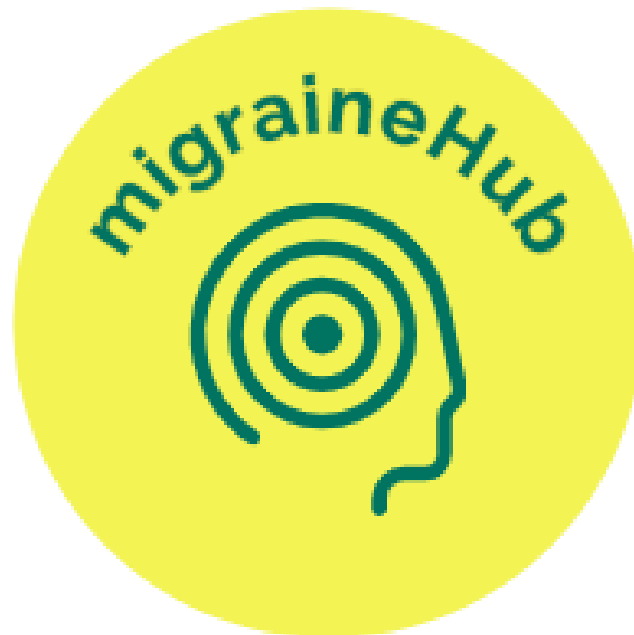




INSTITUTE of
TECHNOLOGY
CARLOW

Institiúid Teicneolaíochta Cheatharlach



Research Document

Student Name: Michelle Bolger

Student Number: C00242743

Supervisor: Dr. Chris Staff

Submission Date: 25/4/2022

Abstract

The inspiration behind this project was to discover more information about migraines, their triggers and symptoms and also to discover information about tracking migraines and the benefits of keeping a journal of migraines.

The research carried out aims to determine the key similarities and differences between similar applications available and how these can be either incorporated or avoided in this project.

The purpose of the “migraineHub” app is to develop a cross platform mobile application that will allow people who suffer from migraines to record their migraines (the frequency, type of migraine, pain scale, medications, triggers and symptoms).

Users will also be able to view statistic about their past migraines and email this information to themselves for future reference or for review by their doctor/neurologist.

Table of Contents

Table of Figures.....	3
1. Introduction	4
2. Overview.....	5
3. Similar Applications.....	6
3.1 Migraine Buddy.....	6
3.2 Headache Diary	15
3.3 Headache Log.....	20
3.4 Migraine Tracker	27
4. Software Technologies.....	33
4.1 Xamarin.....	33
4.2 React Native	34
4.3 Flutter	35
4.4 Databases.....	36
4.4.1 Firebase.....	36
4.4.2 MySQL.....	36
4.4.3 MongoDB	37
4.5 Additional Libraries, Packages and APIs	38
4.5.1 Dynamsoft Barcode Scanner SDK.....	38
4.5.2 ZXing Library.....	38
4.5.3 Syncfusion	38
4.5.4 Microcharts	39
4.5.5 DevExpress.....	39
5. Survey	40
6. Survey Findings	41
7. Conclusion.....	44
References	45
Bibliography.....	46
Appendix.....	47

Table of Figures

Figure 1 - Migraine Buddy Logo	6
Figure 2 - Migraine Buddy - Home Screen	7
Figure 3 - Migraine Buddy - Insights Page	8
Figure 4 - Migraine Buddy - Chat Groups	9
Figure 5 - Migraine Buddy - Program Selection.....	10
Figure 6 - Migraine Buddy - Records of Migraine Attacks	11
Figure 7 - Migraine Buddy - Calendar.....	12
Figure 8 - Migraine Buddy - Sleep Records	13
Figure 9 - Migraine Buddy - Migraine Attack Summary	14
Figure 10 - Headache Diary - Logo	15
Figure 11 - Headache Diary - Adding New Record	16
Figure 12 - Headache Diary - Recording Pain Type	17
Figure 13 - Headache Diary - Headache Journal	18
Figure 14 - Headache Diary - User FAQ.....	19
Figure 15 - Headache Log – Logo	20
Figure 16 - Headache Log - Homepage	21
Figure 17 - Headache Log - Recording Triggers	22
Figure 18 - Headache Log - Recording Pain Location	23
Figure 19 - Headache Log - Recording Pain Type	24
Figure 20 - Headache Log - Migraine Record	25
Figure 21 - Headache Log - All Records	26
Figure 22 - Migraine and Headache Diary - Logo	27
Figure 23 - Migraine and Headache Diary - Add Record	28
Figure 24 - Migraine and Headache Diary - Record Medication.....	29
Figure 25 - Migraine and Headache Diary - Record Triggers	30
Figure 26 - Migraine and Headache Diary - Record Pain Type	31
Figure 27 - Migraine and Headache Diary - Record Symptoms	32
Figure 28 - Xamarin Architecture - Source: https://docs.microsoft.com/en-us/xamarin/get-started/what-is-xamarin	33
Figure 29 - React Native Architecture - Source: https://litslink.com/blog/new-react-native-architecture	34
Figure 30 - Flutter Architecture - Source: https://www.cleveroad.com/blog/why-use-flutter	35

1. Introduction

The purpose of this document is to outline the research that has been carried out in order to create the “migraineHub” application.

The aim of this application is to provide users with a way to track their migraines. A number of areas, topics and technologies are required to be researched and tested in order for this project and application to be successful.

Research will be carried out on migraines, triggers, frequency, types and symptoms. Research will also be carried out on migraine diaries, recording all aspects of migraines and why this is beneficial to individuals who suffer from migraines.

Examination of similar mobile applications will be carried out to discover their advantages, disadvantages and similarities. This will be beneficial for the development of the “migraineHub” app as competitors applications will help in the discovery of what aspects to improve and what to avoid to result in an application that is successful.

Numerous software technologies will be researched such as front end, back end and database technologies to discover which ones will work the best together and will be appropriate for this project.

Aspects of User Experience (UX) and User Interface (UI) design will also be researched to ensure “migraineHub” will be appealing and that the user’s needs are fulfilled.

2. Overview

Migraines are a pain disorder with many descriptions such as a “moderate or severe headache” [1] and a “prevalent neurological disease” [2].

Migraines are a complex and common condition that the World Health Organisation (WHO) classified as the 6th highest cause of years lost due to disability [3].

There are numerous types of migraines such as those with and without aura which are sensory disturbances, basilar migraines (ones which affect balance, speech and vision), hemiplegic (can cause temporary numbness or paralysis) cluster headaches and tension headaches.

Migraines have numerous different symptoms which can often make diagnosis difficult. Symptoms include light and noise sensitivity, nausea, vomiting, cold chills, dizziness, blurry vision, fever, fatigue and many more.

Migraines can be triggered by a variety of reasons making it complicated to fully understand the true causes behind them. Triggers can include stress, lack of food, caffeine, sensitivity to certain foods, hormones, light, lack of and too much sleep.

Many doctors and neurologists suggest those who suffer from migraine attacks should keep diaries or journals to keep track of their migraines, triggers and symptoms. Tracking migraines is beneficial in helping diagnose not only migraines themselves but also can help to narrow down the type of migraine.

Keeping track of triggers, symptoms, pain location, sleep, weather and time can help individuals discover why their migraines occur and how they can avoid certain triggers.

According to Jessica Schroeder et al “Self-tracked health data can help people and their health providers understand and manage chronic conditions” [4] this shows that an application that allows individuals to track their migraines can help them with diagnosis and can also be more convenient than a hand written diary.

3. Similar Applications

3.1 Migraine Buddy



Figure 1 - Migraine Buddy Logo

This app was designed with the help of neurologists, it is currently the number one migraine and headache tracking app available for download.

This app allows users to record a migraine attack. When recording the attack users can indicate the attack type, intensity, medications, symptoms, aura, location, and triggers. With the “MBplus” subscription users can also add information about their menstrual cycle and information about barometric pressure to their attack record. The “MBplus” subscription costs €10.99 per month or €74.99 annually. This subscription gives users deeper insights to their migraine attacks and also gives users access to “programs” these are online courses aimed at providing information such as dietary tips to help with migraines.

This app has a “discover” feature shown in *figures 3, 4 and 5* where users can enrol in “programs”, read articles called “insights” written by fellow users and join chat groups.

This app has many advantages including showing users their migraine and sleep history in an easy to read format. The app also allows users to download their migraine information in PDF format. The main advantage of this app is the “discover” section, this app provides users with a community to discuss their migraines, a space to write their own articles and courses to learn more about migraines.

The main disadvantages of this app are for some users who just want a simple tracker this app might be too much, the app is very focused on building a type of social network of fellow migraine sufferers and this is not appealing to everyone. The second disadvantage is the “MBplus” subscription this locks users out of many features that can provide users with better insights to their migraines. Another disadvantage is the recording system. It provides users with simple selections and gives no other insights into their triggers although this could be locked behind the “MBplus” subscription.

