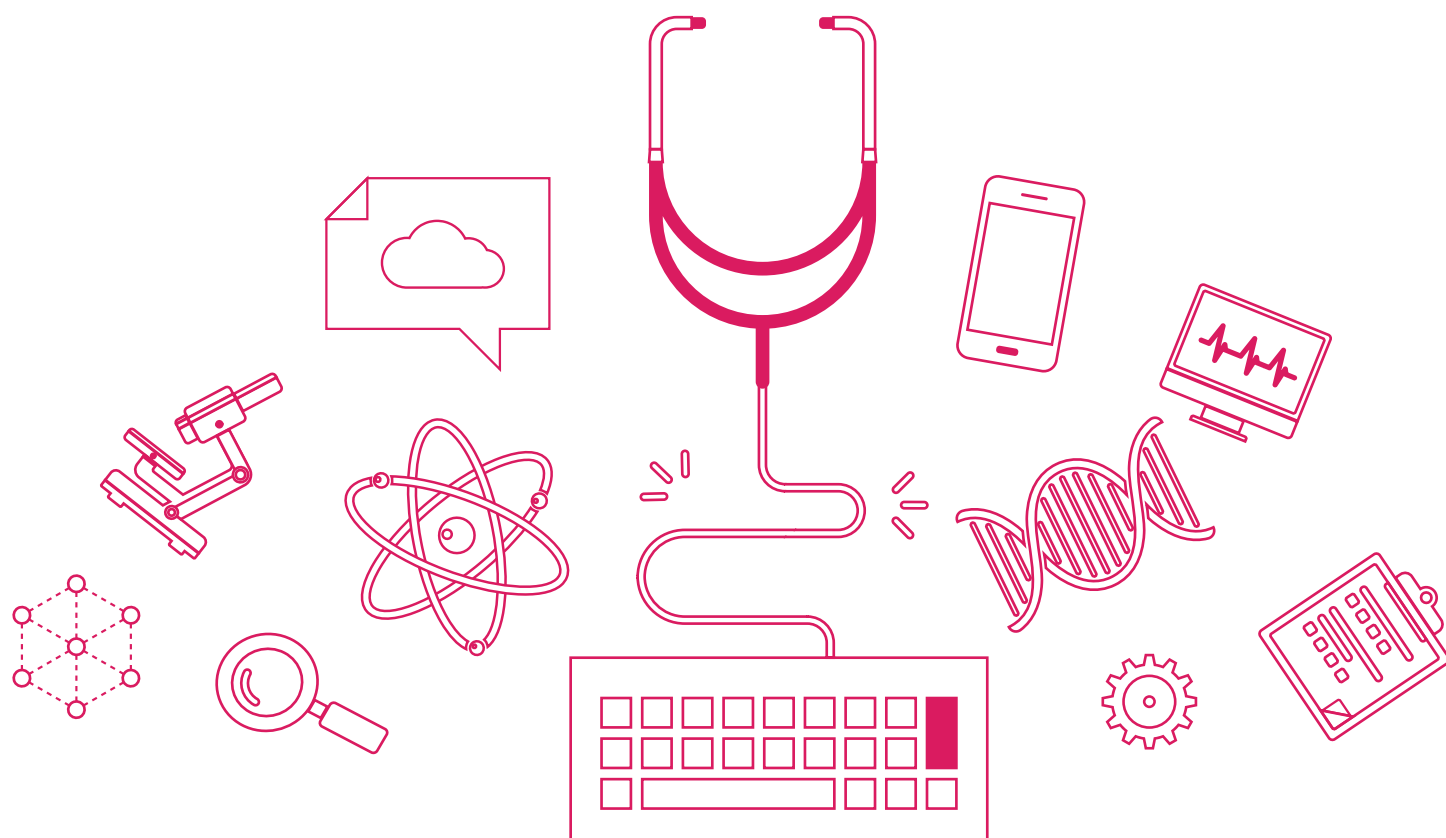


Guidelines for creating healthy living apps



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Summary

This guide is for people interested in creating evidence-based and effective apps that improve the health and wellbeing outcomes for users. The guide is for both those new to developing apps with little software development knowledge, and those new to working in health promotion or behaviour change. As Australia has one of the highest rates of smartphone ownership globally, healthy living smartphone apps are an ideal behaviour change tool, as they are portable, enable reinforcement throughout the day, and can provide context specific advice

The guide is organised by each stage of the app development process so that you can easily access the most relevant parts.

