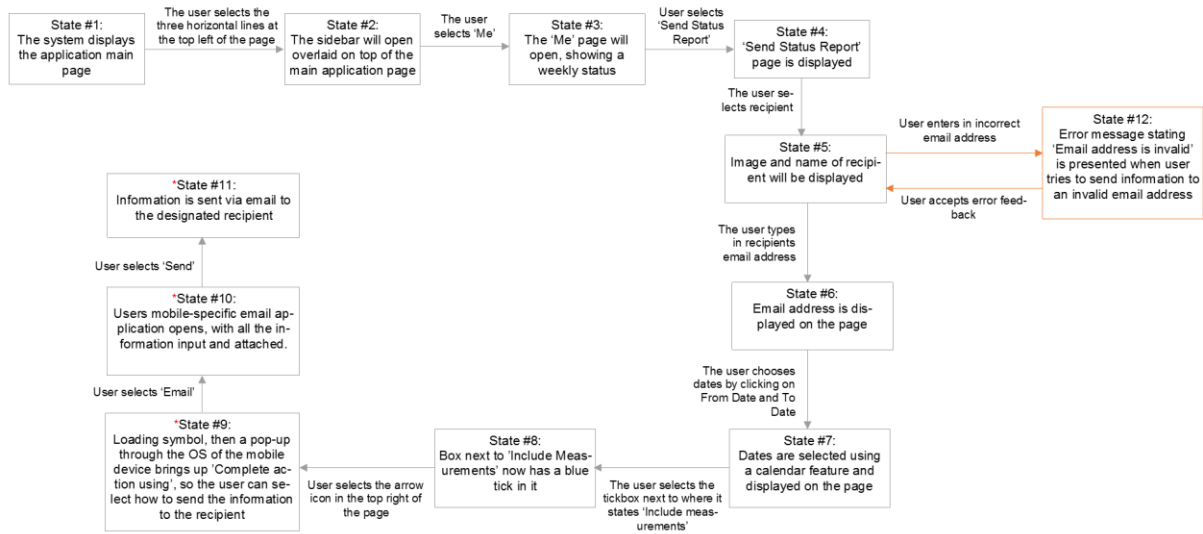
Task: Set up refill reminder



2.11. Medisafe: Sending user information

MediSafe

Task: Sending user information

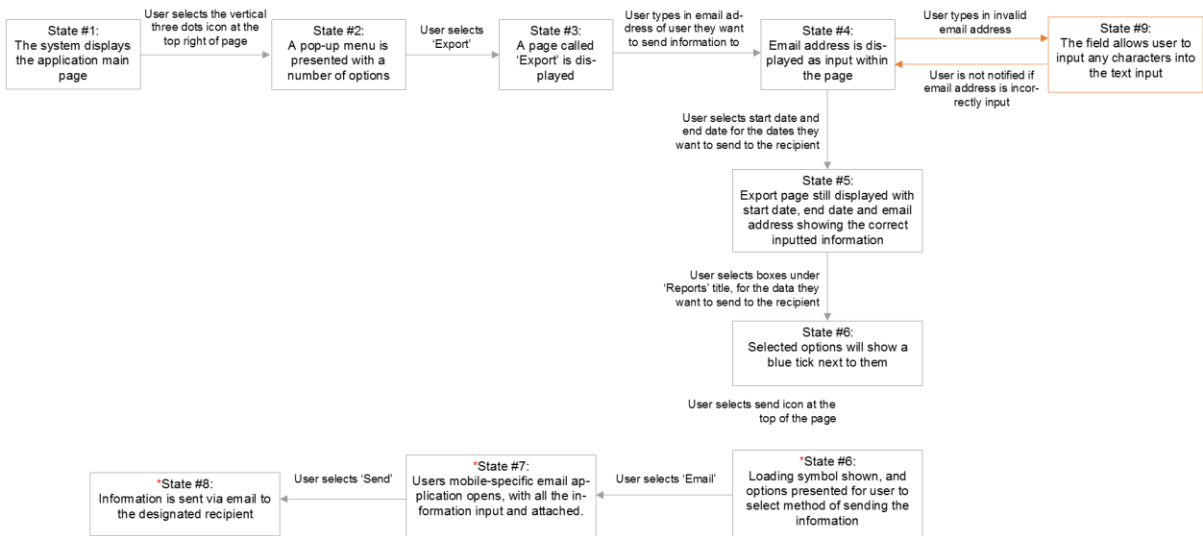


* this feature has been tested on an Android device, so this may differ for other mobile devices

2.12. Med Helper: Sending user information

Med Helper

Task: Sending user information



* this feature has been tested on an Android device, so this may differ for other mobile devices

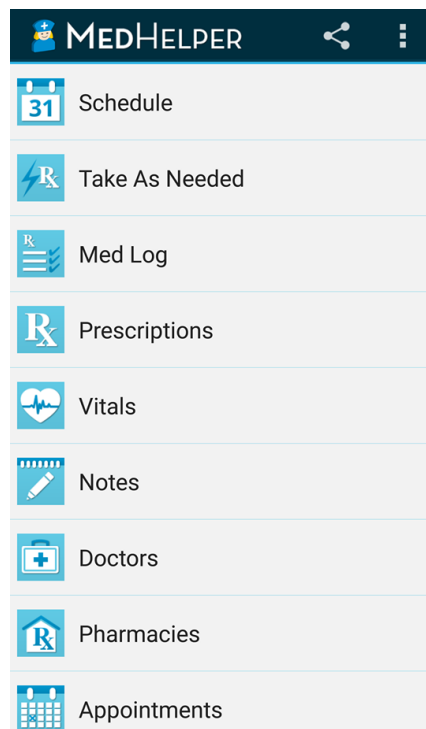
3. Heuristic Evaluation

3.1. Application 1: Med Helper

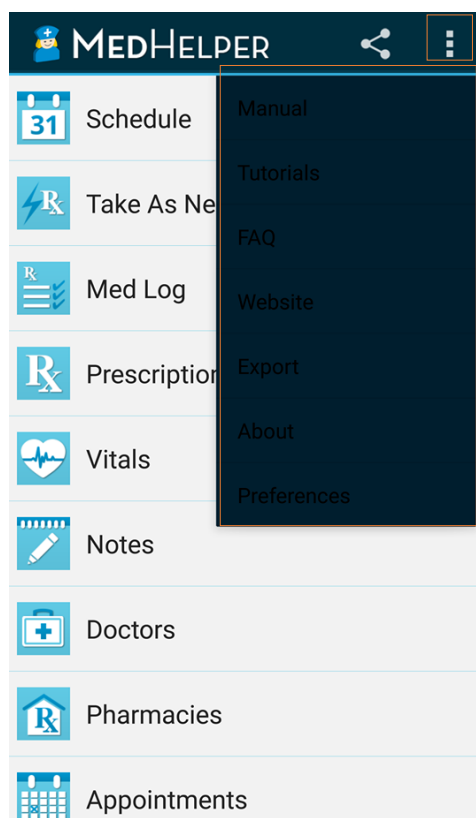
The first application heuristic evaluation has been undertaken on is Med Helper Pill Reminder version 2.7.7. This will be evaluated on a Samsung Galaxy S6 SM-G920F, Android Version: 6.0.1.

Table 1 – Heuristic Evaluation 1	
<i>Problem Number:</i>	1
<i>Problem Title:</i>	No instructions or tutorial when first time opening app
<i>Severity Rating:</i>	3
<i>Heuristic violated:</i>	Visibility of system status Flexibility and efficiency of use Help and documentation
<i>Problem Description:</i>	<ul style="list-style-type: none"> • When you open the app for the first time, it does not prompt the user to do anything • No instructions as to how to add medication reminders • The screen has no onscreen help or easy to find tutorial • Users must rely on knowledge about applications, to know how to use the app • There is an external link to a webpage which has options for ‘Manual’ and ‘Tutorial’, however this would take the user out of the app. It is not easy to know how to return to the app after this. • The links to the ‘Manual’ and ‘Tutorial’ are poorly designed, as the font colour does not contrast with the blue background. Therefore, you can barely read the content.
<i>Recommendations:</i>	<ul style="list-style-type: none"> • When the user enters the app for the first time, a video should be shown on how to use the application • A tutorial and hints should be shown when the user is using the app, and they can remove them easily once they have found what they want to do

Additional Information:



This is the screen that is presented when you open the app for the first time. This is the homepage for the app.