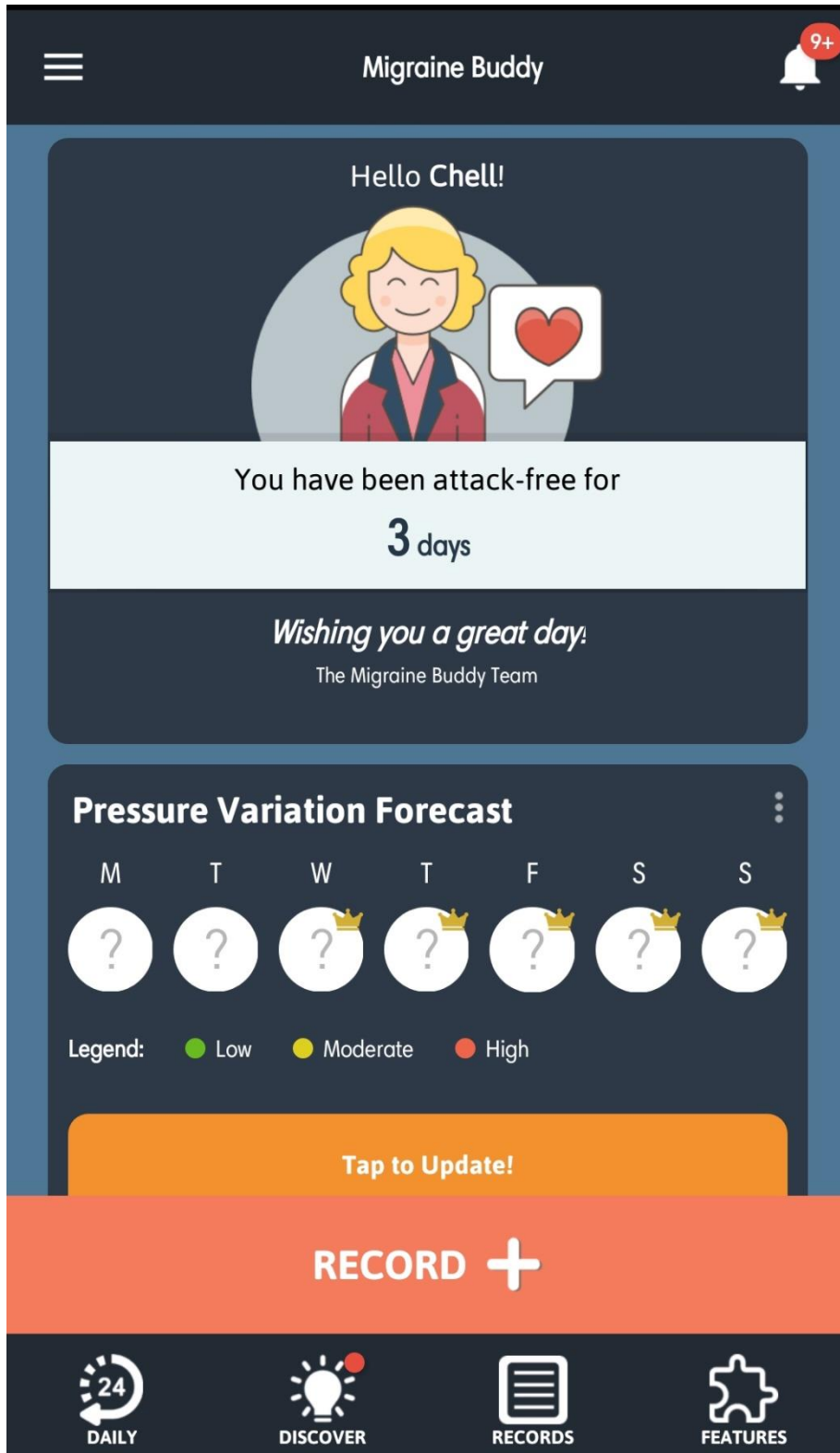


Figure 2 - Migraine Buddy - Home Screen

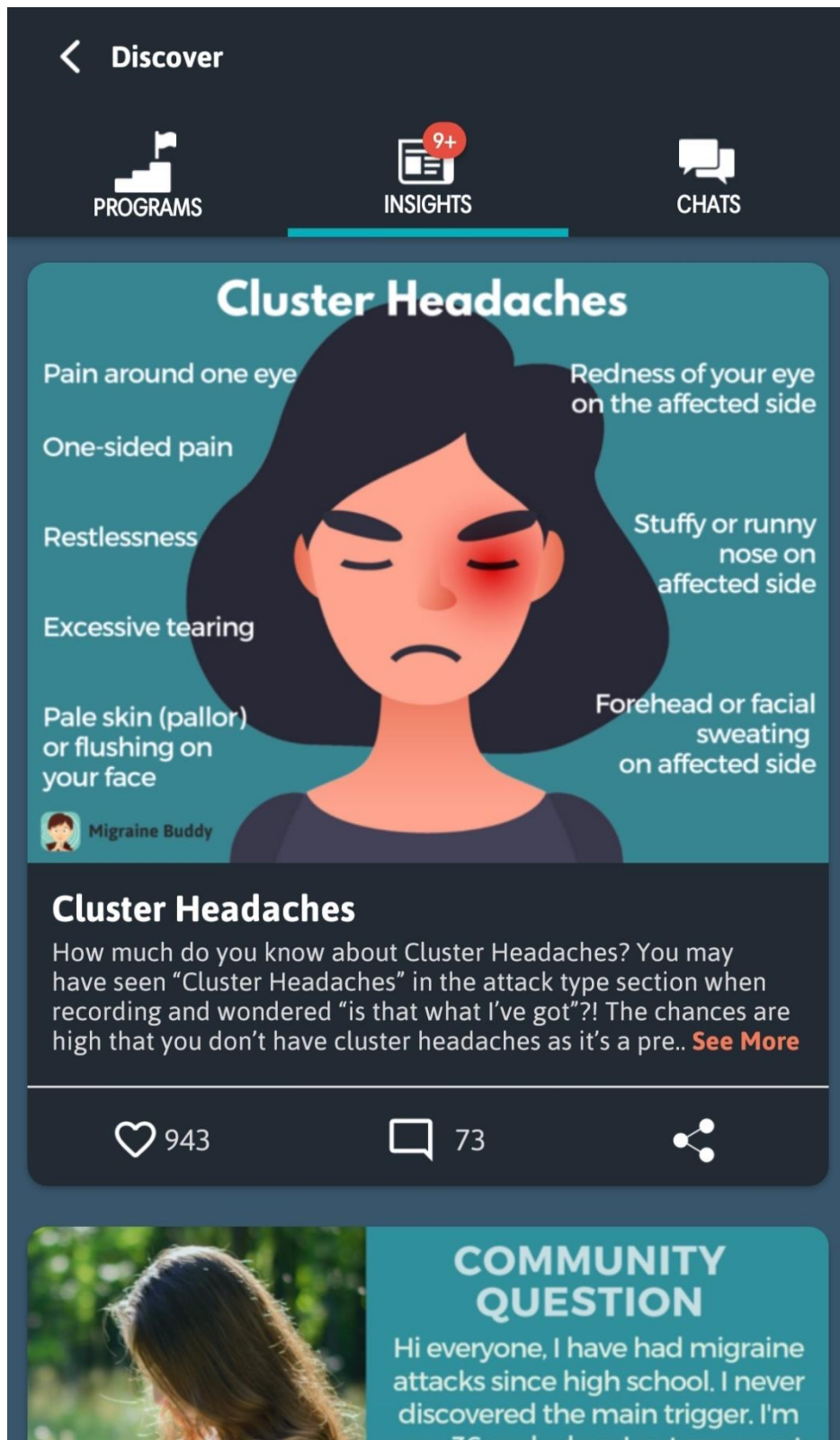


Figure 3 - Migraine Buddy - Insights Page

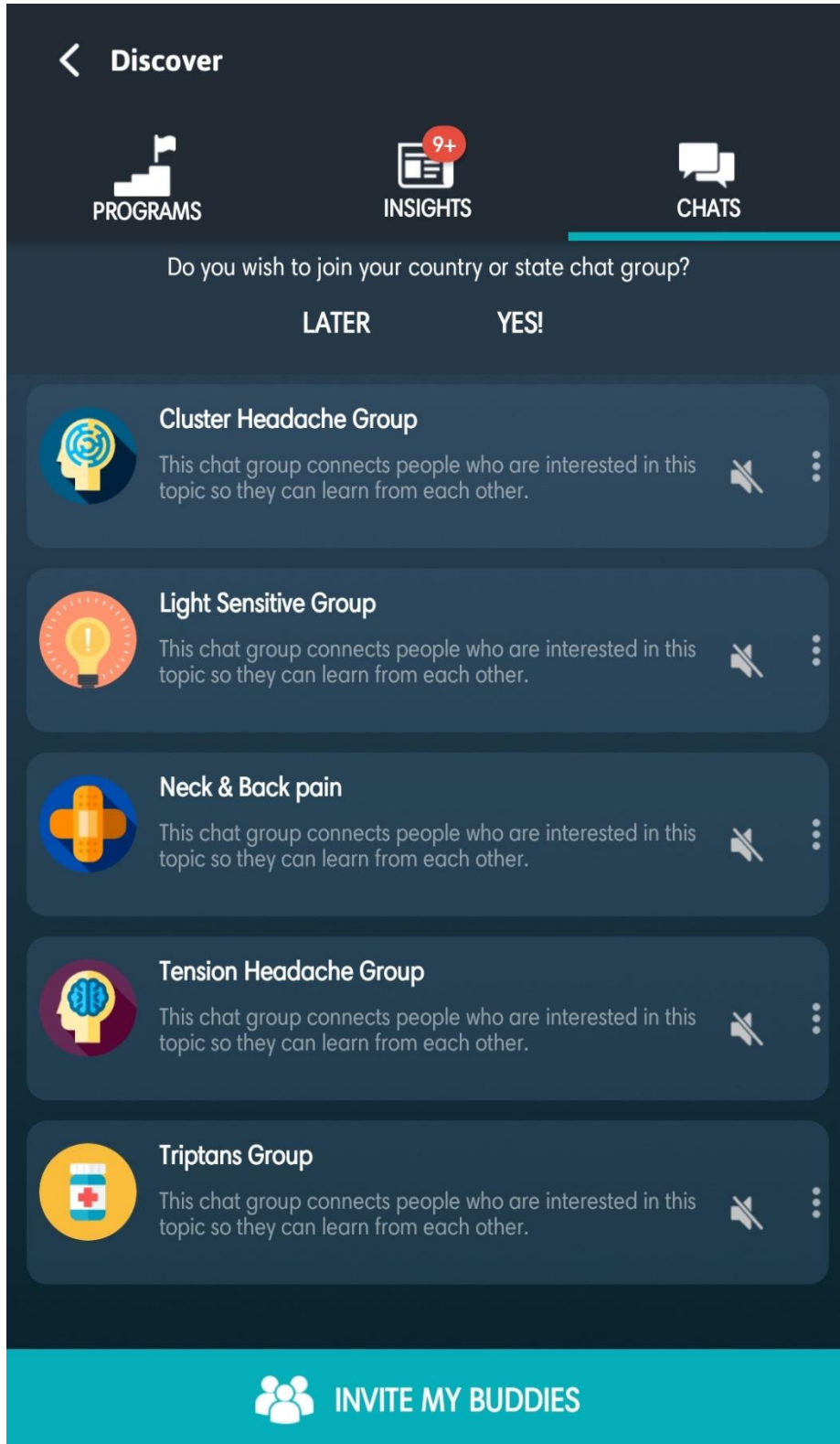


Figure 4 - Migraine Buddy - Chat Groups

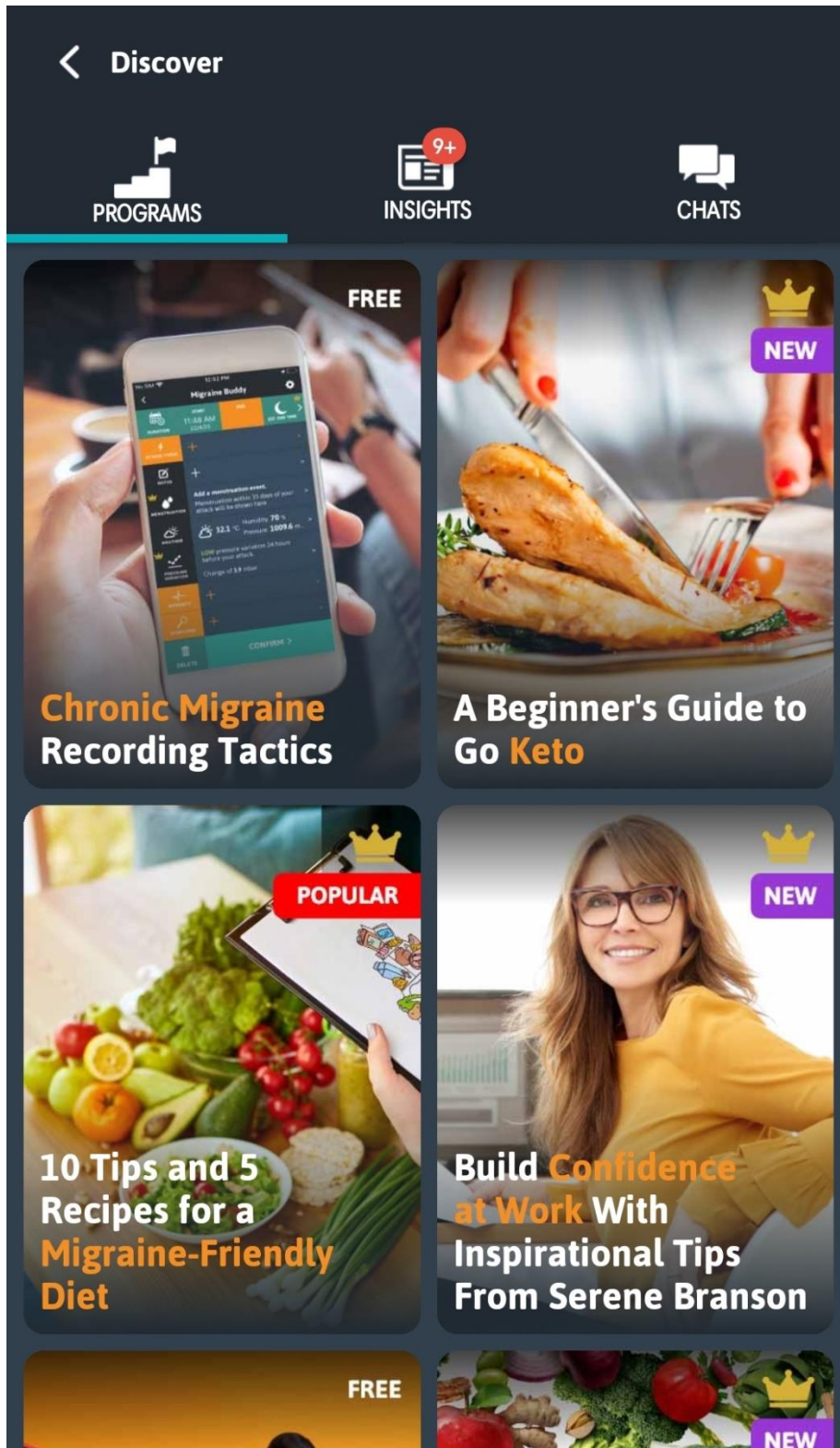


Figure 5 - Migraine Buddy - Program Selection

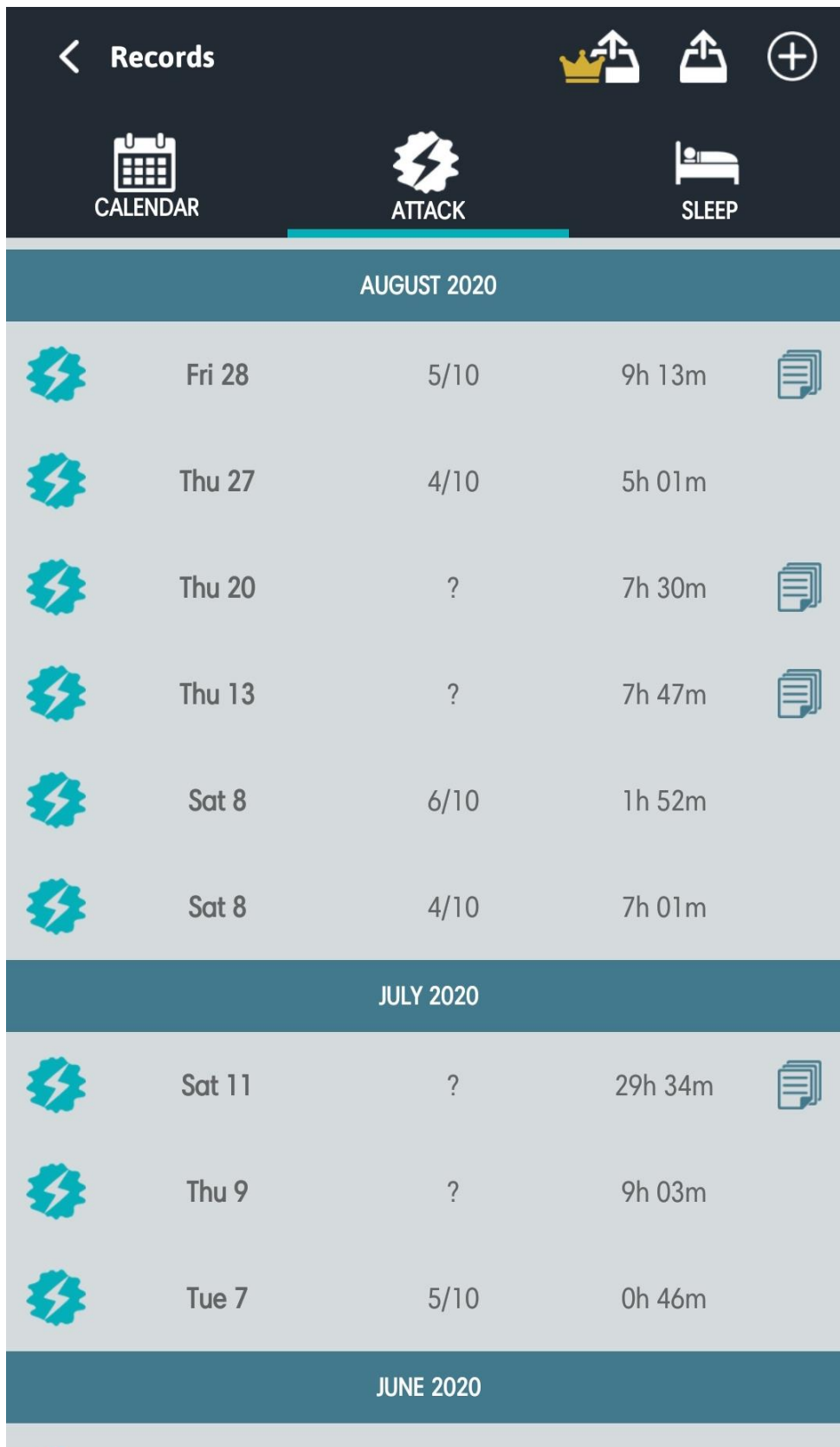


Figure 6 - Migraine Buddy - Records of Migraine Attacks

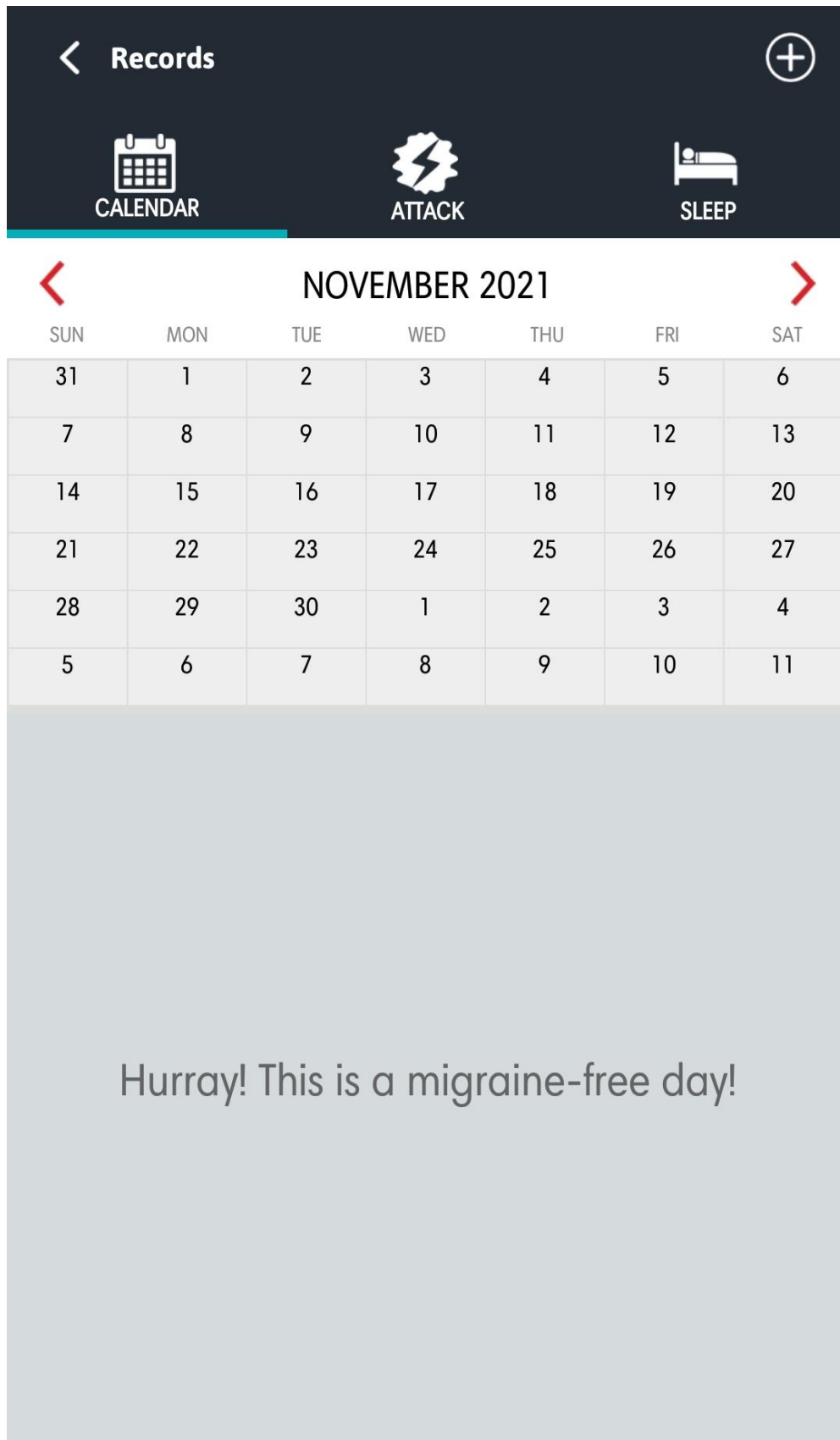


Figure 7 - Migraine Buddy - Calendar

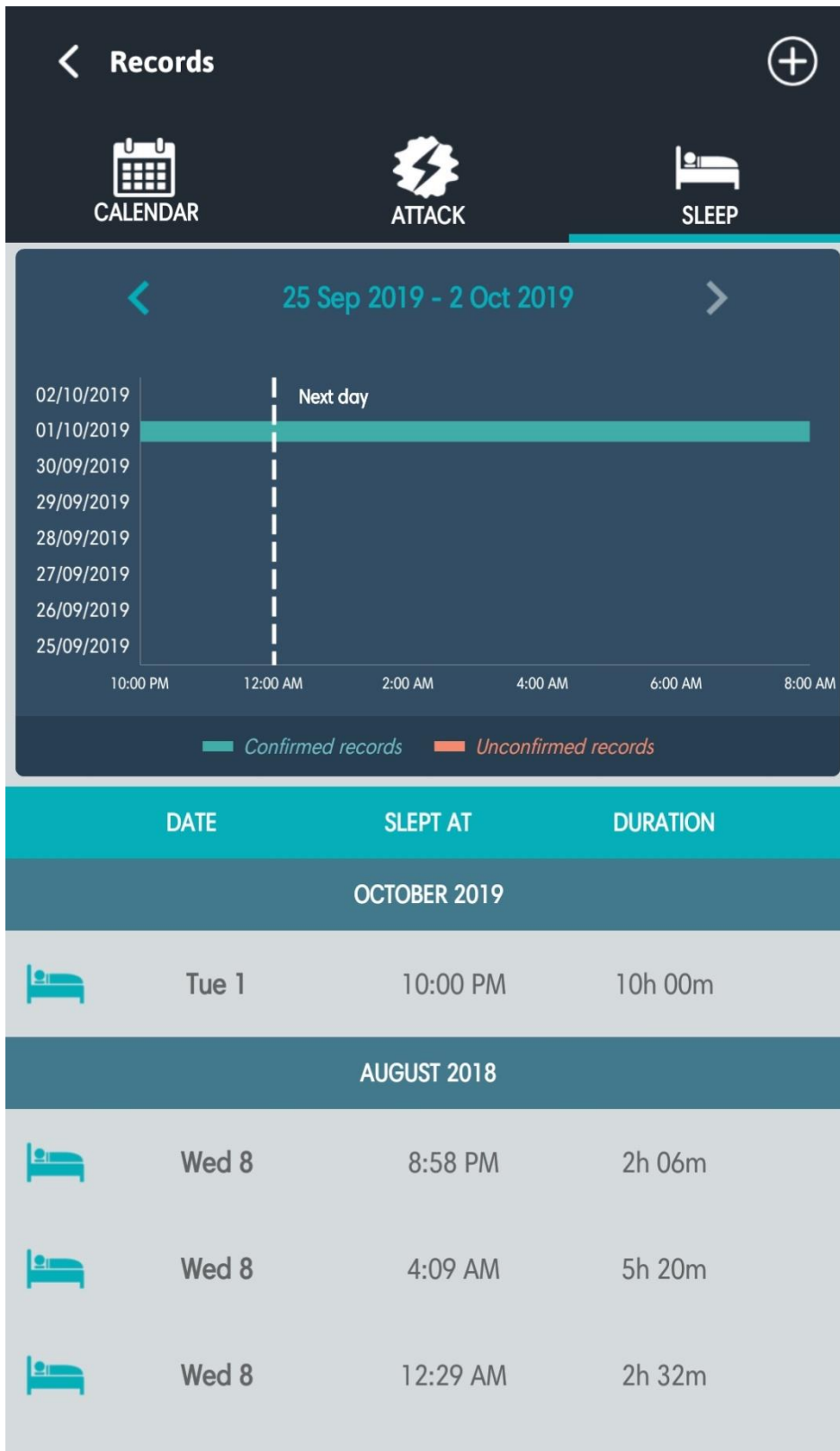


Figure 8 - Migraine Buddy - Sleep Records

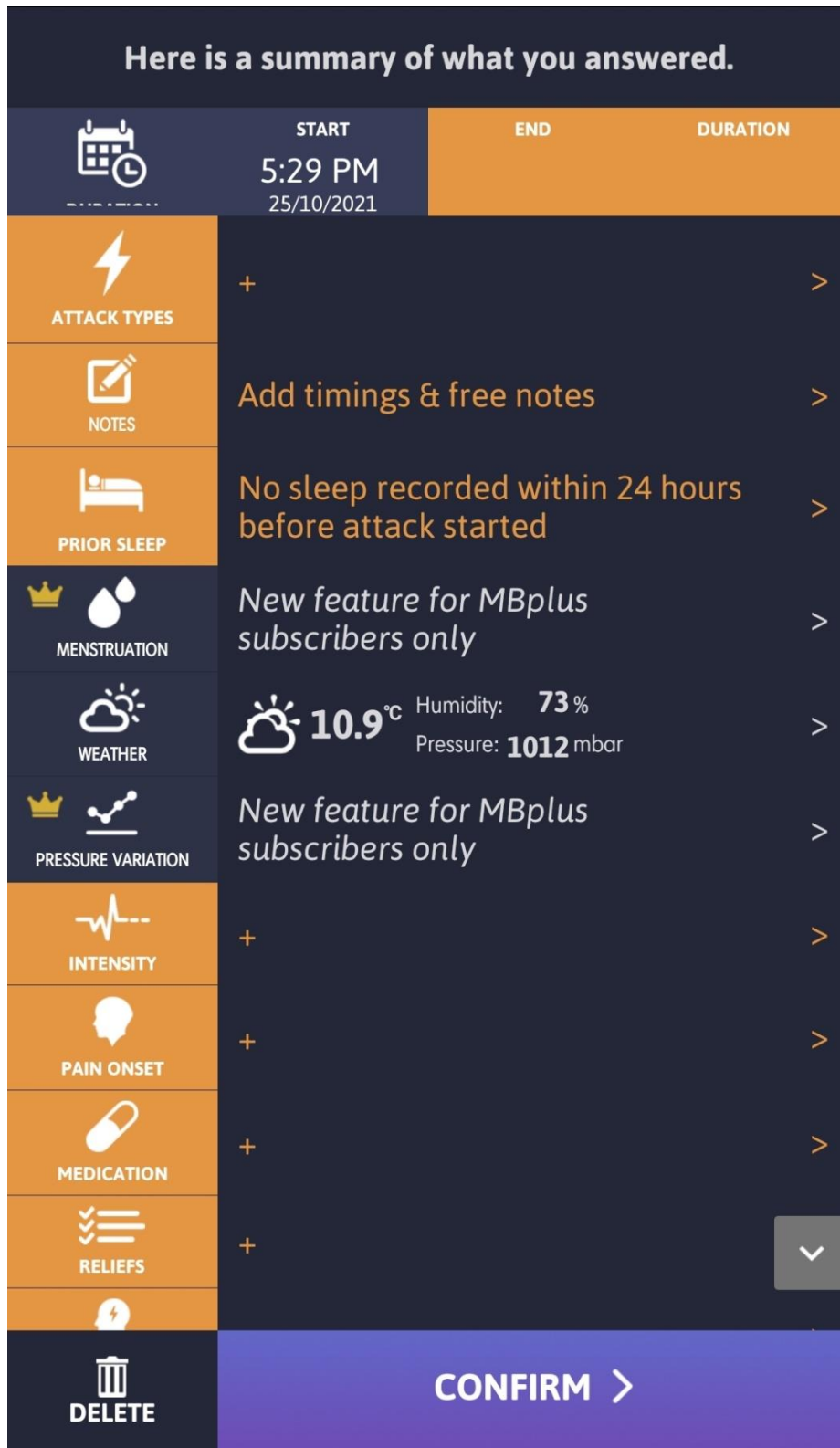


Figure 9 - Migraine Buddy - Migraine Attack Summary

3.2 Headache Diary

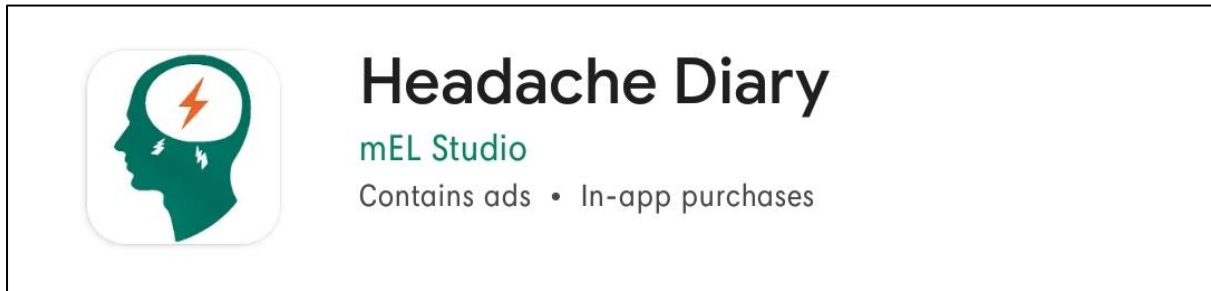


Figure 10 - Headache Diary - Logo

This app allows a user to add a record of a migraine attack. It allows users to indicate their pain levels and migraine duration with sliding scales. Users can also select the type and area of their migraines and headaches.

As shown in *figure 13* this app keeps a journal for users to view the statistics of their headaches/migraines. The app also provides users with an FAQ section shown in *figure 14*.

This app has many advantages including showing users their migraine/headache history in an easy to read format. The provided FAQ section is also a positive addition as it provides users with answers to questions they may have regarding the use of the app ensuring the app can be used easily.

A disadvantage of this app is that it does not provide users with any real insights into their migraines and does not provide them with information on how to manage their pain and triggers.