- **Before you start building your app**
Identifying what your app will do, who will use it and how.
- **Planning your app**
Assessing the right team structure, requirements and quality framework for your app.
- **Building and testing your app**
Selecting the right development and behaviour change frameworks or constructs, and tips for how to create effective healthy living apps.
- **Launching your app**
Advice on marketing and promoting your app to your target users.
- **Updating your app**
Information about the importance of keeping your app up-to-date.

The guide also has further resources and references with more information.



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DISCLAIMER

The information in this document is general in nature, and is not intended to provide or be a substitute for legal advice.

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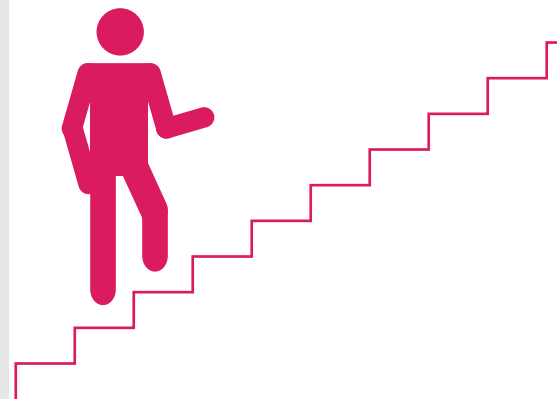
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Checklist for developing an app

BEFORE YOU START BUILDING YOUR APP

- Define the purpose of your app and the problem(s) it will solve
- Specify the goals for your app
- Identify who the app is for (your target users' demographics and profile)
- Create user personas of your ideal users
- Assess what other apps are on the market for a similar purpose or audience
- Choose the right platform(s) for your app to be built on
- Establish what features of each platform will be useful to your app
- Write a strategy for what your app will do, who it is for, how you will build it and how it will be launched



PLANNING YOUR APP

- Ensure your team includes health promotion or behaviour change specialists, software engineers and end-users
- Identify how your team will work together throughout the app development process, particularly to involve end-users
- Assess the relevant literature for your intended behaviour change
- Conduct market research about what your target market wants and needs
- Review the relevant app store or platform guidelines that your app will need to meet
- Consider the legal or regulatory requirements your app must meet, such as privacy or data security

BUILDING AND TESTING YOUR APP

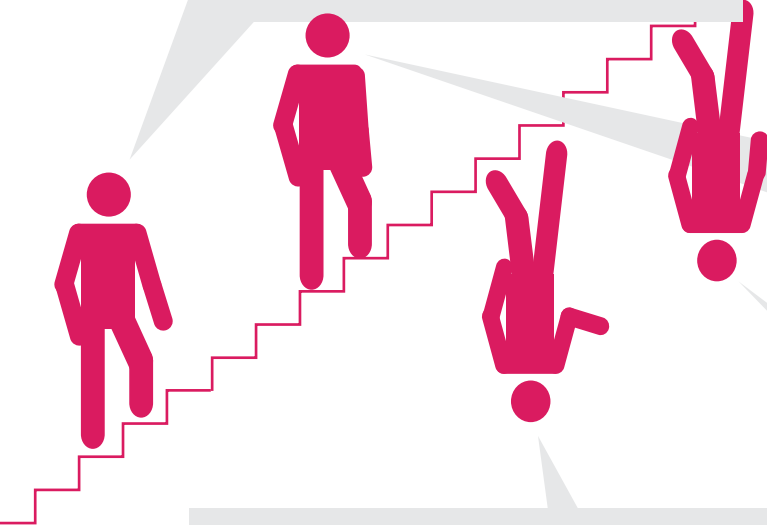
- Incorporate interactive, interesting, engaging or fun features into the app where possible
- Ensure that people from your target audience have used and provided feedback on your user interface
- Assess the 'user journey' of using the app, and consider how it can be streamlined and improved
- Review the language you have used to ensure it is clear and simple to read
- Check that you are providing evidence-based information
- Consider different frameworks for designing the app, such as user-centred design or service design thinking
- Include behaviour change constructs or intervention strategies based on the available literature
- Identify your 'minimum viable product' features that you need to launch the app
- Identify what process you will take to build the app, launch the first version(s) and then iterate to improve it over time