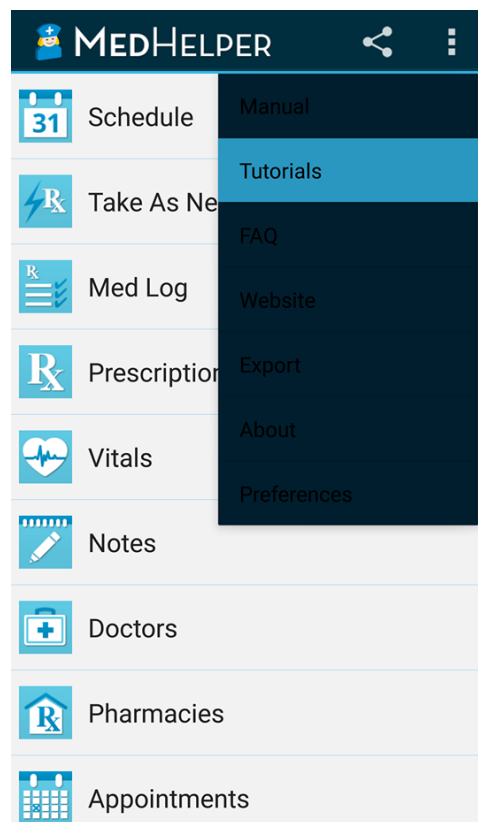


The button the user must press to access the list which will allow them to access tutorial on how to use the app

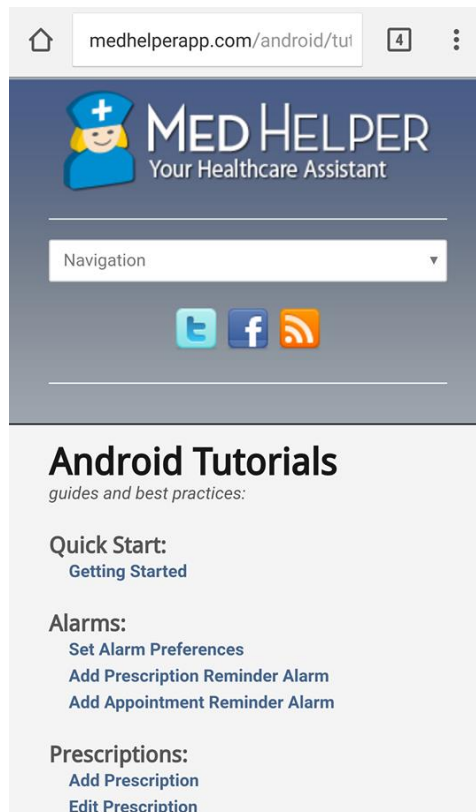
The list of options available once the link has been pressed. The poor visibility of links violates Nielsen's heuristic: Aesthetic and minimalist design

To find a tutorial on how to use the app you must click on the three dots symbol in the top right hand corner. If you had not used any sort of mobile application before, you would not know what this means. Also, as you can see, it brings up a drop-down list, but you cannot see what the links are due to the poor contrast of the navy-blue

background and the black text. The colour scheme for this is very poor, and would not be appropriate for any user.



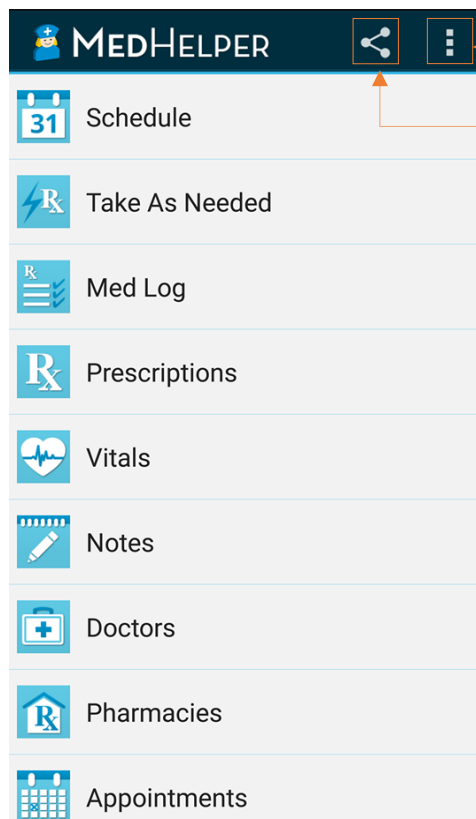
Here you can see that the 'Tutorial' link is highlighted. The only way you can see this is if you hold down the option. An elderly user would not know how to do this. This colour scheme is easier to read, and should be used instead of the blue and black they currently have in place. When you click on this link, users control and freedom is violated, as they do not get any message or alert to let them know that if they click this link they will be taken to an external webpage. The user does not get the choice to stay on the app. This is poor usability in terms of consistency, as the user is not made aware that some of the links are external and some are internal to the app.



This is the external page the user is taken to if they click on the ‘Tutorial’ button. If the user reached this page, they may still struggle to understand how to access the information necessary, as there are lots of further links.

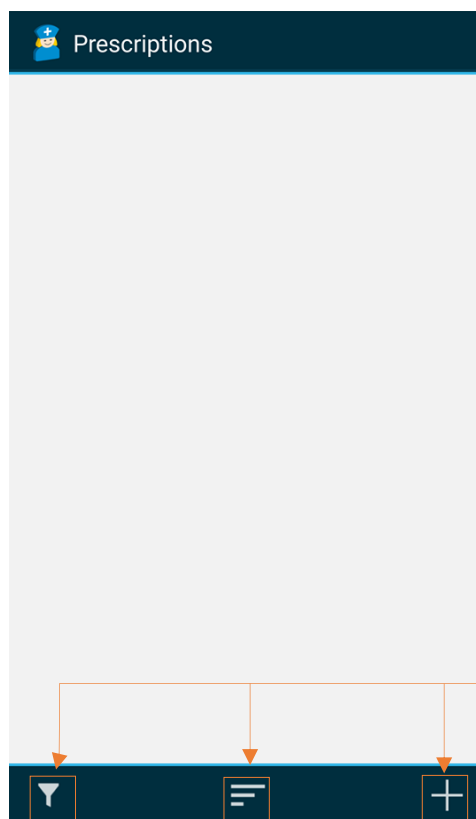
Table 2 – Heuristic Evaluation 1	
Problem Number:	2
Problem Title:	Icons are not self-explanatory
Severity Rating:	2
Applicable Heuristics:	Visibility of System Status
Problem Description:	<ul style="list-style-type: none"> Whilst navigating around the app, there is no text to describe what it is you are pressing, so it is presumed that the user knows what the icon means. Some of the icons are difficult to understand what they represent
Recommendations:	<ul style="list-style-type: none"> Words instead of icons If icons are necessary, ensure they are easy to understand, or for the first time using them have hints to explain to users what the icons mean

Additional Information:



These buttons do not give any information about what their function is. Users who have not used apps before, may not want to press them, due to being unsure of their function.

Icons in the header are not self-explanatory, especially to those who do not use technology regularly.



These buttons do not give any information about what their function is. Users who have not used apps before, may not want to press them, due to being unsure of their function.

Icons at the bottom of the app are not self-explanatory.

The save button – never explained to the user. This can be confusing for elderly users.

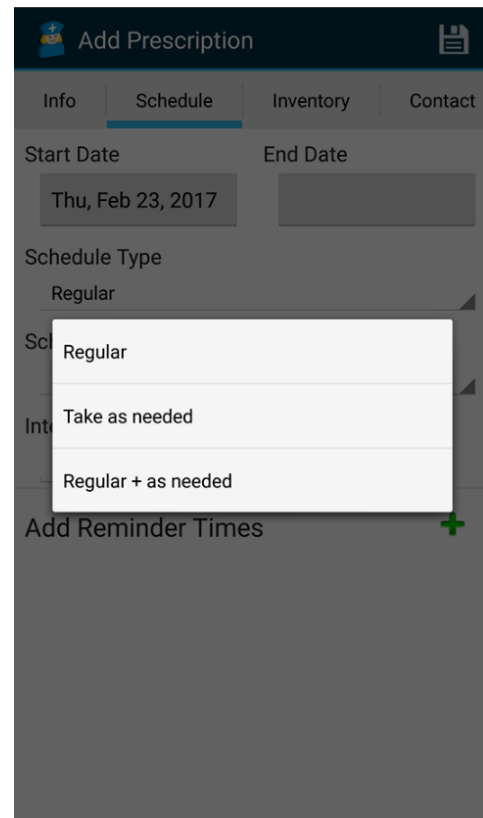
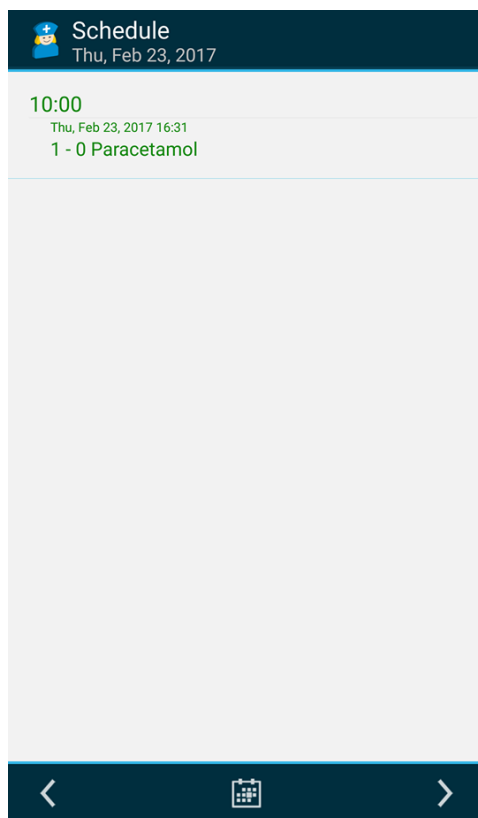
It is not made obvious that the icon in the right-hand corner is the save button.

Table 3 – Heuristic Evaluation 1	
<i>Problem Number:</i>	3
<i>Problem Title:</i>	No feedback provided to inform users of changes
<i>Severity Rating:</i>	2
<i>Applicable Heuristics:</i>	Visibility of System Status User Control and Freedom
<i>Problem Description:</i>	<ul style="list-style-type: none"> When saving an item, such as a prescription, there is no sound or text feedback to confirm that it has saved correctly.
<i>Recommendations:</i>	<ul style="list-style-type: none"> A chime to provide users with positive feedback, so the user knows they have correctly input data. A text box pop-up when the save button is pressed, saying 'Save and return to homepage?'

Table 4 – Heuristic Evaluation 1	
<i>Problem Number:</i>	4
<i>Problem Title:</i>	No feature to increase text size/change font style
<i>Severity Rating:</i>	3
<i>Applicable Heuristics:</i>	Aesthetic and minimalist design User control and freedom
<i>Problem Description:</i>	<ul style="list-style-type: none"> As the app is being considered for the elderly, there is no feature available to enlarge the text or change the fonts. For elderly users who have low vision, they would like the

<i>Recommendations:</i>	ability to choose a larger font. However, there are elderly users who do not have low vision problems, so may not need large font sizes.
	<ul style="list-style-type: none"> • A button which allows you to choose the font size and style you need for your own personal needs. This selection must stay the same for every time you use the app. The reason for doing this is to allow for all users to enjoy their experience on the app. • A serif type font is preferable for elderly, as they help guide the eye across the text.