Add a new record

Pain started:
18/10/2021 15:03

Pain level (from 1 to 10)
5

Duration: 30 min.
30

Type of headache
Add

Localization
Add

Comments

Main Additionally

Figure 11 - Headache Diary - Adding New Record

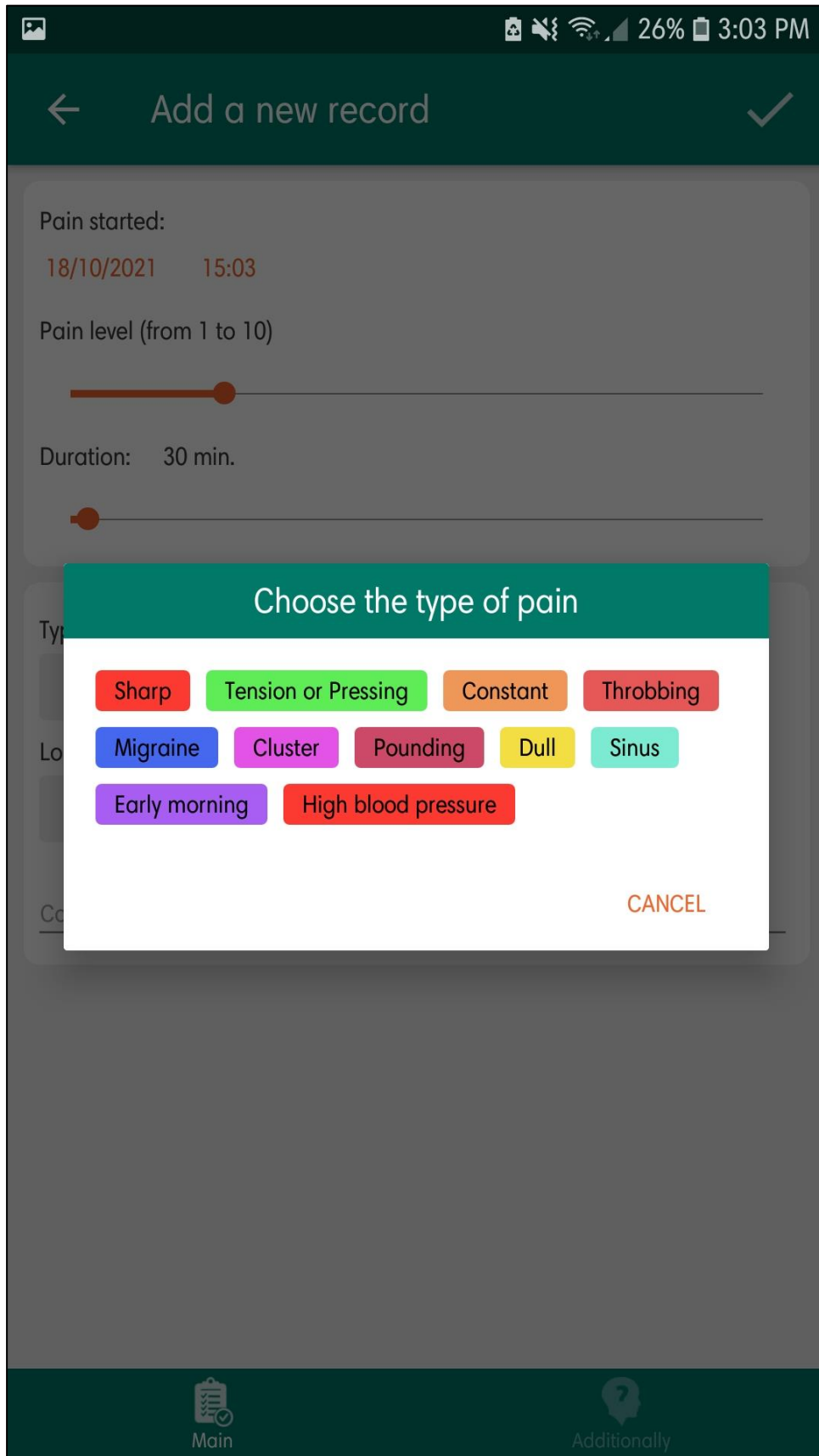


Figure 12 - Headache Diary - Recording Pain Type

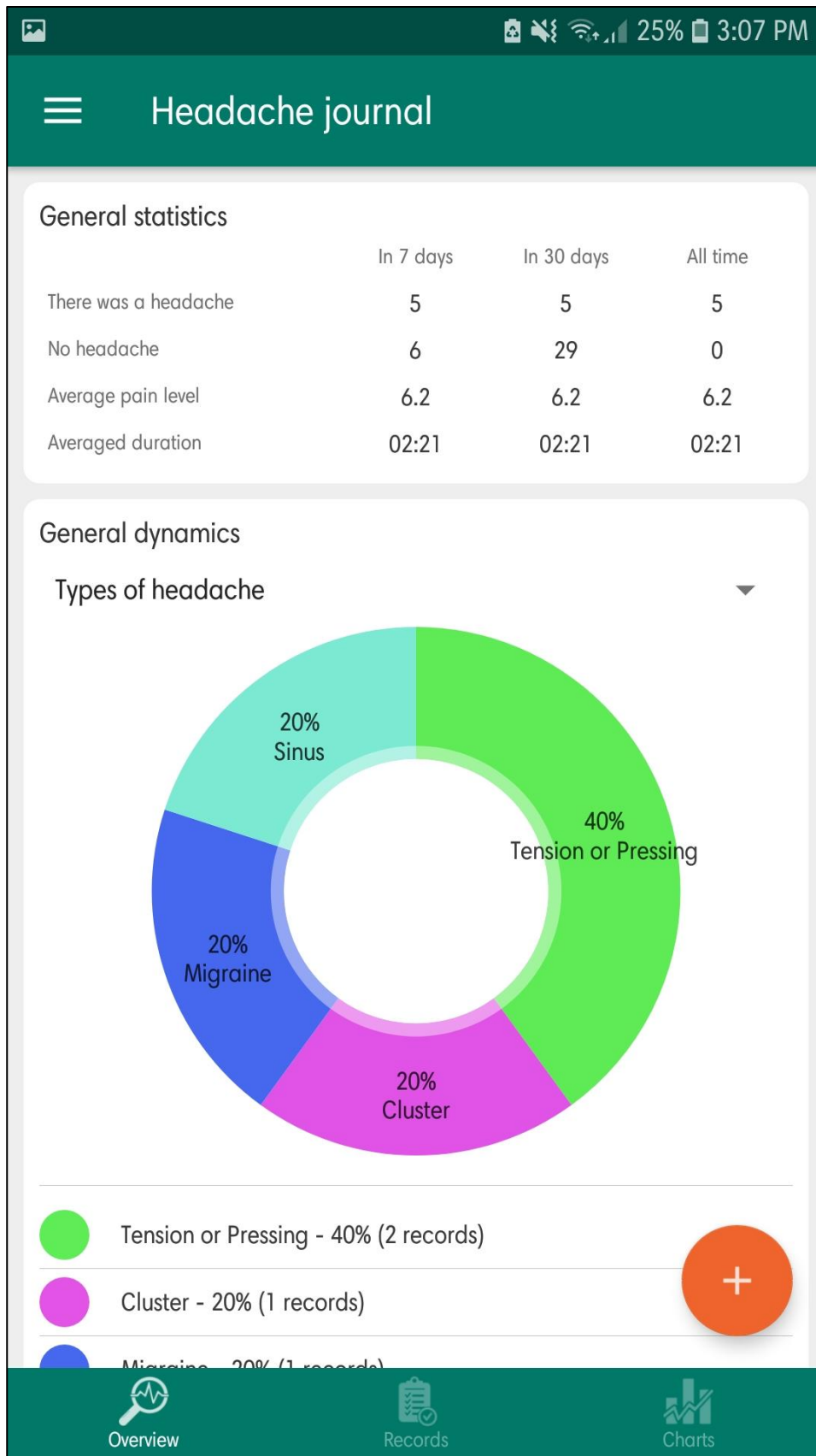


Figure 13 - Headache Diary - Headache Journal

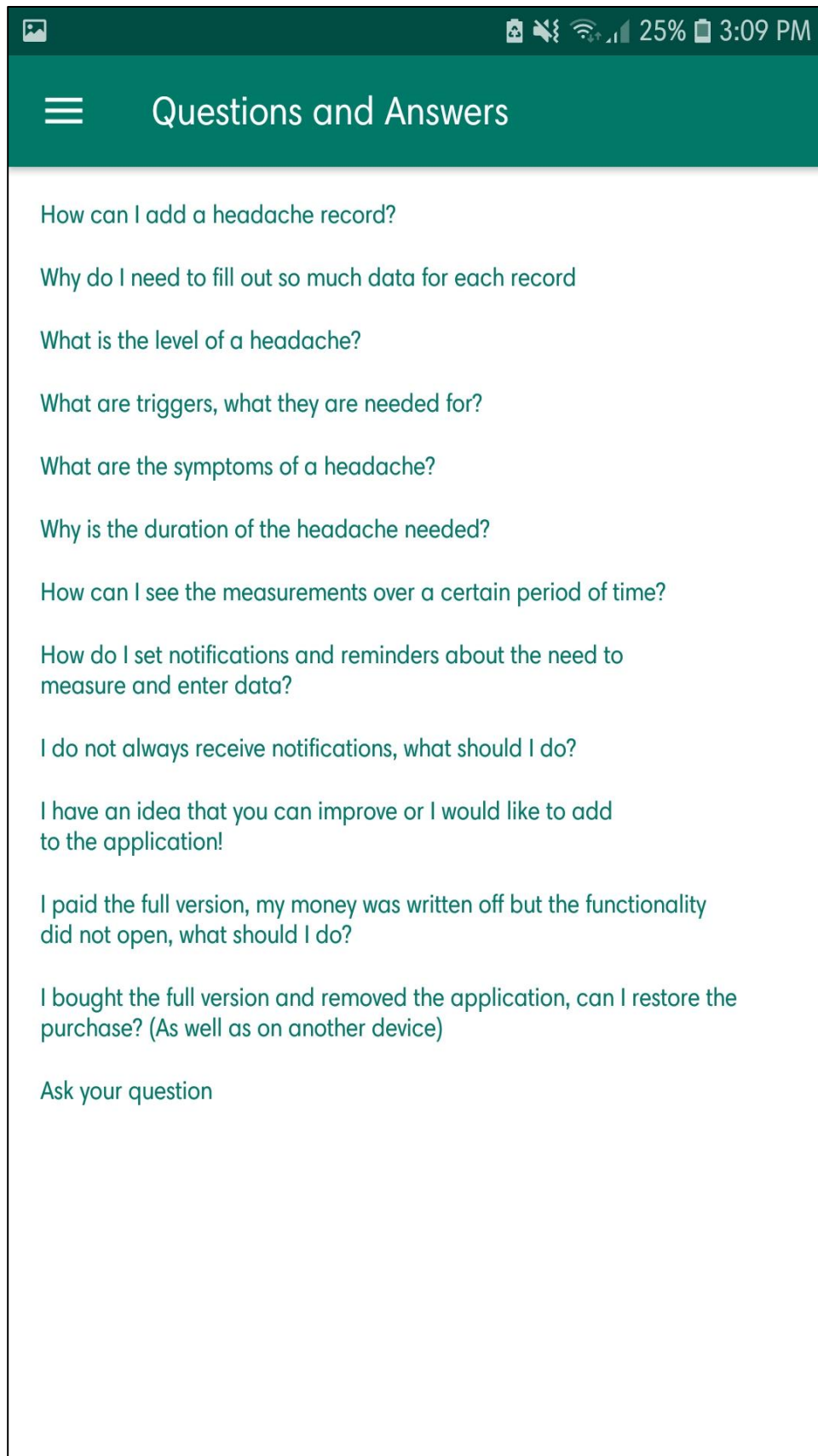


Figure 14 - Headache Diary - User FAQ

3.3 Headache Log

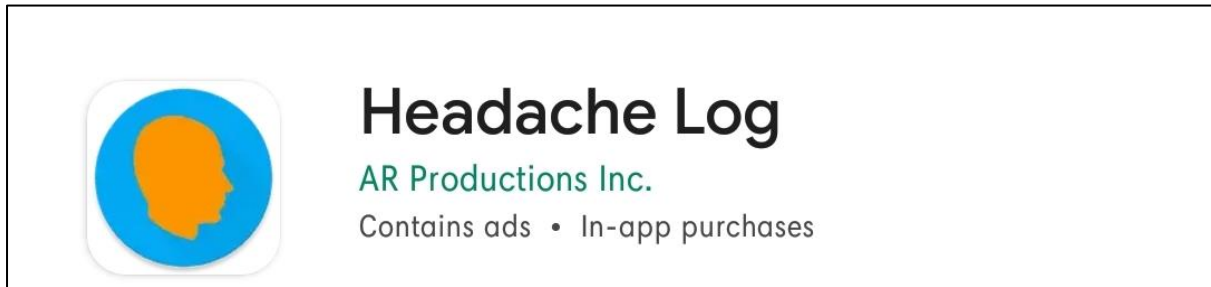


Figure 15 - Headache Log – Logo

This app provides users with a quick and easy method of tracking their headaches and migraines. As shown in *figures 17, 18, and 19* this app's record function has numerous aspects and users can record the severity, pain location, trigger and medication.

The record feature is customisable and allows users to add their own information for example a medication that is not listed in the app.

This app also allows users to “upgrade” this will allow users to back up their information, remove advertisements and to export their migraine information. There was no information provided on the price of this upgrade, when selected the app displayed an error message and force shut.

A major disadvantage of this app is not allowing users to have a backup of their information without payment. A lack of FAQ is also a disadvantage as although the app has a simple layout many things are either hidden in menus or not labelled and this can cause frustration especially in someone who was suffering a migraine attack this could cause them to abandon their record.