LAUNCHING YOUR APP

- Create a promotion strategy to ensure users can find your app and compare it to others on the market
- Consider different ways of creating value for your users
- Assess whether partnerships can help expose your app to your target audience
- Engage with innovators and early adopters to encourage prompt feedback

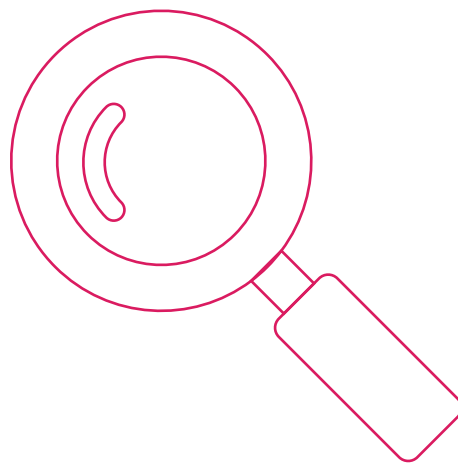
UPDATING YOUR APP

- Have processes in place to evaluate users' responses to and use of your app
- Plan for continuous updates to your app as new features become available or bugs are identified
- Ensure that you keep up-to-date with evidence and guidelines for your intended behaviour change, and update the app when necessary



-2-

Introduction



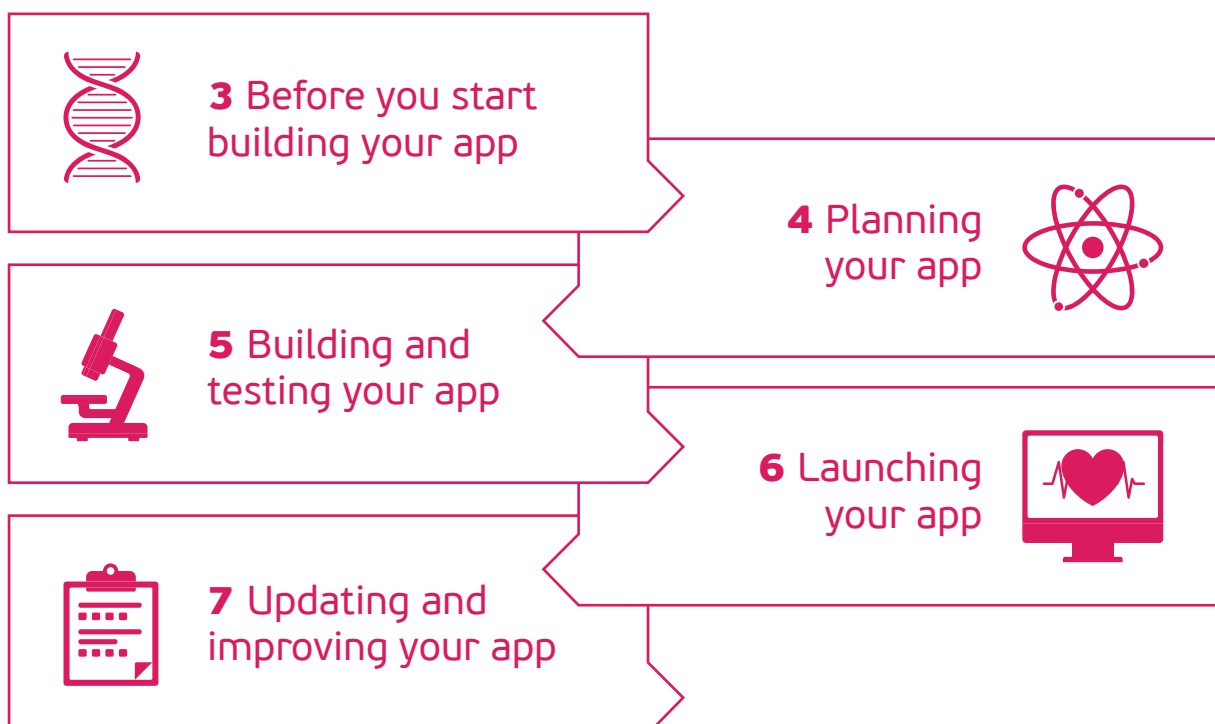
Australia has one of the highest rates of smartphone use in the world. A study in August 2014 found that 81% of Australians owned a smartphone (Deloitte Touche Tohmatsu, 2014). Healthy living apps have been suggested as an ideal behaviour change tool as smartphones are portable, enable reinforcement throughout the day, and can provide context specific advice (Dennison et al., 2013).