Additional Information:



These two images show screens in the app where the text is very small. In the first figure, it is very difficult to read the date and time that the medication was taken. In the second image, the list of options has rather small text.

Table 5 – Heuristic Evaluation 1	
<i>Problem Number:</i>	5
<i>Problem Title:</i>	No set of options available to choose from
<i>Severity Rating:</i>	2
<i>Applicable</i>	Recognition rather than recall
<i>Heuristics:</i>	Error prevention
<i>Problem</i>	<ul style="list-style-type: none"> • When the users are entering in their prescriptions, doctors, pharmacies etc. there is no list of options available for the user to choose from. This means that the user must
<i>Description:</i>	

<i>Recommendations:</i>	remember all the specific information he needs, when it could easily be suggested to him.
	<ul style="list-style-type: none"> • Suggest a set of options, especially for the types of medications. This will help to minimize the application of user memory. It also makes the app more user friendly, and efficient and quicker use of the app. • When the user attempts to type in their medication, a list should pop up with possible suggestions. The user can then select from a list of options, rather than typing in the entire name itself.

Additional Information:

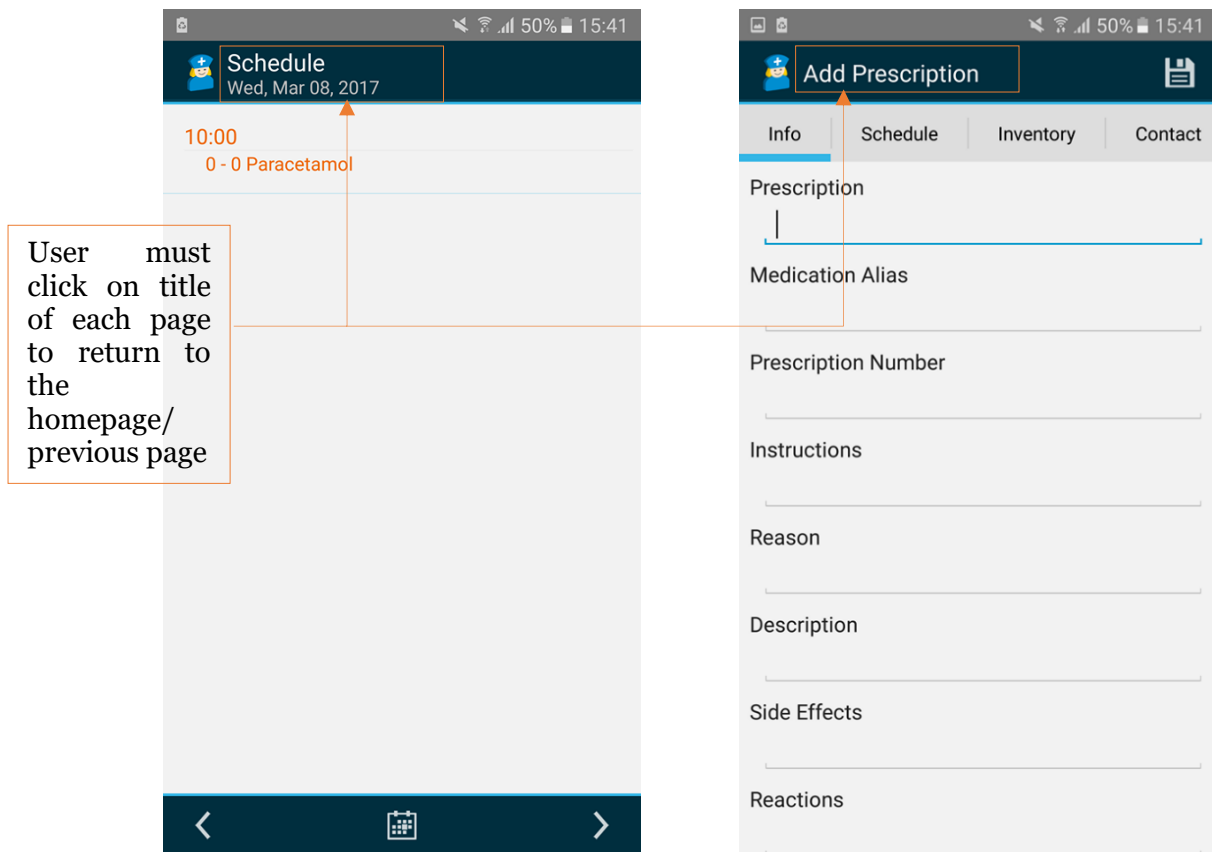
When the user starts to type their medication in, there are no suggested options available.

When typing in the medication, a list of options should appear, instead of the user having to remember all the necessary information

Table 6 – Heuristic Evaluation 1	
<i>Problem Number:</i>	6
<i>Problem Title:</i>	No back button for navigation
<i>Severity Rating:</i>	2
<i>Applicable Heuristics:</i>	Flexibility and Efficiency of use User Control and Freedom
<i>Problem Description:</i>	<ul style="list-style-type: none"> • When the user opens any page from the homepage, the only way for them to get back through the application is to press the logo and page title at the top left hand side of the page. It is never mentioned to the user, and it is unclear

	that this would take the user back to the main page. If the user was not “tech-savvy”, they may not understand how to go back within the application.
<i>Recommendations:</i>	<ul style="list-style-type: none"> • Provide an arrow icon or an icon of a house in the top left corner of the page

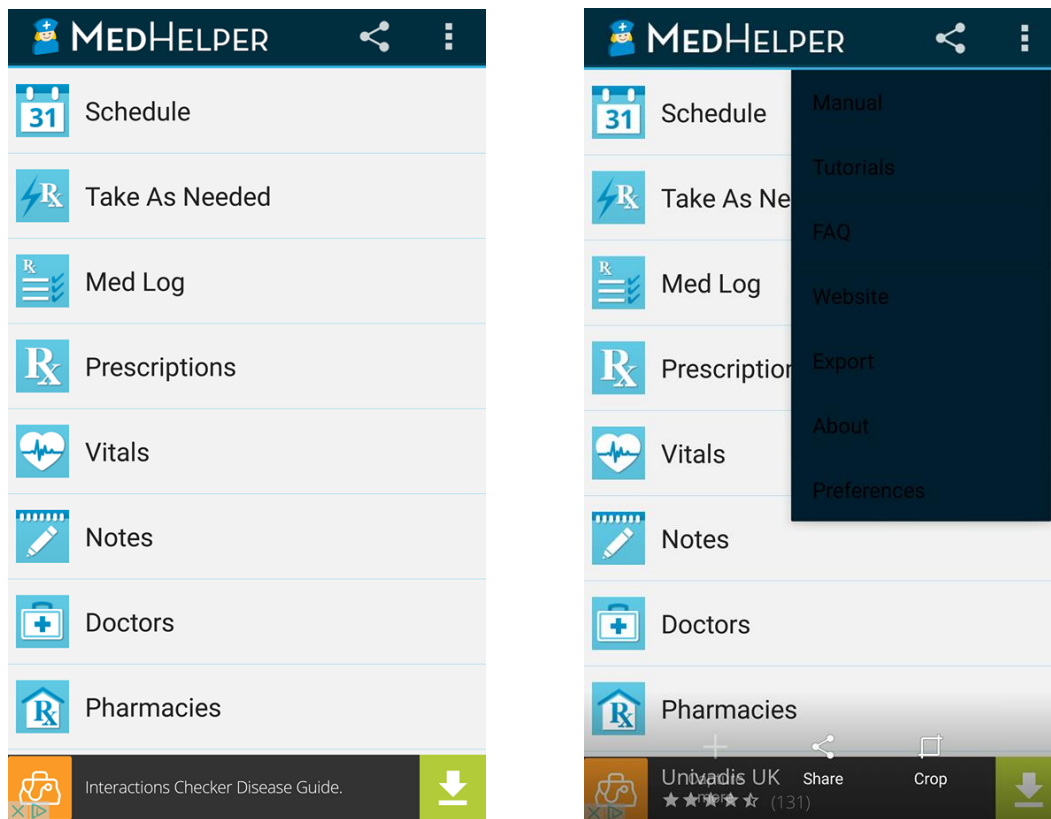
Additional Information:



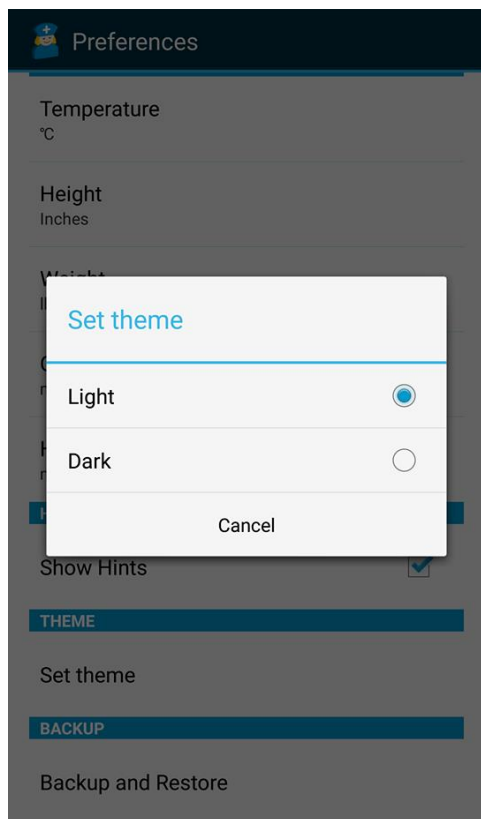
Showing two examples of where the user would have to select to return to the previous page in the application