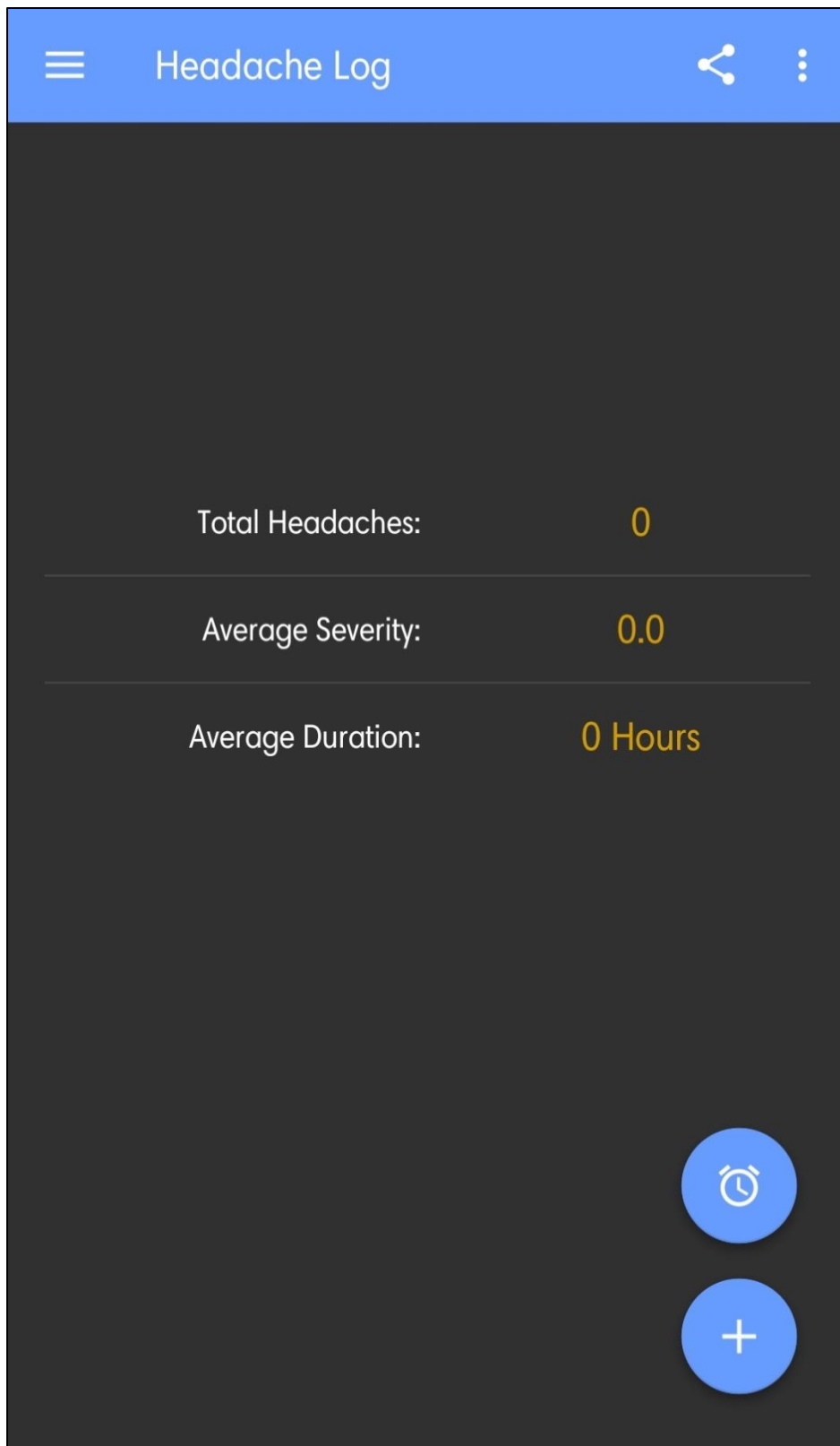


Figure 16 - Headache Log - Homepage

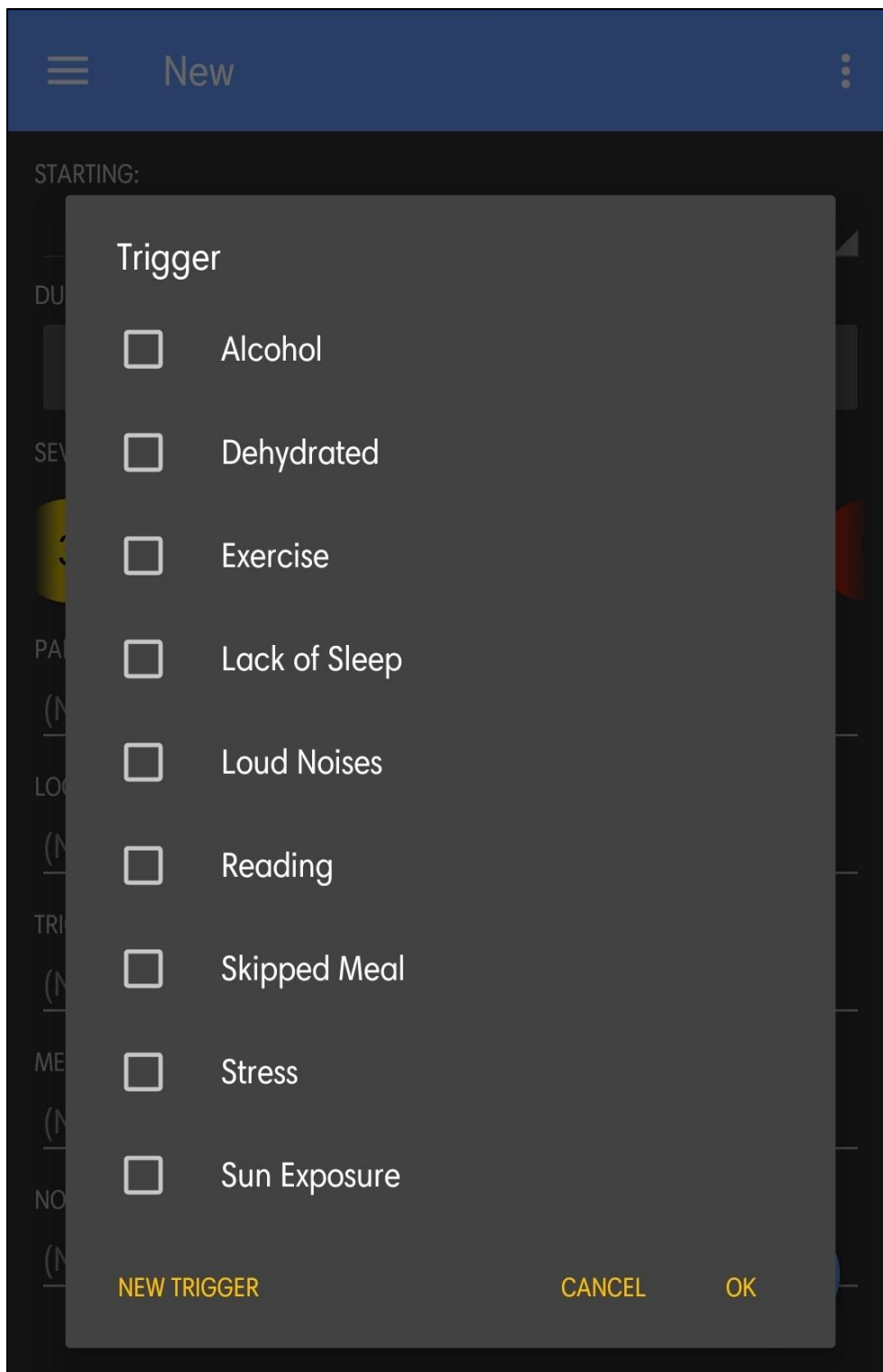


Figure 17 - Headache Log - Recording Triggers

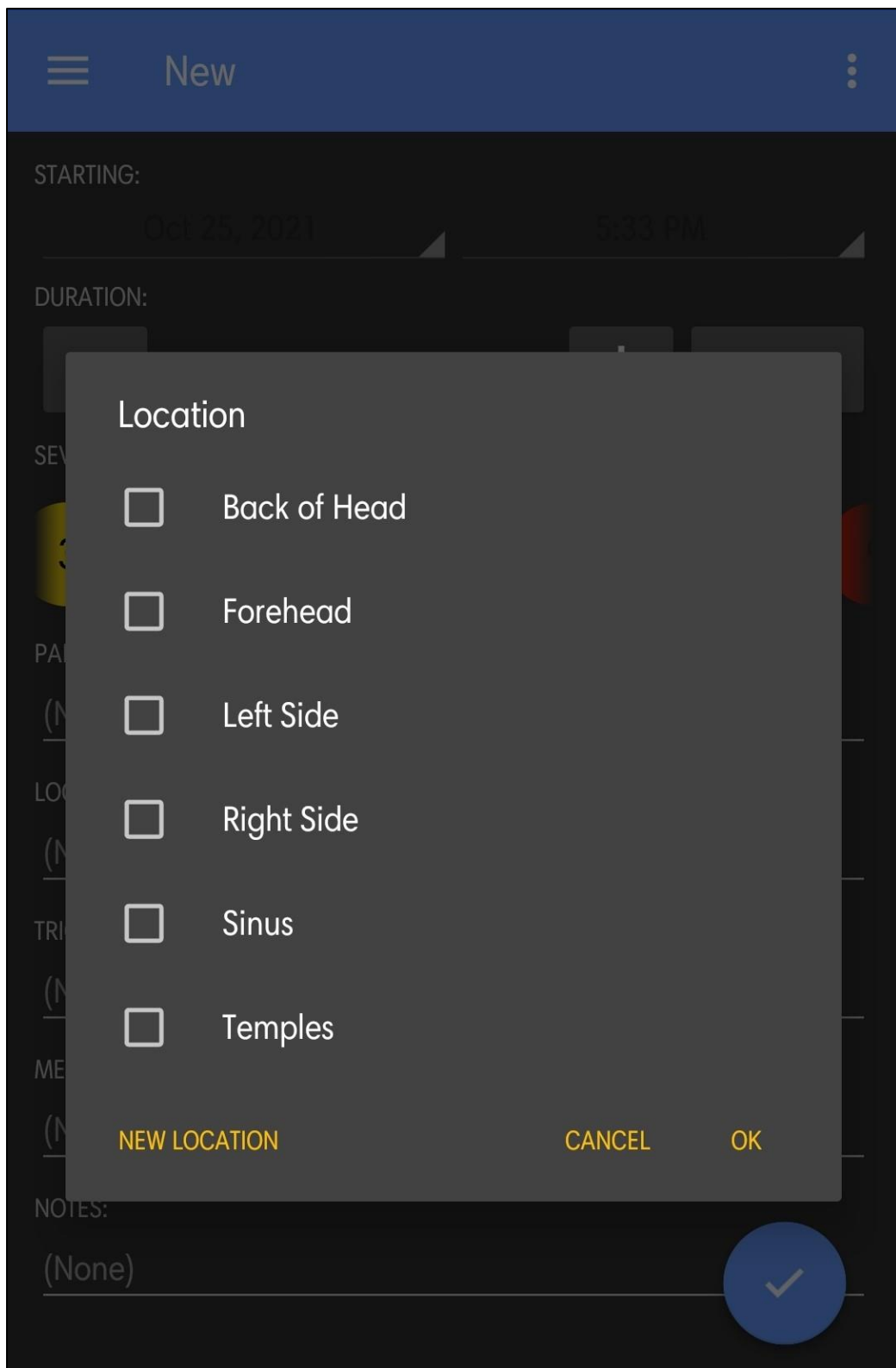


Figure 18 - Headache Log - Recording Pain Location

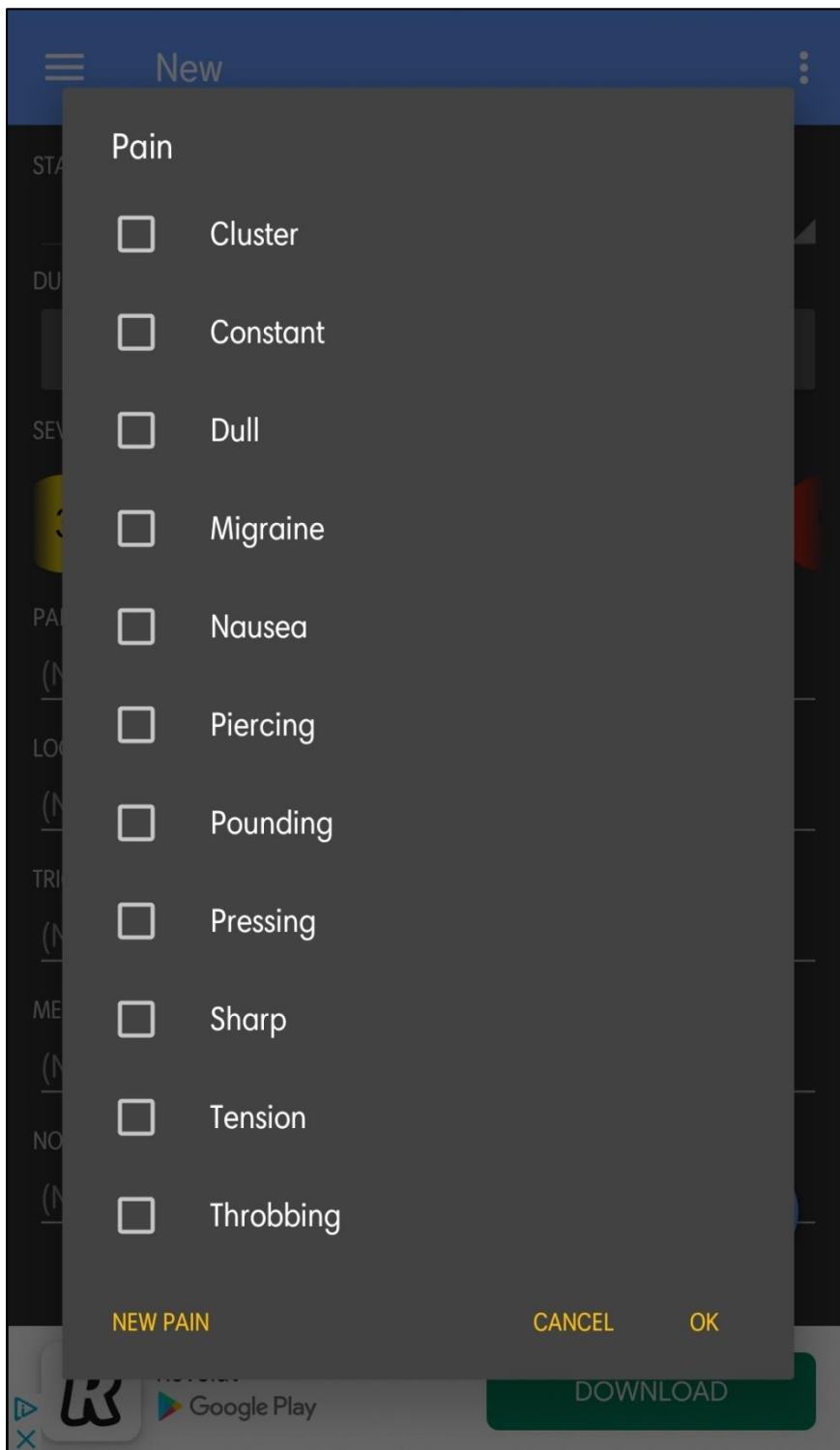


Figure 19 - Headache Log - Recording Pain Type

New

STARTING:
Oct 25, 2021 5:33 PM

DURATION:
— (Hours) + HOURS

SEVERITY:
3 4 5 6 7 8

PAIN:
(None)

LOCATION:
(None)

TRIGGER:
(None)

MEDICATION:
(None)

NOTES:
(None)