This creates a great opportunity for people interested in creating healthy living apps that encourage users to make lifestyle changes such as increasing physical activity or reducing stress levels to attain overall health and wellness goals, for example losing weight or improving mental wellbeing.

This document is a guide for individuals or

organisations that wish to create a healthy living app for smartphones and other devices. While every app is unique, the document provides principles that apply across many domains.

The document outlines each step of the process for creating a healthy living app, starting with before you start building an app and ending with updating and improving your app. The document shares various ways in which developers can enhance the quality of their healthy living apps, exploring the importance of having a defined purpose and development strategy. It provides a range of frameworks and techniques that can be used to produce a healthy living app that will assist with effective, ongoing behaviour change.



-3-

Before you
start building
your app



3.1 PURPOSE – WHAT IS THE PURPOSE OF YOUR APP?

The best apps are those that solve a problem that users are experiencing, and have a clear purpose and goal. For example, the *Water Balance: hydration tracker with goals and reminders* healthy living app lets people easily track and improve their water intake through logging consumption and providing reminders (Plus Sports, 2015).

It is also worthwhile thinking about what your app will not do. The best apps start off small, solving one specific problem or having a single purpose, and then can be improved and expanded.

3.2 AUDIENCE – WHO WILL BE USING YOUR APP?

Successful apps are rarely targeted at everyone. Think about who will get the most value from your app. What is their age? What socioeconomic bracket are they in? Are they male or female? Healthy or unhealthy? Are they educated? In a high-level job? Are they injured or experiencing an illness? Are they interested or trained in a particular activity?

Consider the importance of health equity in choosing the platforms to be used for your app. Although mobile technologies and healthy living apps are often seen to be affordable and accessible, there are often many barriers.

The success of a healthy living app may be limited by a number of social determinants. In addition to cellular network access, users may be limited in their access to fresh food, gym facilities, or a safe neighbourhood to exercise in. The target audience's education level, income, or a number of other socioeconomic factors

and social determinants of health may hinder the success of a healthy living app. For example, if a user is unable to afford a gym membership then a healthy living app requiring access to a gym is unlikely to be useful.

Define the profiles (sometimes called user personas) of your ideal users. Use these profiles throughout the development process to think in their shoes – what they would do in a particular situation, or how they would feel about the advice or guidance your app provides.

3.3 MARKET REVIEW – WHAT ARE OTHER PEOPLE DOING?

Look in the app stores (Apple and Google Play) for apps that do similar things or service similar customers.

If there is something similar on the market, how will your app be different? Knowing what makes it unique will help guide your app's development and launch. You could differ from existing apps through better design, localised information (such as Australian-specific foods), different features, or providing more integration with other fitness tracking devices or data.

Sometimes it might be better to work with an existing app or developer to improve their app to achieve your idea. You might even sub-license a copy of their existing code to reduce the time that you spend replicating features, if budget permits.

3.4 PLATFORM – WHAT PLATFORM(S) WILL YOU BE USING?

3.4.1 OVERVIEW

The different platforms available to app developers – including Apple's iOS, Google's



Android and websites – each have different features and coding languages. As a result, you should decide which platform(s) you want to build, test and release your app on.

In Australia, Apple's iPhone is the most popular mobile device, with 38% of the market (Deloitte Touche Tohmatsu, 2014). iPhones run Apple's iOS operating system (iPads and iPod Touches also run iOS). However, the Android operating system also has a large market share as it runs on a large number of devices, such as Samsung Galaxy phones.

Apple devices generally sell at a higher price point, therefore Apple users are largely considered more affluent than that of Android, a factor that may influence your platform decision. However, part of what differentiates your app from others might be that it supports particular devices that others do not.

There are also other operating systems available, like Windows Phone and Blackberry OS, although with drastically smaller market shares.

With each additional platform, the cost of developing your app will increase. Therefore, it is vital to define your target audience in order to appropriately choose the platform your app will be on – you should choose a platform that your target users already use.

In some cases, instead of developing an app for a specific operating system, it may be more appropriate to create a mobile-friendly website that users can visit on any smartphone or computer.