Table 7 – Heuristic Evaluation 1	
<i>Problem Number:</i>	7
<i>Problem Title:</i>	Only two colour schemes available
<i>Severity Rating:</i>	2
<i>Applicable Heuristics:</i>	Flexibility and Efficiency
<i>Problem Description:</i>	<ul style="list-style-type: none"> • Due to the target audience for our application, the fact there are only two available colour schemes could hinder a lot the users. Due to a lot of colours being difficult for the elderly to read, only having two options is quite limiting.
<i>Recommendations:</i>	<ul style="list-style-type: none"> • Have a selection of options available so that the user can choose which colour scheme would suit them best. • Allow the user to choose background and font colours

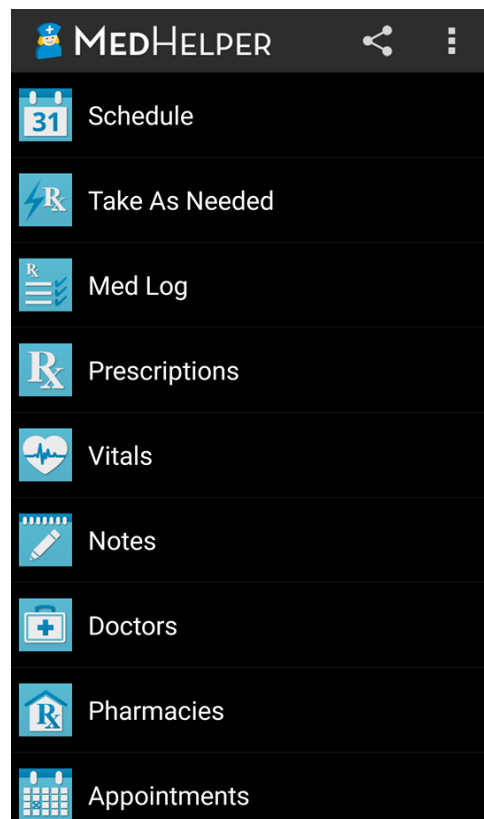
Additional Information:



These two screenshots show the light theme. As you can see, when you select the three vertical dots icon in the top right corner, the text in the dropdown list is not easy to read.



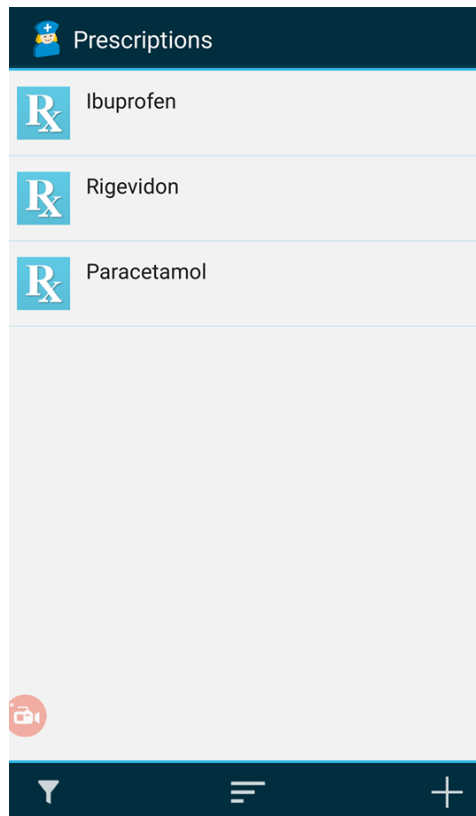
Options for theme colours



This is the dark theme

Table 8 – Heuristic Evaluation 1	
<i>Problem Number:</i>	8
<i>Problem Title:</i>	No images of medication
<i>Severity Rating:</i>	1
<i>Applicable Heuristics:</i>	Recognition rather than recall Match between system and real world
<i>Problem Description:</i>	<ul style="list-style-type: none"> As there many medications that need to be taken at different times of the days, it may become confusing for (especially elderly) users to know which pills to take.
<i>Recommendations:</i>	<ul style="list-style-type: none"> If there were customisable images of pills instead of very long names of medications, it may be easier for the elderly user to know which medication to take. The images could be icons that are colour coded to allow for customisation

Additional Information:



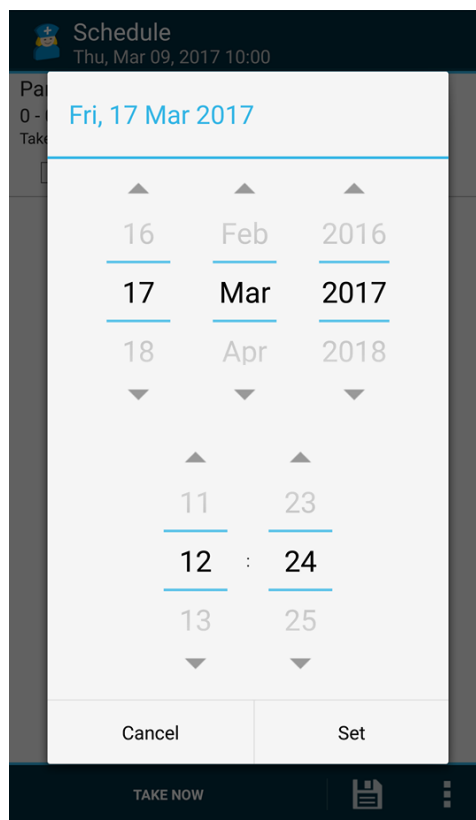
This is the page that shows the user all the medications they are taking.

Table 9 – Heuristic Evaluation 1	
<i>Problem Number:</i>	9
<i>Problem Title:</i>	No easy way to exit the application
<i>Severity Rating:</i>	1
<i>Applicable Heuristics:</i>	Flexibility and efficiency User Control and Freedom

<i>Problem Description:</i>	<ul style="list-style-type: none"> There is no feature in the application to exit the app. Although this is not a common feature within applications, the target audience may want something that they could select to feel like they have completed the tasks
<i>Recommendations:</i>	<ul style="list-style-type: none"> Add in a simple exit button within the application

Table 10– Heuristic Evaluation 1	
<i>Problem Number:</i>	10
<i>Problem Title:</i>	Difficult to set date and time
<i>Severity Rating:</i>	1
<i>Applicable Heuristics:</i>	Flexibility and Efficiency Aesthetic and minimalist design
<i>Problem Description:</i>	<ul style="list-style-type: none"> It is very difficult to set the date and the time. The feature expects the user to scroll to find the correct date – however this can be difficult for inexperienced users to do. There is also a lot of things going on within the one pop-up box (See Figure 13). It has the feature to click on each option, however it is very difficult to select.
<i>Recommendations:</i>	<ul style="list-style-type: none"> Have a calendar feature to ensure that users select the correct date. It also allows it to be more visual for the user.

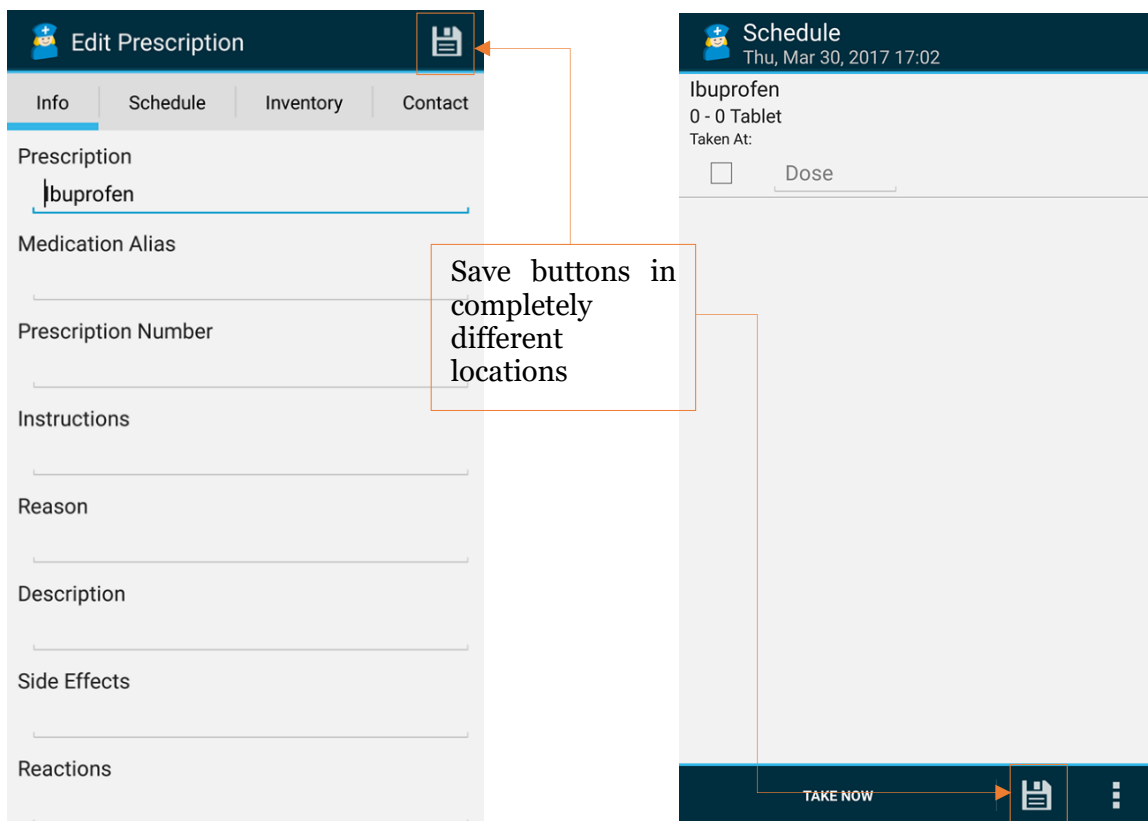
Additional Information:



Selecting the date and time with a scrollbar.