✓

Figure 20 - Headache Log - Migraine Record

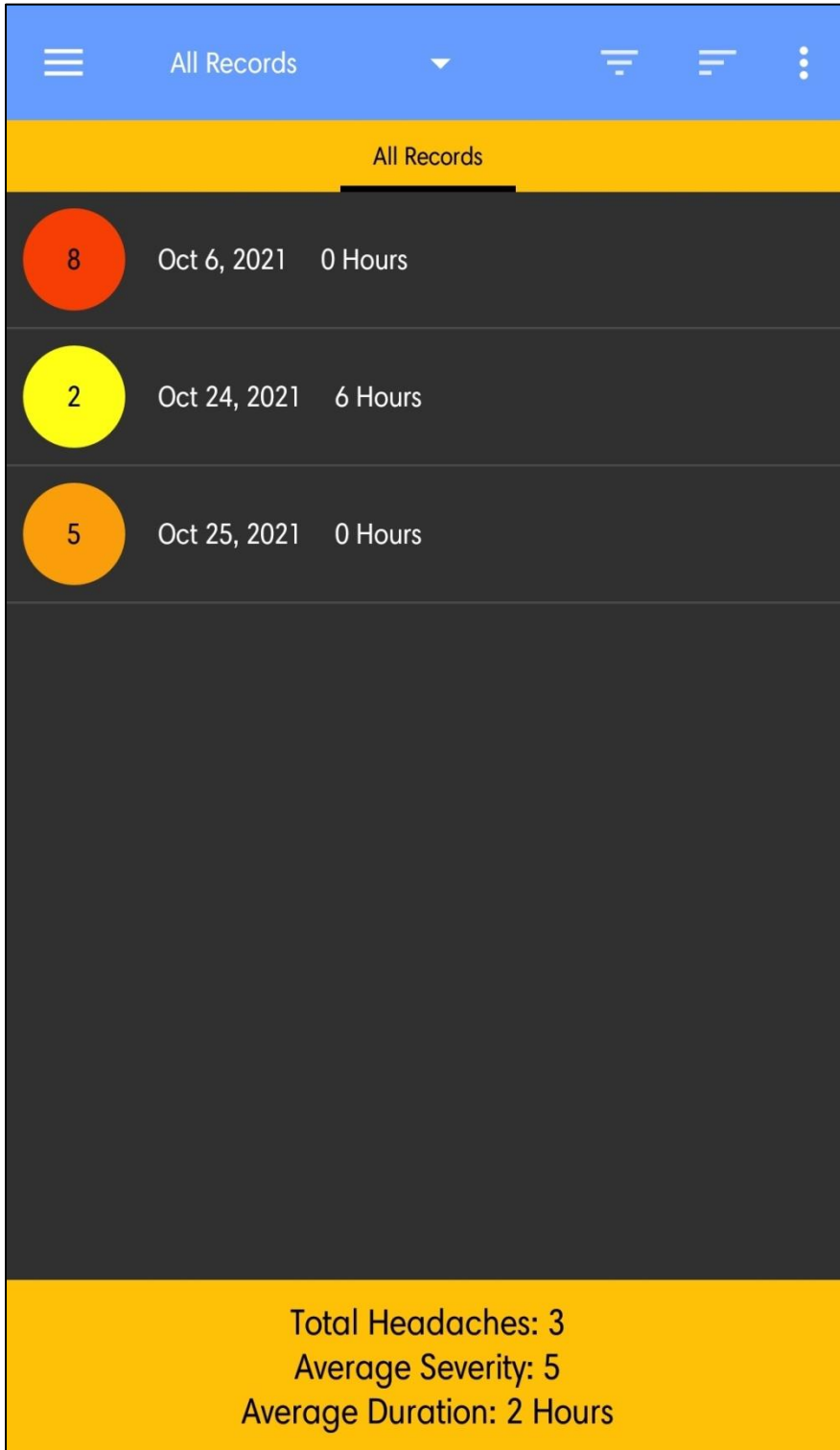


Figure 21 - Headache Log - All Records

3.4 Migraine Tracker

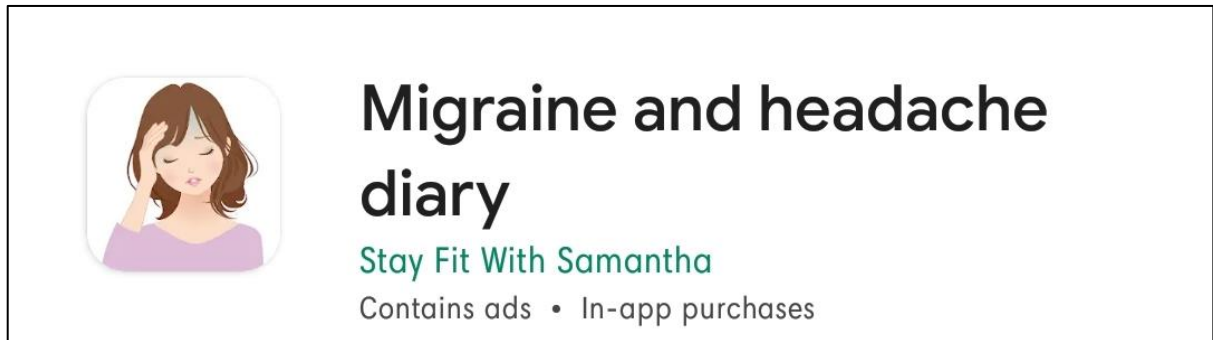


Figure 22 - Migraine and Headache Diary - Logo

As shown in *figure 22* this app allows users to add a migraine attack and record numerous aspects such as duration and “pain score”

This app provides users with a way to indicate their medication, triggers and pain type. The user can also add their symptoms as shown in *figure 27* although this is limited to 3 symptoms and users are not provided a way to add more.

A major flaw of the app as it does not provide the user any information about their migraines which can help manage pain.

An advantage of this app is that it is simple to navigate which can be a benefit to users who wish to record their migraine as it happens.

This simplicity is also a major disadvantage as the app does not provide users with any information or statistics about their migraines, triggers or medications and users are not provided any information about their migraines or what relief methods work for them.

← Add

The headache started at:

11/02/2021 14:31

How long did the headache last? (in hours)

– 3 +

Pain score ?

7

👍 ————— 👎

Pain + **Triggers** +

Medication + **Location** +

Did the medication work? No ▾

Symptoms ▾

Notes

Figure 23 - Migraine and Headache Diary - Add Record

Medication		CANCEL	+
<input type="checkbox"/>	Acetaminophen / Paracetamol		
<input type="checkbox"/>	Advil		
<input type="checkbox"/>	Aspirin		
<input type="checkbox"/>	Frovatriptan		
<input type="checkbox"/>	Ibuprofen		
<input type="checkbox"/>	Naproxen		
<input type="checkbox"/>	Nurofen Migraine		
<input type="checkbox"/>	Rizatriptan		
<input type="checkbox"/>	Sumatriptan		
<p>SAVE</p>			

Figure 24 - Migraine and Headache Diary - Record Medication

Triggers

CANCEL +

- Alcohol
- Caffeine
- Change in daily routine
- Change in weather
- Incorrect posture
- Intensive physical activity
- Menstruation
- Skipped meal
- Slept too short or too long
- Smoking
- Stress
- Strong odors
- Tyramine

SAVE

Figure 25 - Migraine and Headache Diary - Record Triggers

Pain CANCEL +

- Cluster
- Constant
- Dull
- Migraine
- Piercing
- Pressing
- Sharp
- Tension
- Throbbing

SAVE

Figure 26 - Migraine and Headache Diary - Record Pain Type

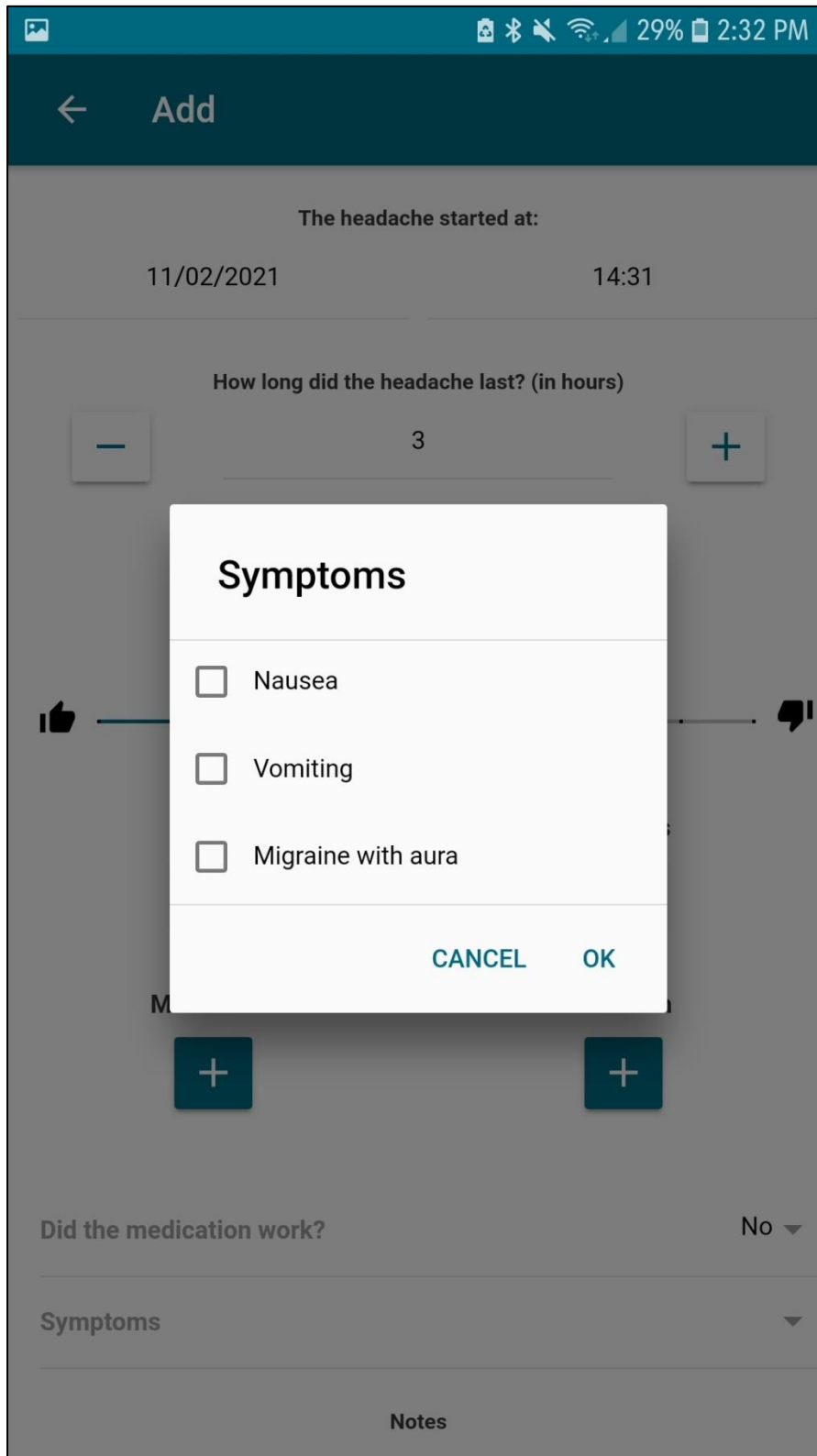


Figure 27 - Migraine and Headache Diary - Record Symptoms

4. Software Technologies

4.1 Xamarin

Xamarin is an open source platform used for building cross-platform applications. Xamarin allows users to build applications that will work for iOS, Android and Windows. Based on the Microsoft technology stack, Xamarin currently has over 1.4 million developers [5]. With its large users base Xamarin is also well documented.

Xamarin is based on the .NET Framework which is a free cross-platform, open-source developer platform that is used to build numerous types of applications [6]. The .NET Framework that Xamarin is built on also automatically handles tasks such as garbage collection and memory allocation.

Xamarin uses C# to create mobile applications in the Visual Studio Integrated Development Environment (IDE).

As shown in *figure 28* Xamarin's architecture allows for the creation of cross-platform applications with native UI and shared C# and Extensible Application Markup Language (XAML) code.

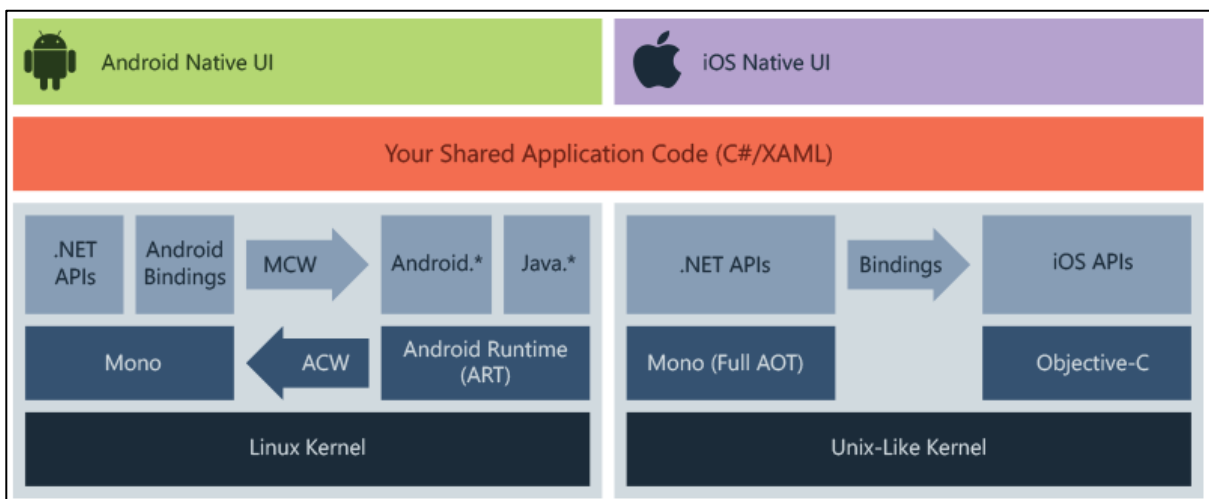


Figure 28 - Xamarin Architecture - Source: <https://docs.microsoft.com/en-us/xamarin/get-started/what-is-xamarin>

Xamarin.Forms is the User Interface (UI) framework that allows developers to build applications from a shared codebase with the UI code written in (XAML) and the back-end code written in C#.

Xamarin.Forms also utilises a XAML Hot Reload tool allowing developers to edit the XAML code during debugging and to view changes in the running application without the need to rebuild [7].

4.2 React Native

React Native is a JavaScript framework used to create mobile applications for iOS and Android. The React Native framework allows developers to create a cross-platform application that uses a single codebase.

React Native is based on React.js a JavaScript framework used to build web based UIs and UI components.