3.4.2 WHAT DO THESE PLATFORMS OFFER?

Each of these platforms offers a different

set of device and operating system features. Assessing the different features of each will help you refine what your app will and won't do.

One factor to consider when making your choice is the recent release of Apple's HealthKit (Apple, 2015b), which is now a part of iOS on both the Apple iPhone and the Apple Watch. HealthKit allows health apps to connect and collate data in a central place. HealthKit makes it easier to collaborate with other apps, and has improved security and privacy for stored information. For instance, a heart monitoring app and blood pressure app could exchange information using HealthKit.

Newer Apple iPhones already store step count data in HealthKit using a sensor inside the phone. This means that if you are building an app that uses step count information, you may not need to develop your own hardware device that counts steps. If your users already have a device that stores step counts into HealthKit then you could potentially access that information. However, depending on your intended audience HealthKit might not be appropriate to rely on, as it is not available on older iPhones or iPads.

Other platforms may have similar features, like Google Fit (Google, 2015), which works on Android phones and wearables, and can collaborate with other apps like HealthKit. Another example is the Samsung S Health system (Samsung Electronics, 2015) for Samsung-manufactured phones (running Android), which has a set of features to allow users to easily track a range of health parameters, such as weight, activity information and sleep quality.



Apple devices generally have very similar hardware features. For example, all of the latest Apple iPhones (the 6 and 6 plus models) have two cameras, a pedometer (as part of HealthKit), and two screen resolutions: one for the smaller 6, and another for the larger 6 plus. Android devices vary widely, as there are many budget phones with smaller screens or no GPS, while more expensive phones will have equivalent or better features than the iPhone. This can make it difficult to produce a consistent look, feel and functionality across many Android devices, whereas it is easier to build and test on iOS.

Knowing the features or limitations of each platform will help you determine the best way to build your app – using in built functions will reduce your development time and cost, and improve the user experience of your app.

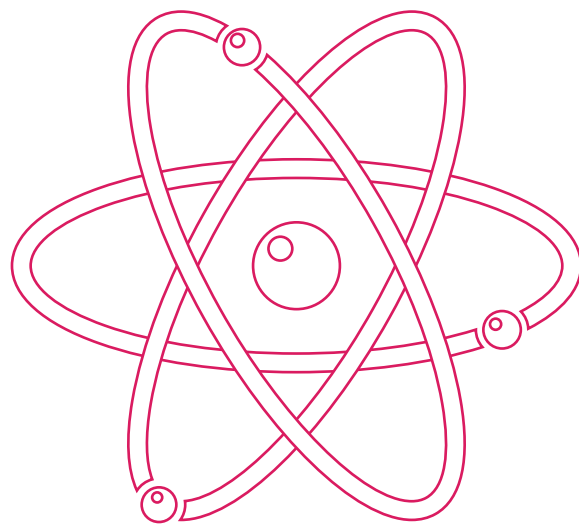
3.5 WRITING A STRATEGY

Compile the information you have collected with the problem your app solves, its purpose, measurable goals, audience and chosen platform(s), and create a strategy to build the app and roll it out. This strategy should help you focus your efforts on producing a high quality and effective healthy living app, and should be created with your app development team.



—4—

Planning your app



4.1 GETTING THE RIGHT TEAM TOGETHER

An effective app development team does not only include people who write computer code. To produce an effective healthy living app, you need input from health promotion and / or behaviour change specialists, consumers, and software engineers. Although time consuming and costly, the inclusion of a number of different perspectives is imperative to quality assurance. Each role is explored below.

4.1.1 HEALTH PROMOTION AND/OR BEHAVIOURAL CHANGE SPECIALIST

Health professionals play a very important role in the development of healthy living apps. They are invaluable to the process as they have the required knowledge to check if certain algorithms will create the desired result (Weaver et al., 2013), they are aware of various duty of care implications that may exist (Gay and Leijdekkers, 2011), and they are able to ensure the consistency and validity of information/feedback presented by the app (Huckvale et al., 2012).

Behaviour change theory has been described as critical in understanding the way in which individuals, groups, and organisations behave and change (West et al., 2012). Healthy living apps have also been suggested as an ideal behaviour change tool as smartphones are portable, enable reinforcement throughout the day, allow for social connection and can provide context specific advice (Dennison et al., 2013). Apps have the benefit of being cost effective as they are typically less expensive than other behaviour change tools, such as personal trainers, gyms, personal diet plans or formal relaxation courses.