Table 11– Heuristic Evaluation 1	
Problem Number:	11
Problem Title:	Save button is not in a consistent location
Severity Rating:	3
Applicable Heuristics:	Consistency and Standards Recognition rather than Recall
Problem Description:	<ul style="list-style-type: none"> When undertaking two different tasks that require saving, the save icon is not in the same location. This can be very confusing if the user is expecting to see the icon in the same location as it was previously.
Recommendations:	<ul style="list-style-type: none"> Ensure that the save button is always in the same location, even if it is for different tasks. This way, the use will always know where to look when to save a setting.

Additional Information:



3.2. Application 2: Medisafe

The second application I am going to do a heuristic evaluation on is Medisafe Meds & Pill Reminder v.7.21. This will be evaluated on a Samsung Galaxy S6 SM-G920F, Android Version: 6.0.1.

Table 12– Heuristic Evaluation 2	
Problem Number:	12
Problem Title:	Provide user with options
Severity Rating:	0
Applicable Heuristics:	User control and freedom
Problem Description:	<ul style="list-style-type: none"> The user is provided with a pop-up often when they open the application. This pop-up is good usability because it allows the user to fulfil what they are asking, as well as providing the user with the option to do it later, or to not be asked about it again.
Recommendations:	<ul style="list-style-type: none"> None

Additional Information:

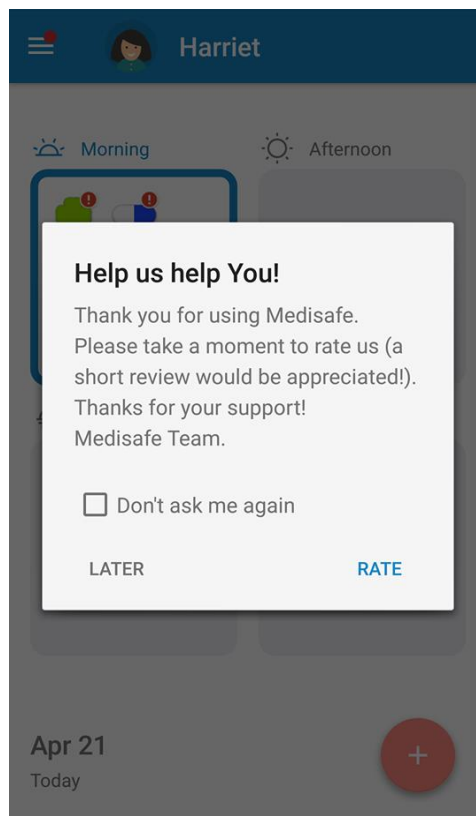


Table 13– Heuristic Evaluation 2	
Problem Number:	13
Problem Title:	All information provided to the user on one page
Severity Rating:	0
Applicable Heuristics:	Visibility of system status

<i>Problem Description:</i>	All the information about each medication is provided to the user on one page. Therefore, the user can see whether they need to take it, or get more refills.
<i>Recommendations:</i>	<ul style="list-style-type: none"> None

Additional Information:

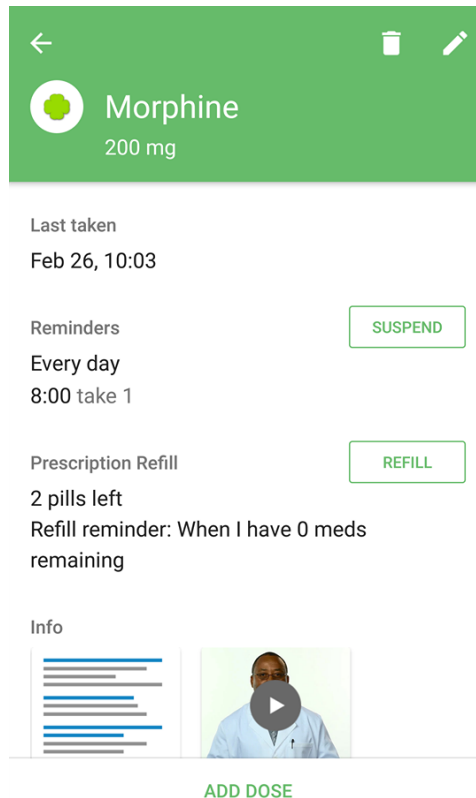


Table 14– Heuristic Evaluation 2	
<i>Problem Number:</i>	14
<i>Problem Title:</i>	Logging in to the application
<i>Severity Rating:</i>	1
<i>Applicable Heuristics:</i>	Help users recognize, diagnose, and recover from errors
<i>Problem Description:</i>	The application will let the user know when the password or username is incorrect. For example, here it states that the password must be at least 6 characters in length.
<i>Recommendations:</i>	When the user enters in the username and password incorrectly, the system could let the user know which field was entered incorrectly.

Additional Information:

← Log in

Email
harriet.clarke@live.co.uk

Password
....

Please use a password that is at least 6 characters long

Forgot your password?

LOGIN WITH EMAIL

Sign in with Google

← Log in

Email
harriet.clarke@live.co.uk

Password
.....

There was an error. Please try again

Invalid email or password

OK

Table 15– Heuristic Evaluation 2	
Problem Number:	15
Problem Title:	Support Page
Severity Rating:	0
Applicable Heuristics:	Help and Documentation
Problem Description:	There are many FAQ's available for the user to find out information. If the user is very stuck, they can contact the Medisafe support team easily through email.
Recommendations:	None

Additional Information:

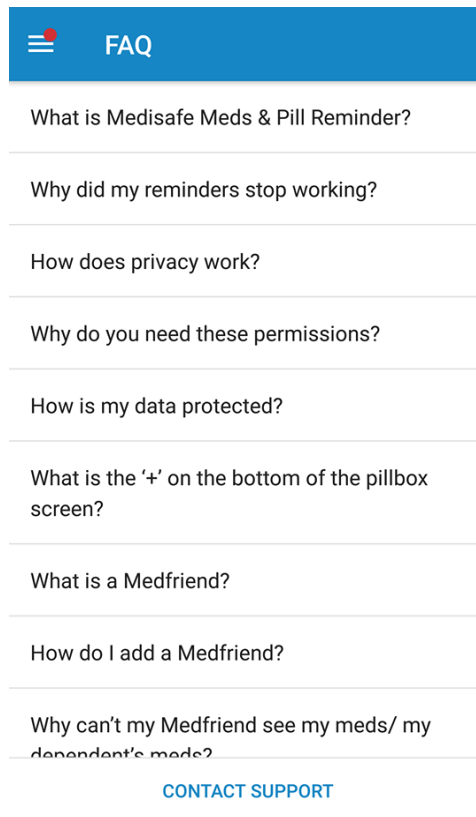


Table 16– Heuristic Evaluation 2	
<i>Problem Number:</i>	16
<i>Problem Title:</i>	The homepage is not overbearing with information overload
<i>Severity Rating:</i>	0
<i>Applicable Heuristics:</i>	Aesthetic and minimalist design
<i>Problem Description:</i>	No irrelevant information is presented, and instead of lots of text to see which medications to take, the user is presented with images instead. This gives the homepage a clean-cut feel to it.
<i>Recommendations:</i>	None

Additional Information:

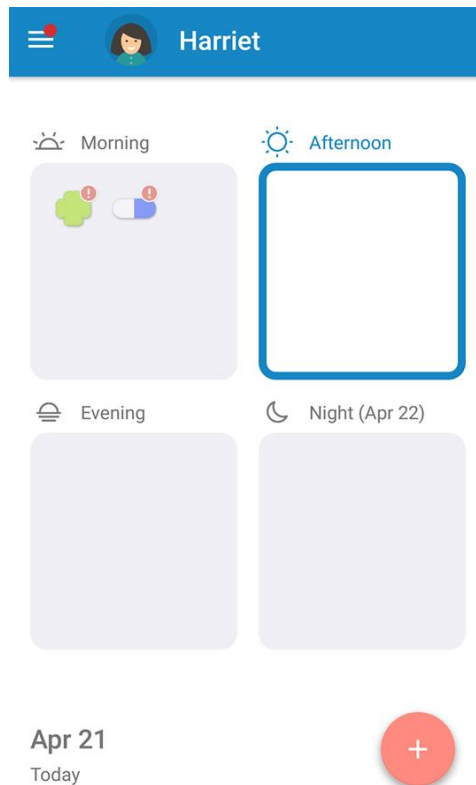


Table 17– Heuristic Evaluation 2	
Problem Number:	17
Problem Title:	Allows users to pay for extra features
Severity Rating:	1
Applicable Heuristics:	Flexibility and Efficiency of use
Problem Description:	This allows for users who are not experienced on the application to use the basic free version, however those who need the extra features will have to pay money to use the application.
Recommendations:	Allow the extra features to be available for free, to allow for greater tailoring of information. Elderly patients are very unlikely to sign up to spend money on this type of application.