React Native makes use of a both JavaScript and the JavaScript XML (JSX) languages. As shown in *figure 29* the React Native Architecture makes use of a “bridge” which allows the JavaScript code and native code to interact. The “JavaScript Thread” is where the JavaScript code will be compiled. The “Native Thread” is where native code is executed and communication is carried out with the “JavaScript Thread” when the UI needs updating or native functions need to run. The “Shadow Thread” is where the application layout is calculated with the help of Facebook’s layout engine “Yoga”. [8]

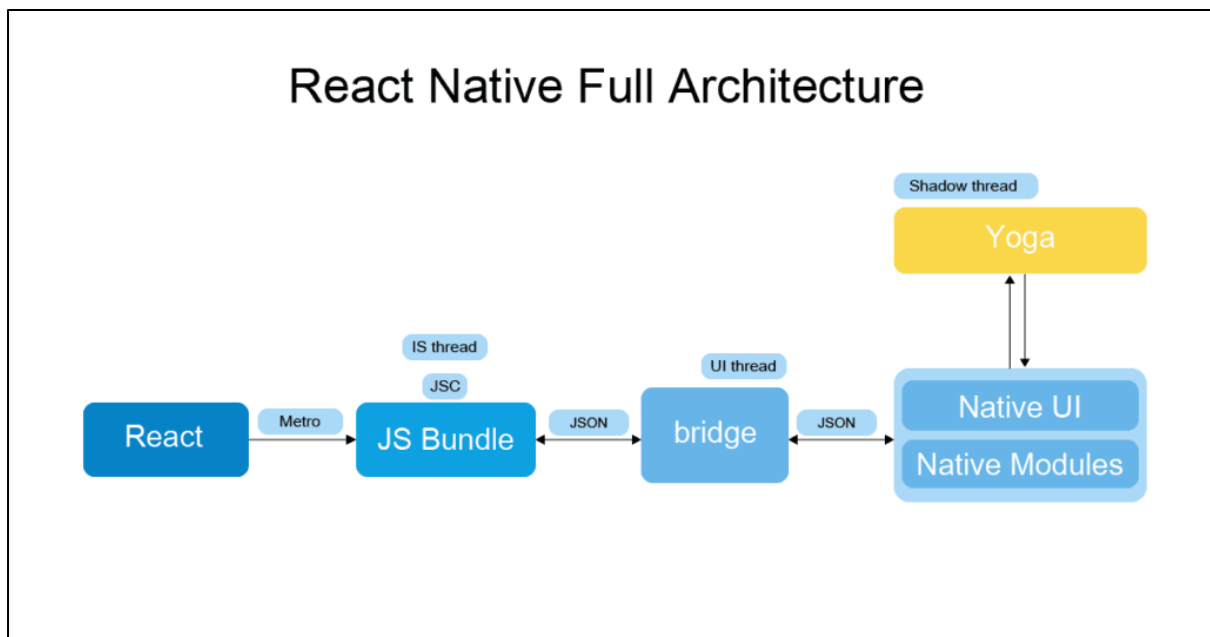


Figure 29 - React Native Architecture - Source: <https://litslink.com/blog/new-react-native-architecture>

With React Native being used in the development of numerous apps such as Facebook and Instagram it is widely used, open-source and well documented. Similar to Xamarin React Native also makes use of hot reloading.

4.3 Flutter

Flutter is an open source UI toolkit developed by Google used to build applications for mobile, web, desktop, and embedded devices from a single codebase [9]. Consisting of a Software Development Kit (SDK) and a widget based UI library Flutter utilises the Dart programming language which is similar to C++ and Java.

Flutter allows developers to create cross-platform apps that use the same codebase. Like React Native and Xamarin, Flutter also makes use of a hot reload feature to allow developers to see code changes in real time.

Although Flutter is quite new it provides developers with clear and concise documentation, online tutorials and online support from other developers. Flutter apps tend to be quite large in size and thus take longer to download or update this is due to the custom widgets.

As shown in *figure 30* Flutter makes use of the “Skia” graphics engine this means that unlike React Native a bridge is not required to communicate with native components because Flutter does not use them as all the interfaces are drawn using “Skia”.

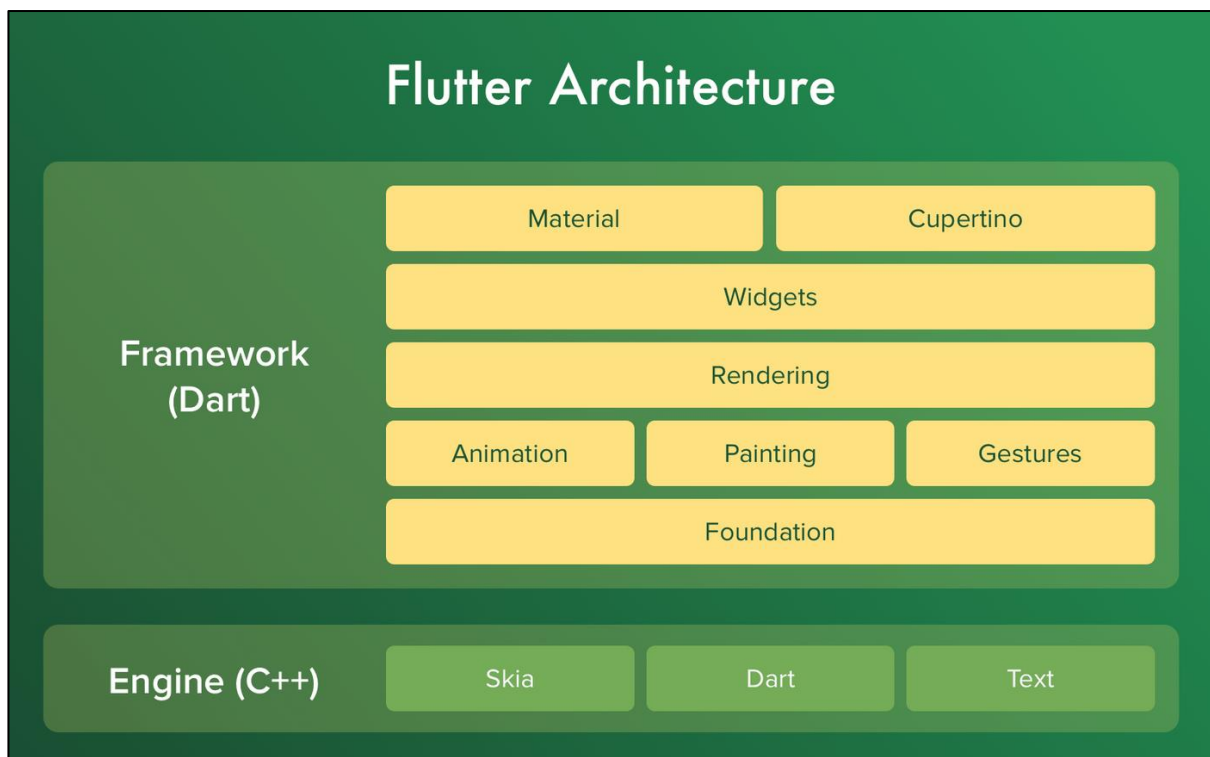


Figure 30 - Flutter Architecture - Source: <https://www.cleveroad.com/blog/why-use-flutter>

4.4 Databases

4.4.1 Firebase

Google's Firebase Realtime Database is a cloud based non Structured Query Language (NoSQL) database which allows users data to be stored and synced in realtime.

Data is stored as JavaScript Object Notation (JSON) objects which are synchronised in realtime to every connected client. The database is optimised for offline use ensuring that if a user loses connection then their information will be stored locally on their device and when a connection is re-established their data will automatically be synchronised.

The Firebase Realtime database utilises the Realtime Database Application Programming Interface (API) which only allows operations to be carried out quickly meaning an application can have multiple users and will still remain responsive.

Firebase also provides functionalities such as analytics and crash reports allowing developers to focus on their user's needs.

4.4.2 MySQL

MySQL is an open- source relational database management system (RDBMS). A relational database organises data into one or multiple tables where data types can be related.

A MySQL database requires all the data to have certain structure, all rows and columns in a table need to have similar structure and the values within a table need to be represented by certain data types. This rigid structure means a MySQL database lacks flexibility.

A MySQL database also lacks speed when queries are being performed as data can be stored across multiple tables.

4.4.3 MongoDB

MongoDB is a cross platform document oriented database program, it is classified as a NoSQL database.

When using MongoDB user's data is stored in JSON like documents consisting of field and value pairs. This documents structure allows querying to be carried out quickly as related data can be stored together. MongoDB is horizontally scalable meaning it is useful for large scale applications.

4.5 Additional Libraries, Packages and APIs

To provide users of “migraineHub” with statistics of their migraines and a way to scan food items a number of libraries are packages will be needed the following is a selection that has been researched.

4.5.1 Dymsoft Barcode Scanner SDK

Dymsoft is a software development company that provides solutions for document capture and barcode scanning. Dymsoft promises this scanner is easy to incorporate into both Android and iOS applications. Dymsoft also provides numerous advantages such as the ability to scan problematic barcodes such as ones which are out of focus, wrinkled, distorted or in poor contrast.

The biggest disadvantage of Dymsoft is that developers are required to create a Dymsoft account developers can then use the barcode scanner through either a 30 day free trial or through purchasing the scanner with prices starting at \$1,249 per year based on the number of barcodes scanned. Prices for the android and iOS scanner are unavailable on the Dymsoft website and developers are required to request a pricing quote.

4.5.2 ZXing Library

The ZXing (“zebra crossing”) library is an open-source, multi-platform barcode image processing library. The library is implemented in Java but provides ports to other languages.

The ZXing library can be easily integrated into any project and can also be customised to fit the needs of the application being developed.

An advantage of the ZXing library is that it is open-source meaning it is free to use. It is also well documented through the developers GitHub.

A disadvantage of the ZXing library is that it is currently in maintenance mode, this means that only bug fixes and minor enhancements will be carried out in the future and there is no active development happening on this library.

4.5.3 Syncfusion

Syncfusion provides a collection of enterprise grade components for mobile applications. Syncfusion provides a number of components that could be used with this project such as pickers, radio buttons, barcode scanner and charts.

An advantage of using Syncfusion is its wide variety of components that can be integrated into a mobile application. The Syncfusion is also widely used and well documented.

A disadvantage of Syncfusion is developers are required to create an account to use the components. The components are available for use through a 30 free trial or through a paid subscription.

4.5.4 Microcharts

Microcharts is a simple open-source library for creating charts on a wide range of platforms. Microcharts utilises the SkiaSharp library to provide developers with simple customisable charts. The SkiaSharp library is a 2D graphics API for .NET based on Google's Skia Graphics library.

Microcharts provides ready to use charts for a variety of platforms. An advantage of Microcharts is that it is open-source with a large community of contributors providing updates and fixes regularly.

A disadvantage of Microcharts is that it is currently in Beta meaning it is not a 100% finished product and issues could still be encountered.

4.5.5 DevExpress

DevExpress provides numerous packages for web and mobile applications. DevExpress provides UI components such as charts and forms. An advantage of using DevExpress is that there are many components available for use providing high customisability The DevExpress is also well documented with a live chart help desk available.

A disadvantage of DevExpress is that similarly to Syncfusion an account is required and components can be used through a 30 day free trial or a paid subscription. Although, DevExpress does provide a small number of components for free an account is still required.

5. Survey

A survey was created using “Google Forms”. This survey was created to obtain information from individuals who suffer from migraines about how they track their migraines and how it benefits them.

The survey was conducted through e-mail on a group of 8 individuals of varying ages who have been affected by migraines.

The survey can be found here: <https://forms.gle/Pq6LS7d98SziyqCY9>

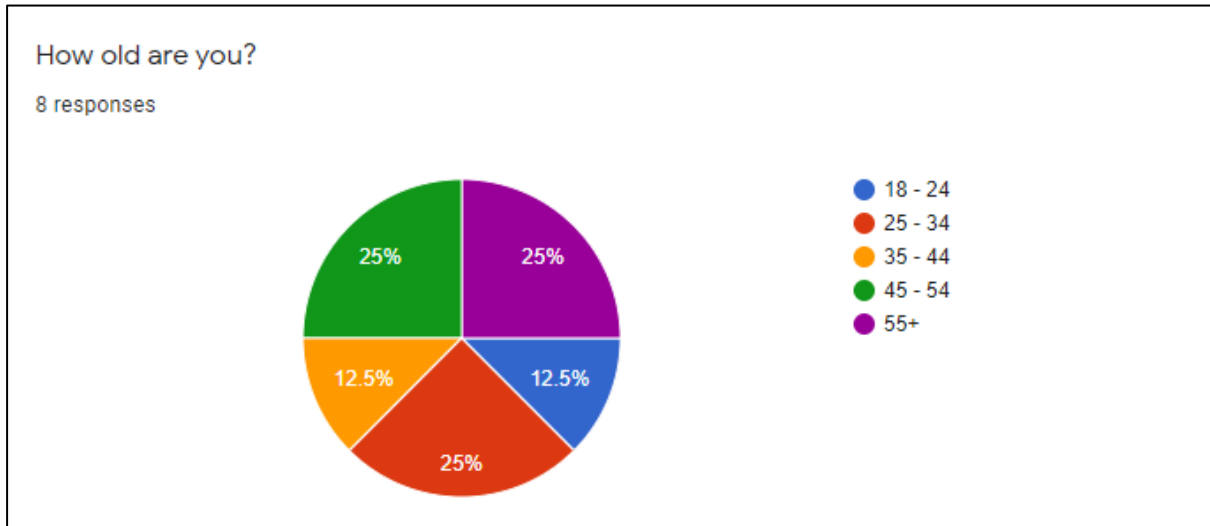
The survey consisted of 6 questions.

The questions asked are as follows:

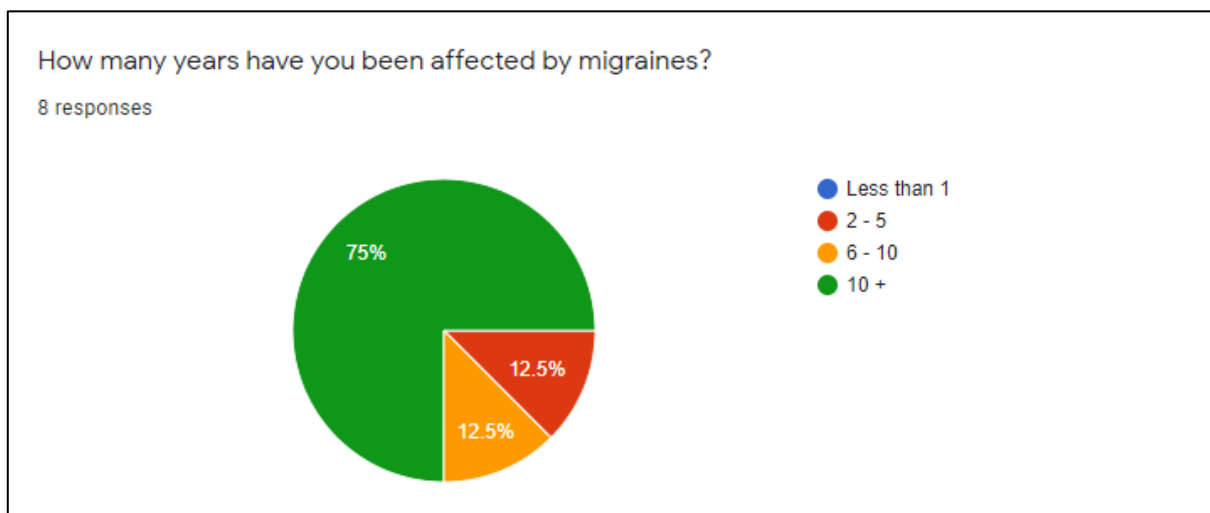
1. How old are you?
2. How many years have you been affected by migraines?
3. Do you currently track your migraines?
4. If yes, do you feel tracking your migraines helps you to (tick all that apply)
5. How do you track your migraines?
6. If no, please state your reasons for not tracking your migraines

A copy of this survey can be found in the appendix of this document.