Involving health promotion professionals

and behaviour change experts in the development of your app as early as possible will result in an app that has the greatest chance of improving an individual's health and wellbeing.

Some principles and frameworks are discussed later in this document (section 5.5), and may be a good place to start when discussing how your app may assist with creating meaningful behaviour change.

4.1.2 SOFTWARE ENGINEERS

Although there are several programs that assist in the process of creating apps and state that there is 'no need to write any source code' (Paschou et al., 2013), it is important to have IT specialists or software developers involved in the development process. A software developer will be able to (at a minimum) explain how you can best allocate your budget. Sometimes a simple 'minimum viable product' can be produced using out-of-the-box tools, and then a custom app written once data is collected suggesting a full set of features would be useful.

Your software developer will ensure you meet the various app policies and guidelines to ensure that it will be approved for distribution through app stores.

Although it is costly to employ a software developer rather than use an app development program yourself, it may improve your app's quality (Quinn et al., 2013). If you are interested in gaining app development skills, there are many courses available. Doing some work yourself may allow you to minimise costs and will give you first-hand experience in the creation phase. However, it is important that you have an experienced software engineer check your



app before launch for quality, privacy and security.

4.1.3 CONSUMERS OR OTHER STAKEHOLDERS

Involving the end-user is critical in app development. There have been many studies that have found that without user input, apps are likely to lack key features, and ultimately be less effective (McCurdie et al., 2012, Verhoeven et al., 2010, Cafazzo et al., 2009). Furthermore, user perception of an app's usefulness and functionality has a significant impact on technology adoption. Adopting a user-centred design (UCD) process (discussed later in section 5.4) will help to ensure the quality of these factors (McCurdie et al., 2012).

These end-users should be from the target audience you have identified, and the earlier they are involved in the development process, the better. This includes showing end-users early test versions of the app or even plans.

4.2 RELEVANT LITERATURE

There are a number of models and principles that are used to create behaviour change. In addition to planning your app and thinking about how it should be built and function, it is also important to consider the most relevant behaviour change literature.

Your behaviour change or health promotion specialist can help you search relevant academic literature and research databases. Some common frameworks are included later in this document (section 5.5) to provide a starting point for your discussions.

4.3 MARKET RESEARCH

There are two types of market research: qualitative and quantitative. Qualitative

research examines the underlining meaning or cause of phenomena and various issues. Qualitative research techniques include interviews, focus groups, discourse analysis, and semiotics. Quantitative research provides numerical responses to research questions. For example, from a quantitative design you might infer that Y percentage of people think initiative X is a good idea, but not know why they feel this way. Understanding the underlying motives of consumer behaviour is vital in producing a successful app to meet those needs. Ensure that your market research analysis uses a range of techniques to paint a complete picture of your target market's wants and needs.

If you are inexperienced or unsure how to conduct market research, there are a number of market research focused agencies that specialise in the field. It is highly recommended you engage these professional services to ensure the success of your app, as the importance of a user-centred approach cannot be stressed enough.

Market research techniques are how you can understand your target audience's needs, wants and thoughts about your proposed app. This is discussed later in section 5.4.

4.4 LAWS, POLICIES AND GUIDELINES

4.4.1 APPLE APP STORE DEVELOPER GUIDELINES

Apple's App Store has 1.4 million apps (Ranger, 2015), and is known for having some of the strictest app review guidelines. The Apple Store review guidelines (Apple, 2015a) are very specific across 29 different areas, from general terms and conditions to religion, culture, and ethnicity guidelines. Apple states that their guidelines are



designed to look out for the interests of children, stop apps that are 'over the line', and ensure quality and functionality.

Developers should also be aware of the Program License Agreement, Human Interface Guidelines, and other contracts that may be imposed by Apple. Apple's guidelines also state that apps conducting health-related human research must obtain consent from users or, in the case of minors, a parent or guardian.

Ensure that you review the Apple developer guidelines in the planning phase of your app development. This will ensure your end product complies with the guidelines and will reduce work later on if it requires multiple submissions to be approved. The Apple developer guidelines are available online (Apple, 2015a).