Additional Information:

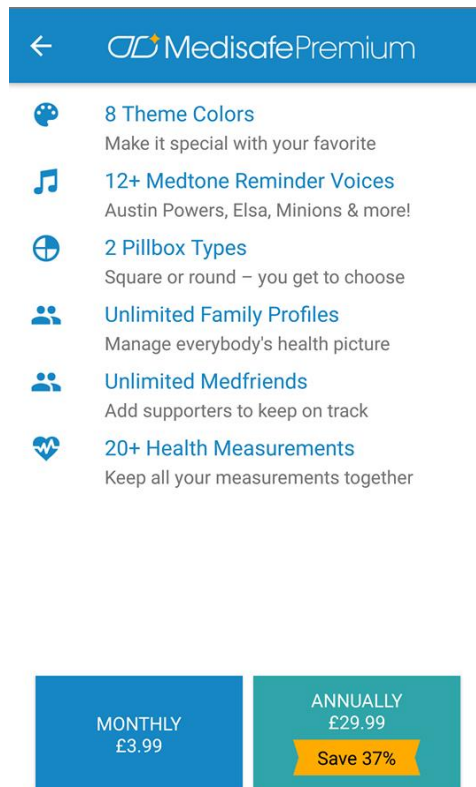


Table 18– Heuristic Evaluation 2	
<i>Problem Number:</i>	18
<i>Problem Title:</i>	Options are returned when the user starts to type in the medication name
<i>Severity Rating:</i>	0
<i>Applicable Heuristics:</i>	Recognition rather than recall
<i>Problem Description:</i>	This is a great feature for elderly patients. As a lot of medication names are long, after three characters are entered into the search bar, a long list of relevant options is provided. Many also come with an image of the medication already pre-set.
<i>Recommendations:</i>	None

Additional Information:

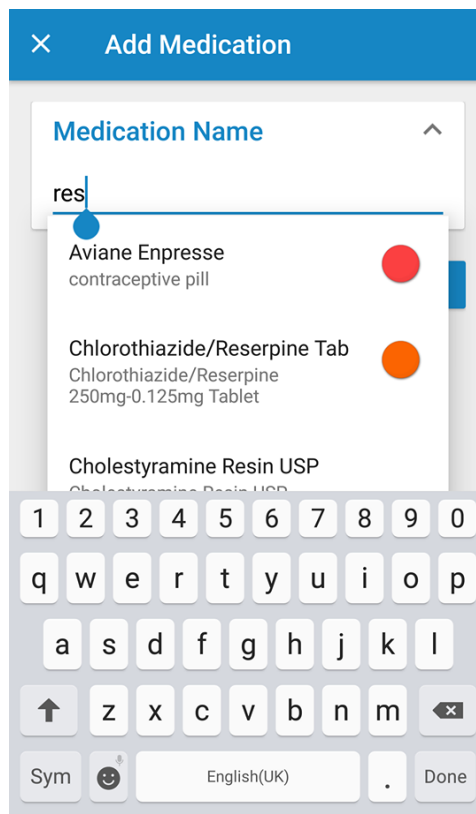


Table 19– Heuristic Evaluation 2	
<i>Problem Number:</i>	19
<i>Problem Title:</i>	User is prompted before going back on any unsaved changes
<i>Severity Rating:</i>	0
<i>Applicable Heuristics:</i>	Error Prevention
<i>Problem Description:</i>	When the user is adding a new medication, if they accidentally select the back button, the user is prompted with a pop-up, asking them if they want to return to the homepage without saving their changes.
<i>Recommendations:</i>	None

Additional Information:

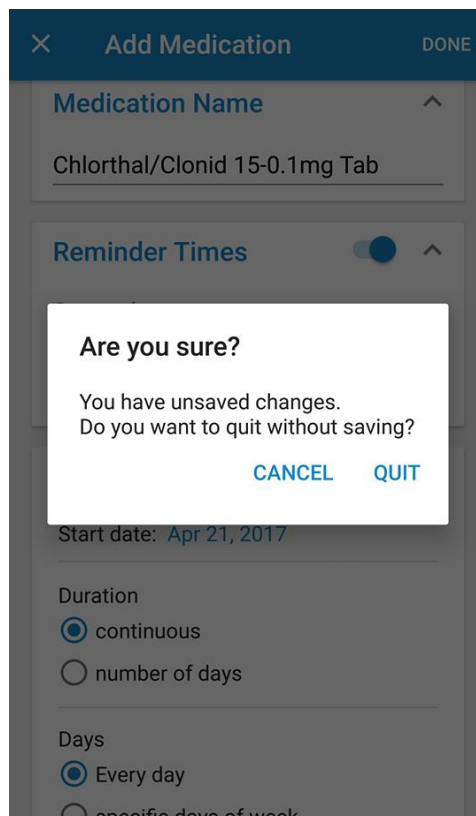
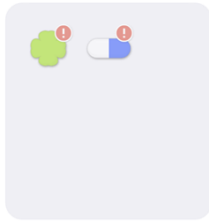


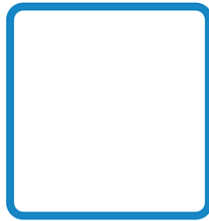
Table 20– Heuristic Evaluation 2	
Problem Number:	20
Problem Title:	All buttons are consistent
Severity Rating:	0
Applicable Heuristics:	Consistency and Standards
Problem Description:	All buttons and text are consistent throughout the app. There are no unusual colours or fonts that are abnormal to the house scheme.
Recommendations:	None

Additional Information:

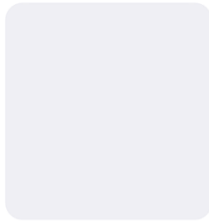
☀ Morning



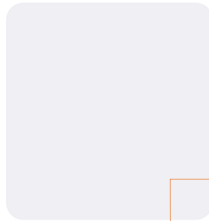
☀ Afternoon



🌙 Evening



🌙 Night (Apr 22)



Apr 21
Today



This button is consistently in the same place on different pages.



Active meds

🔵 Body, Hair, Skin/Nails Cap
1 pills left

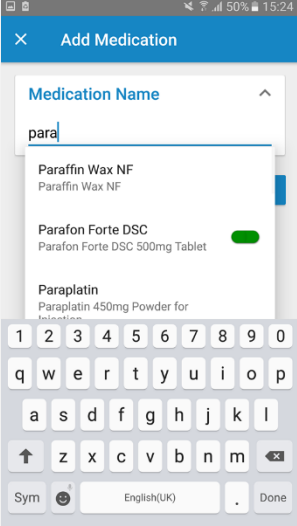
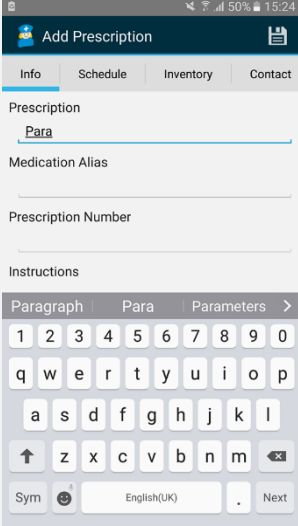
🟢 Morphine 200 mg
2 pills left


4. Gap Analysis

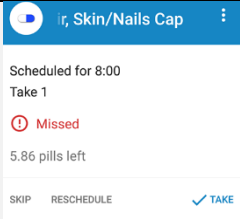
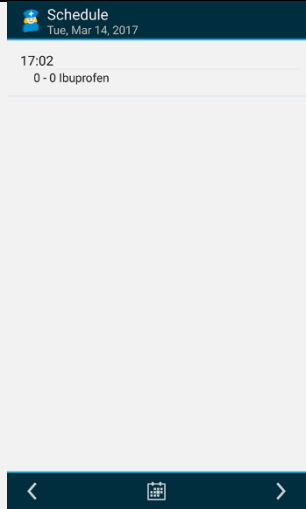

4.1 Requirements for medical reminders:

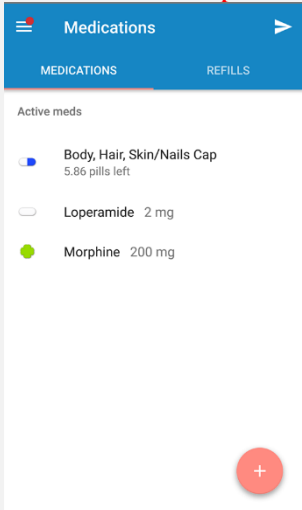
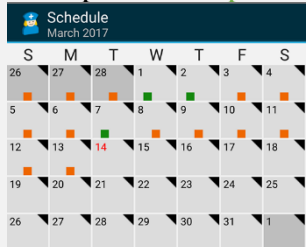

ID:	1.1
Requirement:	The interface must alert the user when they have not taken their medication
Justification:	This was identified when 83% of medical professional respondents in Question 14 stated that they thought this would be the most important feature for a medical reminder application.
Acceptance Criteria:	The interface displays a notification at the time the user has selected they will take the specific medication The system will notify the user even if the application is not open If the user's mobile device is turned off, the notification will appear as soon as it is turned back on
Priority:	Essential
Med Helper/Medisafe compliance:	Medisafe are partially compliant . They will show the notifications if the user has not taken their medications. However, it is not automatic when the user's phone has just been turned back on. Med Helper

ID:	1.2
Requirement:	The interface could have a list of medications for the user to choose from, as well as typing in their own
Justification:	It was determined during the heuristic evaluation that it can be quite difficult for the user to type in the entire medication name, especially as many of them have lengthy names, without there being suggestions for the user to select.
Acceptance Criteria:	The interface displays a list of relevant medication names when the user has typed in the first three letters of the medication name
Priority:	Desirable
Med Helper/Medisafe compliance:	Medisafe is compliant : Med Helper is not compliant :

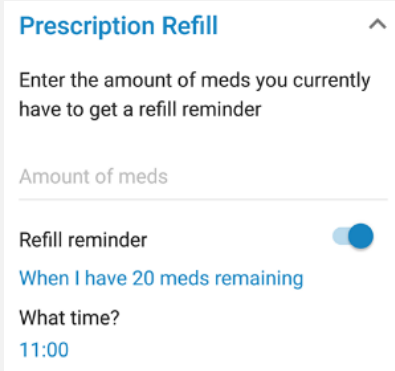
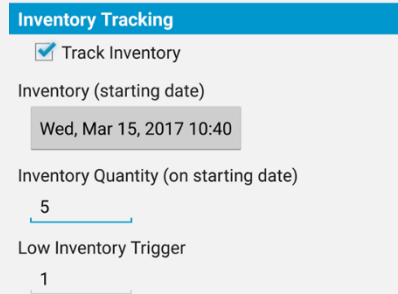
	 <p>When the user types in the name of the medication, options are suggested</p>	 <p>No options are suggested when the user starts to type in the name of their medication</p>
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ID:	1.3	
Requirement:	The interface should have images of the medications	
Justification:	The question was asked on the medical questionnaire (Question 14) if the Images of the medication should be displayed on the application, and 10 out of 18 respondents stated they thought this option would be a relevant feature. When the user is adding a medication, they should be able to choose an icon for the medication, instead of having to remember its name.	
Acceptance Criteria:	The user can select the size, shape and colour of the medication. The image is presented when the reminder to take the medicine is shown.	
Priority:	Desirable	
Med Helper/ Medisafe compliance:	 <p>When selecting the medication, it provides you with the option to choose the shape and colour of the medication</p>	Med Helper is not compliant:

	 <p>When you select the medication, it shows the image of the medication in the top left corner, and this is also applicable to notifications</p>	 <p>There are no options to have images of the medication of Med Helper. This is all that is shown when the user needs to select that they have taken their medication.</p> 
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ID:	1.4	
Requirement:	The interface must have a calendar feature	
Justification:	When undertaking the heuristic evaluation, it was discovered in Table 10 that it was quite difficult to set the date and time. The user will need to be able to visualise and see when and how often they should be taking their medication.	
Acceptance Criteria:	The application should have an option to view a calendar of medications	
Priority:	Desirable	
Med Helper/ Medisafe compliance:	<p>Medisafe is not compliant:</p>  <p>As you can see above, there is no calendar feature available</p>	<p>Med Helper is compliant:</p>  <p>As you can see, the calendar shows all the dates and provides information for whether</p> 

		the medication has been taken on the specified dates, and shows which dates medication will need to be taken.
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ID:	1.5	
Requirement:	The interface must alert users to take their medicine at their specific chosen reminder time	
Justification:	This is very important, as certain medications need to be taken at a certain time of day e.g. first thing when waking up. Therefore, the time on the reminders is vital and should always remind users without fail. Elderly users are more likely to be forgetful or forget which tablet it is that they will need to take.	
Acceptance Criteria:	The user is presented with a notification to take their medication whether the app is open or not	
Priority:	Essential	
Med Helper/Medisafe compliance:	<p>Medisafe is compliant. Medisafe always brings up the reminder alerts at the specified times</p>  <p>The screenshot shows the 'Prescription Refill' screen in the Medisafe app. It has a title bar with 'Prescription Refill' and an upward arrow. Below the title bar, it says 'Enter the amount of meds you currently have to get a refill reminder'. There is a text input field labeled 'Amount of meds'. Below that is a toggle switch for 'Refill reminder', which is turned on. Under the toggle, it says 'When I have 20 meds remaining'. At the bottom, it asks 'What time?' with a time picker set to '11:00'.</p>	<p>Med Helper is part-compliant. You can set up to track inventory, but cannot choose reminder times</p>  <p>The screenshot shows the 'Inventory Tracking' screen in the Med Helper app. It has a title bar with 'Inventory Tracking'. Below the title bar, there is a checkbox labeled 'Track Inventory' which is checked. Below that, it says 'Inventory (starting date)' with a date picker set to 'Wed, Mar 15, 2017 10:40'. Below that, it says 'Inventory Quantity (on starting date)' with a numeric input field set to '5'. At the bottom, it says 'Low Inventory Trigger' with a numeric input field set to '1'.</p>

ID:	1.6	
Requirement:	The interface should allow users to have refill reminders	
Justification:	On Question 14 of the questionnaire for medical professionals, one of the options selected by 61% of respondents suggested that they thought refill reminders could be useful for their patients.	
Acceptance Criteria:	A pop-up reminder should be presented to the user when they are low on medication, even if the application is not open.	
Priority:	Desirable	
Med Helper/Medisafe compliance:	Medisafe is compliant . The user can set up refill reminders for every medication	Med Helper is part-compliant . The user can set up refill tracking, however

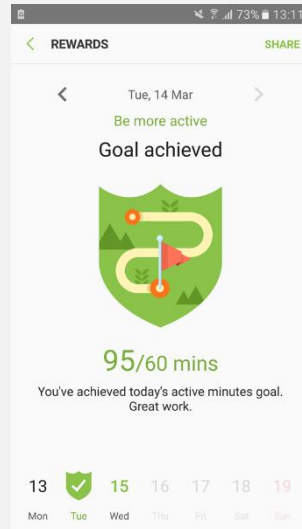
		the reminders are not consistent.
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4.2 Requirements for mobility tracking:

ID:	2.1
<i>Requirement:</i>	The interface must provide an option for user's permission to track user's mobility at all times
<i>Justification:</i>	The user must be granted the choice to allow the application to monitor their activity.
<i>Acceptance Criteria:</i>	The user is provided with a dialogue box when they open the application for the first time, for them to read the terms and conditions before choosing for the application to track their activity.
<i>Priority:</i>	Essential
<i>SHealth compliance:</i>	SHealth is not compliant . The application is pre-installed on any Samsung Galaxy device (starting from the S5 model).

ID:	2.2
<i>Requirement:</i>	The system must record the user's daily activity and be sensitive to movement around the house
<i>Justification:</i>	This feature is necessary in recording the patient's daily movement. The application needs to be sensitive to ensure that users are moving around the house, for example getting out of bed in the morning, and ensuring they do not spend hours a day sat on the sofa. Dependent on the user's healthcare needs, the application should be flexible to change the requirements for how active the user should be. The tracker will need to be more sensitive than the current applications on the market, as these tend to track activity for users that walk and run miles.
<i>Acceptance Criteria:</i>	The application should automatically track the user's mobility when they awaken for the day
<i>Priority:</i>	Essential
<i>SHealth compliance:</i>	SHealth is part-compliant . SHealth tracks movement that the user takes as long as they have their phone with them at all times. Google Fit can be connected with SHealth to have more accurate measurements.

ID:	2.3
<i>Requirement:</i>	The interface could have an audio confirmation when the user has been active for the target they set as their daily active task.
<i>Justification:</i>	To help provide users who are not as "tech-savvy" a confirmation that they are completing the tasks correctly. If a positive
<i>Acceptance Criteria:</i>	The system should provide an alert of positive feedback when the user reaches their daily target

Priority:	Desirable
SHealth compliance:	<p>SHealth is compliant. When the user reaches their daily step target, they alert the user with a notification and a positive sound chime.</p> 

ID:	2.4
Requirement:	The system must be linked to the user's family member's application, to alert them of the user's activity if it is unusual
Justification:	The medical questionnaire results found that 72% of respondents thought that having alerts to the family members of the patients if they are wandering around or leaving the house at odd hours, would be beneficial for the patient's aftercare.
Acceptance Criteria:	<p>Allow for two applications to be linked, and provided with options for which data is to be shared</p> <p>The family member must also have the app downloaded</p>
Priority:	Essential
SHealth compliance:	SHealth is not compliant . They only currently allow for users to "challenge" their friends to reach the most steps in a week, in which the feature shares each user's number of steps with both app users. This shows that SHealth have the functionality to be able to share this kind of data, however it is not currently implemented.

4.3 Requirements for vital tracking:

ID:	3.1
Requirement:	The interface should provide accurate measurement methods for vitals to be tracked
Justification:	Current applications that track vitals are not going to be as accurate as using external devices. 10 out of 18 respondents of the medical questionnaire thought that it would be a good feature of the application to be able to monitor vital signs without any extra equipment. Of course, there are some vital

	signs that are unable to be measured without extra equipment, however the vital signs that can be measured without extra equipment should be extremely accurate to ensure that false readings are not provided.
<i>Acceptance Criteria:</i>	The application has a sensor that that user can press their finger on to measure their vital signs
<i>Priority:</i>	Essential
<i>SHealth compliance:</i>	SHealth is compliant . They currently provide the option to measure Heart Rate, Stress Levels and SpO ₂ (oxygen saturation). They allow users to enter in their measurements for Blood Glucose and Blood Pressure, but cannot measure these without extra equipment.

ID:	3.2
<i>Requirement:</i>	The system must alert users if they are not correctly using the vital tracker
<i>Justification:</i>	To make certain that patients record accurate vital sign readings, and ensure that we adhere to Nielsen's Heuristics, the application must provide feedback and alert the user if they are not providing the reading correctly.
<i>Acceptance Criteria:</i>	The interface displays positive and negative feedback when the user is taking their vital signs
<i>Priority:</i>	Essential
<i>SHealth compliance:</i>	SHealth is compliant . They ensure that they provide the user with constant feedback. If the user has not pressed their finger over the sensor correctly, the recording will stop and provide the user with further instructions. If the user has correctly placed their finger on the sensor correctly, positive feedback is provided by the circle moving and providing a percentage of how much of the measurement has been provided, and how long is left to wait.

ID:	3.3
<i>Requirement:</i>	The system could have auditory commentary on how to complete tasks
<i>Justification:</i>	"Approximately one in three people between the ages of 65 and 74 has hearing loss and nearly half of those older than 75 have difficulty hearing" [1] Therefore it would be beneficial for the application to have a feature where the user can select a button for auditory commentary to tell them how to complete the tasks e.g. throughout measuring the vitals, if they are not completing the recording properly, an auditory voice could alert them to let them know to place their finger correctly on the sensor.
<i>Acceptance Criteria:</i>	The interface has a button the user can click when they want audio commentary turned on
<i>Priority:</i>	Desirable
<i>SHealth compliance:</i>	SHealth is not compliant . They currently only have text to explain how to complete tasks.