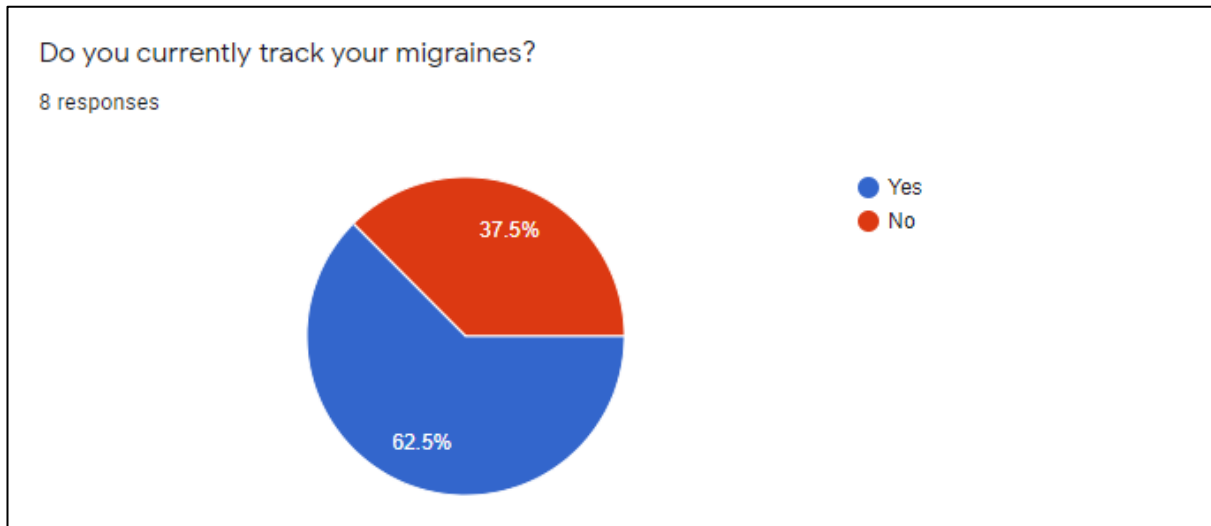
6. Survey Findings



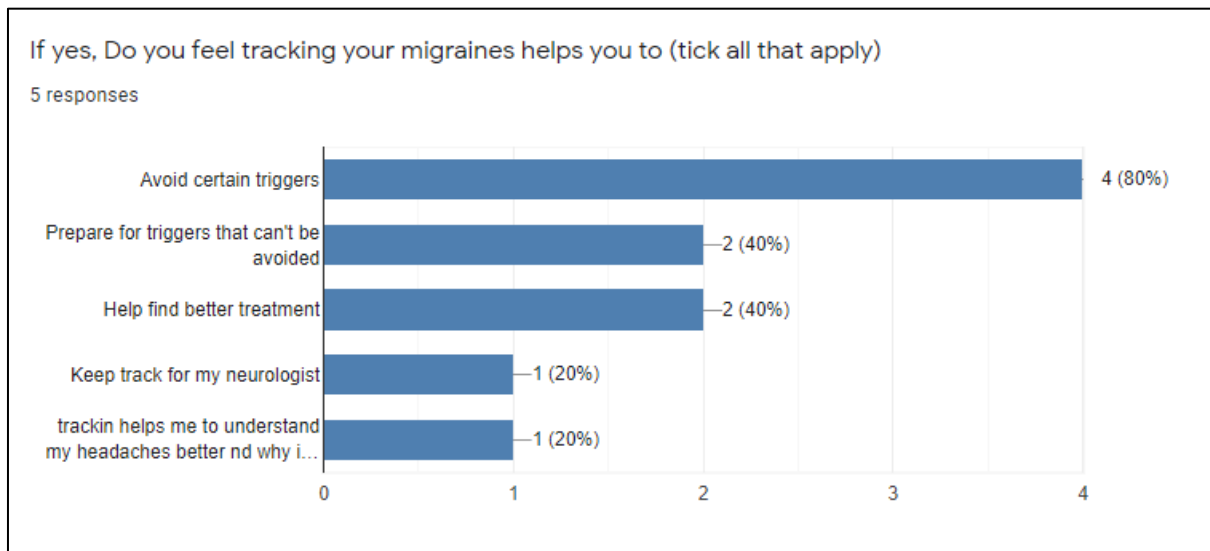
Most of those surveyed were over 24 years old, except for 12.5% of responders who were in the 35 – 44 year old category.



75% of those asked stated they have been affected by migraines for over 10 years, this shows that most of the responders have been dealing with migraines since at least puberty.

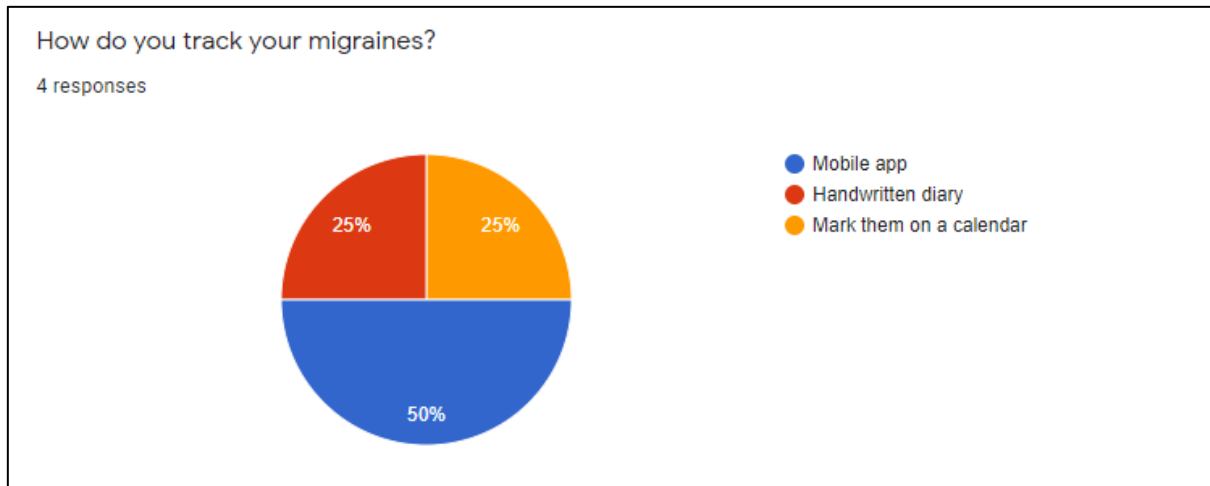


Over 65% of those responding stated they already track their migraines.

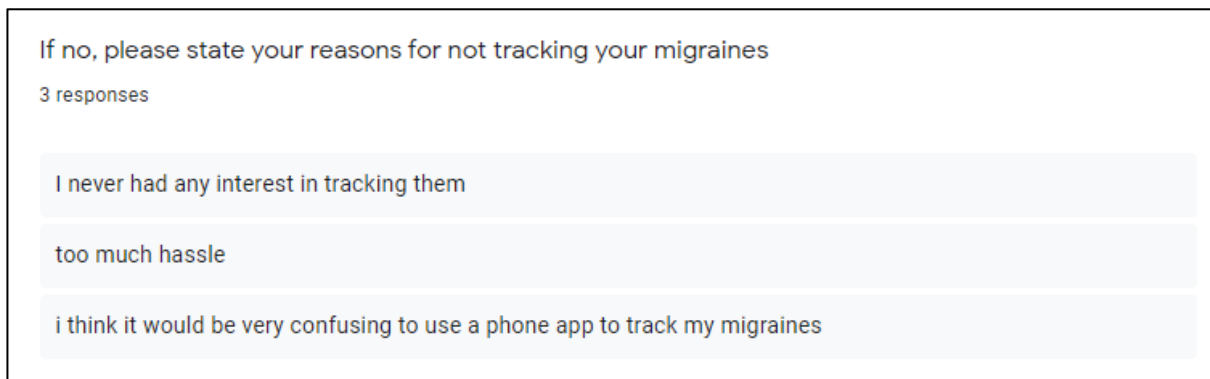


When asked how tracking migraines helps them, the most popular answer among responders was that tracking helps them to avoid certain triggers, tracking also helps to prepare for unavoidable triggers and to help discover better treatments.

Two responders also stated that tracking their migraines help them to understand their headaches/migraines better and the reasons behind why they occur and also to aid their neurologist with their treatment.



Half of those asked stated they use a mobile application for tracking. The other half of responders was evenly split between utilising a handwritten diary and marking the occurrences of migraines on a calendar.



Those who stated they do not track their migraines gave reasons such as not having any interest in tracking, feeling there is too much hassle involved and the feeling that it would be too confusing using an application to track their migraines.

7. Conclusion

In conclusion upon completion of the research detailed within this document the following decisions have been made to ensure the successful completion of this project.

Xamarin Forms has been chosen as the cross platform application to create this project. Xamarin is ideal for this project as it will allow the application to be created for both Android and iOS, this will ensure the application can be used by a wider audience and will reach more people who suffer from migraines.

Xamarin also provides developers with a range of documentation and tutorials ensuring any issues encountered can be researched and dealt with accordingly.

The Firebase Realtime Database has been chosen as the database for this project. The Firebase Realtime Database is the best suitable database for this project because of its ease of use, large amounts of available documentation and its ability to integrate well with Xamarin Forms.

ZXing barcode scanner has been chosen as the barcode scanner library for this project. A NuGet package can be installed in the Xamarin Forms project and can be easily integrated.

The Microcharts library has been chosen to be used for any charts that will be required to be made in this project. Similar to the ZXing barcode scanner, a NuGet package can be installed.

The survey conducted shows that there is a suitable market for “migraineHub” as it was discovered most people track their migraines in some way. The application will need to use the research undertaken on similar application to ensure it is successful.

The similar applications researched showed that there are some common elements that can be added to this project to ensure ease of use such as clear well laid out menus. The main aspect that similar applications had in common was that characteristics of migraines they chose to track such as triggers, symptoms, pain relief, pain location and medication.

Many of the application did not provide a way for users to create accounts. They also did not provide a way for users to log information about the food they had eaten. Some applications also had some features locked behind a pay wall, for this project this will not be implemented.

References

- [1] Health A to Z – Migraine Overview, (10/5/19) Available at: <https://www.nhs.uk/conditions/migraine/>
- [2] Purbaugh M.V., Vuppala AA.D. (2021) Migraine. In: Henderson A.D., Carey A.R. (eds) Controversies in Neuro-Ophthalmic Management. Springer, Cham. https://doi.org/10.1007/978-3-030-74103-7_20
- [3] Headache disorders (8/4/16) Available at: <https://www.who.int/news-room/factsheets/detail/headache-disorders>
- [4] Jessica Schroeder, Chia-Fang Chung, Daniel A. Epstein, Ravi Karkar, Adele Parsons, Natalia Murinova, James Fogarty, and Sean A. Munson. 2018. Examining Self-Tracking by People with Migraine: Goals, Needs, and Opportunities in a Chronic Health Condition. In Proceedings of the 2018 Designing Interactive Systems Conference (DIS '18). Association for Computing Machinery, New York, NY, USA, 135–148. DOI: <https://doi.org/10.1145/3196709.3196738>
- [5] “The Good and The Bad of Xamarin Mobile Development”, (13/11/20), Available at: <https://www.altexsoft.com/blog/mobile/pros-and-cons-of-xamarin-vs-native/>
- [6] “What is .NET?” Available at: <https://dotnet.microsoft.com/learn/dotnet/what-is-dotnet>
- [7] XAML Hot Reload for Xamarin.Forms, (07/08/21), Available at: <https://docs.microsoft.com/en-us/xamarin/xamarin-forms/xaml/hot-reload>
- [8] Anastasia Rashevskaya, “React Native Re-Architecture — What to Expect from The Popular Cross-Platform Framework?” (23/10/20), Available at: <https://litslink.com/blog/new-react-native-architecture>
- [9] Karan Shah, “Flutter vs. Kotlin – Which framework to choose for your next project?” (22/10/21), Available at: <https://www.solutelabs.com/blog/flutter-vs-kotlin>

Bibliography

- “What is Xamarin.Forms?” (7/8/21), Available at: <https://docs.microsoft.com/en-us/xamarin/get-started/what-is-xamarin-forms>
- “What Is React Native? Complex Guide for 2021” Available at: <https://www.netguru.com/glossary/react-native>
- Nat Chrzanowska, “React Native Pros and Cons - Facebook’s Framework in 2021 (Updated)”, (16/5/19), Available at: <https://www.netguru.com/blog/react-native-pros-and-cons>
- “Flutter architectural overview”, Available at: <https://flutter.dev/docs/resources/architectural-overview>
- Bridget Botelho, “MongoDB”, Available at: <https://searchdatamanagement.techtarget.com/definition/MongoDB>
- “Migraine Headaches”, Available at: <https://my.clevelandclinic.org/health/diseases/5005-migraine-headaches#symptoms-and-causes>
- “Types of Migraine”, Available at: <https://migraine.ie/what-is-a-migraine/#types-of-migraine>

Appendix

10/31/21, 2:02 PM Migraine Tracking

Migraine Tracking

A survey to discover opinions about tracking migraines.

1. How old are you?

Mark only one oval.

18 - 24

25 - 34

35 - 44

45 - 54

55+

2. How many years have you been affected by migraines?

Mark only one oval.

Less than 1

2 - 5

6 - 10

10 +

3. Do you currently track your migraines?

Mark only one oval.

Yes

No

https://docs.google.com/forms/d/1c7DPiETPbYhBGQ#tDt8ZkKdoFhPaV56_4jUhrldBtA/edit 1/2

10/31/21, 2:02 PM

Migraine Tracking

4. If yes, Do you feel tracking your migraines helps you to (tick all that apply)

Check all that apply.

- Avoid certain triggers
- Prepare for triggers that can't be avoided
- Help find better treatment

Other: _____

5. How do you track your migraines?

Mark only one oval.

- Mobile app
- Handwritten diary
- Other: _____

6. If no, please state your reasons for not tracking your migraines

This content is neither created nor endorsed by Google.