4.4.2 GOOGLE PLAY / ANDROID DEVELOPER GUIDELINES

Android operating system devices comprise a significant part of the market, making it an important platform to consider when making your app, with a large number of apps available for download (Ranger, 2015). Before an app is released on Google Play (the Android 'App Store'), there are similar requirements about quality, publishing, and promotional requirements that app developers must adhere to.

The Android guidelines include publishing and promotional procedures for app quality and how they are to be marketed to users. App quality is discussed through three main areas: core app quality, tablet app quality, and improving app quality (Android, n.d.-b).

Core app quality covers four criteria: app design and interaction, functionality,

performance, and Google Play store criteria (Android, n.d.-a). These criteria require that apps operate as intended (e.g. the back button is used for going back), notifications are limited to reasonable numbers, suitable permissions are requested, and that they are stable and visually well designed.

Rather than a set of criteria, to improve app quality the Android documentation includes a list of strategies that can and should be employed. These strategies range from listening and responding to your users, to integration with third party apps through methods like screen widgets and rich notifications (Android, n.d.-c). The latest version of the Android developer guidelines are available on the Android website (Android, n.d.-b).

4.4.3 APP QUALITY ALLIANCE GUIDELINES

While not a requirement for developers to adhere to (unlike the Apple or Google guidelines), the App Quality Alliance (AQuA) publishes best practice methods for app development. These include recommendations about:

- Installation and launching the app
- Internet/mobile data utilisation
- Battery life considerations
- Messaging or calling
- The user interface, including application speed, error messages and consistency
- Performance requirements
- Tests to use
- Data handling and security requirements
- Privacy, content and policies, including for social network integration.

These guidelines provide more detail



about the functional best practice recommendations for app developers based on user and industry input. The latest guidelines are available from the AQuA website (App Quality Alliance, 2013).

4.4.4 PRIVACY AND DATA SECURITY

Healthy living app developers may have access to sensitive private health information, therefore adherence to appropriate privacy regulations is recommended, despite it not always being a formal requirement.

Basic security measures that you might take include: allowing password protection; adhering to the relevant health privacy principles; and providing a privacy statement or disclosure outlining what user information is being collected, by who, and for what purpose.

You also need to consider the security risks that in-app purchasing and in-app ads may have. If you are including these features, make sure you can answer the following questions:

- What information are these ads collecting about your customer and how is it used?
- Will ads or in-app purchases detract from user satisfaction? Research suggests that in-app advertising can be annoying and invasive of privacy (Thurm and Kane, 2010, Gupta, 2013).
- How will you ensure that any ads displayed do not promote negative health behaviours or interventions that are not evidence-based?

In addition to the privacy issues discussed, there are a number of privacy and consent concerns related to minors' use of smartphone apps. Although guidelines are

yet to be developed in this area, the impact your healthy living app may have on minors should be considered, particularly in terms of content appropriateness and privacy.

The Office of the Australian Information Commission recently published a set of guidelines for app developers, advocating a 'privacy by design' approach (Office of the Australian Information Commissioner, 2013). These guidelines recommend developers have both detailed and 'short form' privacy policies in place to ensure users are consenting to their information being collected and/or used.

A privacy policy should be included in your final app if you collect any information from users. The privacy policy should include the information that is collected, why it is collected, when or if it is shared with third parties, how the user can opt out and have their information removed, and how long the data will be stored for.

4.4.5 OTHER REGULATORY AREAS

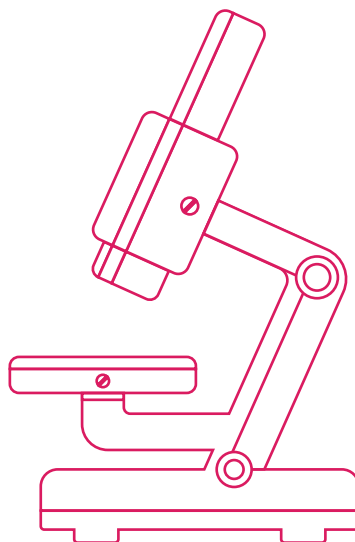
In Australia and overseas, there may be other regulatory bodies related to developing your healthy living app. For example, the Therapeutic Goods Administration (TGA) regulates apps that have information about medicines, and you would need to review their requirements prior to providing information in this area.

If you are using your app to collect health information for research purposes, you may need to request permission from a human research ethics committee, who will assess how you are collecting, storing and using the information. They may require certain data to be collected or not collected, or a particular consent process.