4.4 Requirements for the application as a whole

ID:	4.1
Requirement:	The user must allow the user to share data with their specified health professional
Justification:	The questionnaire results show that for every feature of the application (mobility, vitals and medication reminders), that it would be a necessary feature to share with the user's carer/GP or Social worker. This would not be an alert as such, but would allow the users to send daily/weekly/monthly data to their specified health professional, when they are supposed to (dependent on their care plan).
Acceptance Criteria:	The interface must provide a 'Share' button for all monitored measurements, trends and history.
Priority:	Essential

ID:	4.2
Requirement:	The application must adhere to the Data Protection Act
Justification:	When dealing with patient's medical records, it is very important that those who should not have access to the information, cannot access the information (such as any third party to the application). The patient and who they choose to share their medical records are the only ones who have access to the data.
Acceptance Criteria:	The system is secure, restricts data and access to authorised users only. The system must provide a log in feature when the user opens the application
Priority:	Essential

ID:	4.3
Requirement:	The system should provide a tutorial on how to use the application
Justification:	When undertaking the heuristic evaluation and reading reviews of the previously analysed applications, one of the main issues was the lack of understanding on how to use the app. For my target audience, it is vital that there is a tutorial to teach them how to use the application.
Acceptance Criteria:	A tutorial is mandatory when the user opens the app for the first time. The tutorial can be accessed at any other time
Priority:	Desirable

ID:	4.4
Requirement:	The system should be able to record and monitor measurements without an internet connection

<i>Justification:</i>	Based on several comments from the questionnaire, it is thought that a lot of elderly people may not even have access to a smartphone, let alone an internet connection. As I do not want this project to be hindered through extra costs, it would be important if the user could use the application without having to worry about their Wi-Fi working, or that their phone has an internet connection.
<i>Acceptance Criteria:</i>	The application should be fully functional without an internet connection, apart from sharing medical data with others.
<i>Priority:</i>	Desirable

ID:	4.5
<i>Requirement:</i>	The manufacturer of the application must inform users of the data they collect, and inform them of any potential privacy issues they may be concerned with
<i>Justification:</i>	It is important that the user knows that their medical records are not going to be used, viewed or tampered with by anyone else than themselves.
<i>Acceptance Criteria:</i>	The interface informs the user about the information that is collected from the application, and what their terms and conditions are if the user chooses to use the app.
<i>Priority:</i>	Essential

ID:	4.6
<i>Requirement:</i>	The system should have a feature that allows users to track and view trends/history for all measurements collected.
<i>Justification:</i>	In the questionnaire for medical professionals, in Question 13 56% of respondents thought that it would be important to able to track and view the history of previous vital recordings. However, when looking at the functionality of SHealth, they have trends for all their features, not just for vitals. This is a good way for the user seeing how their progress is, and if they are improving or not.
<i>Acceptance Criteria:</i>	The interface should provide users with a feature to view trends and history of all measurements provided.
<i>Priority:</i>	Desirable

ID:	4.7
<i>Requirement:</i>	The system must ensure reminders users have set up are always presented
<i>Justification:</i>	It is vital that reminders that are set up are always shown. If there is a time that a reminder is not presented, this could affect the user's health as they may forget to take a medication, which could affect them in many ways that could compromise their recovery.
<i>Acceptance Criteria:</i>	The application must present the reminder when the user has set up the reminder for.

	If the smartphone is turned off, reminders must present as soon as the smartphone is turned on, even if the application is not open.
<i>Priority:</i>	Desirable

ID:	4.8
<i>Requirement:</i>	The text size should be altered for the user's preference and settings should remain when the app is next re-opened
<i>Justification:</i>	In the medical questionnaire, on Question 15, 66% of respondents said that they thought the ability to change text size would be important for the target audience. This will allow for users who have visual impairments, to ensure they can read the text as easily as the average user.
<i>Acceptance Criteria:</i>	The interface should have a feature that allows the user to select the size font they find easiest to read.
<i>Priority:</i>	Desirable

ID:	4.9
<i>Requirement:</i>	The interface won't have an exit feature
<i>Justification:</i>	In the heuristic evaluation, it was difficult to understand how to exit the application. It would be great if the user could exit the application through the application itself and not through the smartphone features. Due to time constraints, it has been agreed that this feature will not be able to be completed, unless time allows it.
<i>Acceptance Criteria:</i>	The interface will have a button that will allow the user to exit the application
<i>Priority:</i>	Desirable

ID:	4.10
<i>Requirement:</i>	The interface should provide guidance when the user requests it
<i>Justification:</i>	The medical questionnaire provided a few comments of users unsure about whether the application would be suitable for the elderly patients, and whether they would be able to use such an application. 16 out of 18 respondents in Question 15 thought that 'Clear Instructions' would be one of the most appropriate features for the application for the elderly patients. Therefore, to adhere to Nielsen's 'Help users recognise, diagnose, and recover from errors', the application should be providing users with the most support it possibly can.
<i>Acceptance Criteria:</i>	Provide users with a button they can select when they need help
<i>Priority:</i>	Desirable

ID:	4.11
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<i>Requirement:</i>	The system should allow users to log in to their account with authorised login credentials
<i>Justification:</i>	This relates to Requirement ID: 4.2, as the target audience are more aware of their safety when it comes to electronic information. With a log in feature, it will allow users the safety and authentication that only they can access their data.
<i>Acceptance Criteria:</i>	As soon as the application is opened, the user must enter in their log in details
<i>Priority:</i>	Desirable

ID:	4.12
<i>Requirement:</i>	The system could allow users to view their medical record history
<i>Justification:</i>	This feature would be a great way to incorporate all the user's medical history, as well as their present medical data. This would allow their Carer, GP and social worker to determine if there is any extra health care needs that the user should be regularly monitoring.
<i>Acceptance Criteria:</i>	The interface will provide users with an option to view their medical records
<i>Priority:</i>	Desirable

4.5 Non-functional requirements:

ID:	5.1
<i>Requirement:</i>	The interface should have large icons
<i>Justification:</i>	It is important the application is usable for our target audience of elderly patients. It is known that "One in five people aged 75 and over are living with sight loss" [2]. Therefore, the application needs to adhere to this, and ensure that all users will be able to see the icons to understand what their function would be. In the medical questionnaire, on Question 15, 14 out of 18 respondents selected the option for the application to have large icons, as an appropriate feature for the application.
<i>Acceptance Criteria:</i>	The interface must have large, easy to understand icons
<i>Priority:</i>	Desirable

ID:	5.2
<i>Requirement:</i>	The interface must be simple, easy to navigate and user-friendly
<i>Justification:</i>	In the medical questionnaire, on Question 15, 14 out of 18 respondents thought that it would be appropriate for the target audience that the application has simple navigation, and 16 out of 18 thought that a simple design would be appropriate. This will help to adhere to Nielsen's heuristics of Aesthetic and Minimalist Design.

<i>Acceptance Criteria:</i>	The interface must not contain any redundant data and use concise, easy to understand text and options for navigation
<i>Priority:</i>	Essential

ID:	5.3
<i>Requirement:</i>	All icons should be self-explanatory and consistently placed within the system
<i>Justification:</i>	To ensure adherence with Nielsen's heuristics, it is important that all icons and pages in the application are consistently placed. This will help to adhere to Nielsen's heuristic of "Recognition rather than recall", which ensures that users should not have to remember information from one part of the dialogue to another.
<i>Acceptance Criteria:</i>	The interface should be consistent throughout all pages in the application, and all required icons are consistently placed
<i>Priority:</i>	Desirable

ID:	5.4
<i>Requirement:</i>	The system could try to limit the usage of multi-touch gestures
<i>Justification:</i>	It is necessary that the multi-touch features that most smartphones can do is limited within the application. This is because our target audience will not be used to using a smart-phone, and is more likely become confused with the application if it involves lots of multi-touch gestures.
<i>Acceptance Criteria:</i>	The system should only incorporate single-touch gestures
<i>Priority:</i>	Desirable

ID:	5.5
<i>Requirement:</i>	The user could have the option to change the colour scheme in the application
<i>Justification:</i>	If the application had option to change the colour scheme, this could be useful for the target audience who find it difficult to see some colours on others. This way the colours are specified by the user, so they can choose the colours best suited for their sight.
<i>Acceptance Criteria:</i>	The system provides users with the option to choose the colour scheme when they open the app for the first time The colour scheme can be changed at any time
<i>Priority:</i>	Desirable

ID:	5.6
<i>Requirement:</i>	The system must be secure and encrypted
<i>Justification:</i>	This relates to ID:4.2, as the user will want their information to be kept secure, especially as they do not want any sensitive data or their medical records being compromised

<i>Acceptance Criteria:</i>	The system is secure and restricts data access to only those authorised to access it
<i>Priority:</i>	Essential

ID:	5.7
<i>Requirement:</i>	The system won't replace carers/social workers
<i>Justification:</i>	It is necessary that this application is not seen as a replacement for any carer or social worker, it is just there to help aid their recovery and ease the workload for the social worker/carer
<i>Acceptance Criteria:</i>	The carer/social worker can view their patients shared information from their own application on their smartphone
<i>Priority:</i>	Essential

ID:	5.8
<i>Requirement:</i>	The system should run error free
<i>Justification:</i>	The system needs to be reliable, as elderly patients are less likely to understand how to troubleshoot a problem if it arises.
<i>Acceptance Criteria:</i>	The system should run error free for the patients, and those who the data is shared with, no matter which device the application is downloaded on
<i>Priority:</i>	Desirable

References

- [1] NIDCD Information Clearinghouse, "Hearing Loss and Older Adults," 13 02 2017. [Online]. Available: <https://www.nidcd.nih.gov/health/hearing-loss-older-adults>.
- [2] Royal National Institute of Blind People, "Key information and statistics on sight loss.," 2015. [Online]. Available: <http://www.rnib.org.uk/knowledge-and-research-hub/key-information-and-statistics>. [Accessed 14 03 2017].
- [3] Google Play, *Med Helper Pill Reminder*, Manyeta, 2014.