-5-

Building and testing your app



5.1 OVERVIEW

There are a number of app features that encourage people to engage and interact with the app and to promote long-term use. These features are common to many apps – you should look at some popular apps to see how they work and display information. Beyond the base requirement of receiving accurate information, people increasingly expect to have a great ‘experience’ when using an app. Slow or difficult to use apps are less likely to encourage long-term use, and will often receive negative reviews, which discourages other users from downloading them.

5.2 PRINCIPLES FOR CREATING EFFECTIVE HEALTHY LIVING APPS

Below are some principles to consider when creating a healthy living app. While the principles will not apply to every app, they provide guidance on best practice.

5.2.1 INTERESTING, ENGAGING AND FUN

Making your app interesting, engaging and fun will make using it feel less like a chore for your app’s users. Think about strategies to increase engagement through entertainment, like gamification (points-based systems), interactive visuals or customised advice (Stoyanov et al., 2015). The more that a user actively enjoys using your app and is engaged with it, the more likely it will be that they continue to use it.

5.2.2 WELL-DESIGNED USER INTERFACE

An app’s interface, the design and layout that the user interacts with, is very important. Apps with great interfaces – where it is easy to find, navigate and interact with the content – will be used

by more people than an app with great information but a poor interface.

There are many ways that you can design a user interface, such as considering ‘user journeys’ and how the app will educate them at each stage (e.g. initial download and on-boarding). Think about how you can use features like reminders, prompts or notifications to perform particular tasks, and how users will navigate through your app’s features.

Involving your end-user in your interface design will enable you to create interfaces that make logical sense to your audience. Showing potential end-users early drawings of the interface, for example, will help you produce a better, more effective app.

5.2.3 SIMPLE AND CLEAR LANGUAGE

Using simple and clear language in your app’s name, description, navigation and content will make it easier for people to discover and use the app. You should use plain English principles in your app, such as the active voice, pronouns (you, we, our), short sentences and paragraphs, and dot points or lists. On phones in particular, short paragraphs and visual representation of information (e.g. infographics) will be much easier for users to read.

Think about the complexity of your content – don’t provide all the information in one block – and make sure that your target audience will be able to comprehend the language you are using. Sometimes it is more appropriate to give a summary with a link to more information for those interested. Make sure you ask someone to edit and review the information in your app – at a minimum the users involved in producing it. Professional writers or editors may be able to assist with



creating simple and engaging material.

5.3 EVIDENCE-BASED INFORMATION

It is essential that healthy living apps include evidence-based information. Although smartphone apps are a reasonably new technology, there is an extensive body of literature that can be used to inform developers of the types of content that should be included in a healthy living app. For example, specific guidelines, such as those relating to healthy eating, physical exercise, alcohol intake, as well as information available on mental wellbeing, and the dangers of tobacco should all be included in the relevant app (Department of Health and Ageing, 2014, National Health and Medical Research Council, 2013, Department of Health and Ageing, 2013).

You should consider having a third party review the app for the inclusion of up-to-date evidence and adherence to the best practice guidelines and principles. When you have a third party review your app, it is recommended that you use a behaviour change checklist available in the literature (such as Michie et al. (2011) or Yang et al. (2015)). When developing a healthy living app, a third party reviewer who is also a health promotion expert, or a specialist in the content area of the healthy living app would be beneficial as they can guide you on healthy living specific issues.

You should also ensure that there are processes in place to update the app as information or guidelines change over time. This might be in the form of a periodic evidence and content review, or through ongoing discussion with users and experts.

5.4 FRAMEWORKS FOR DEVELOPERS

In addition to the app store guidelines, you might find some of the frameworks listed below useful to improve the quality of your healthy living app. These frameworks highlight the importance of user input and continued evaluation throughout the development process. Only a summary of each process and framework is provided in this document; for more information about each framework, refer to *Resources* (section 8) for appropriate references.

5.4.1 USER-CENTRED DESIGN (UCD) PROCESS

The UCD process focuses on the end-user's engagement, experience, acceptance, and satisfaction. Consumers are less likely to return to an app that has not engaged them immediately (McCurdie et al., 2012). Put simply, the UCD process involves user input throughout the entire development process in order to enhance the likelihood of end-user adoption and to eliminate application weaknesses (Esser and Goossens, 2009).

The UCD process incorporates a mixture of qualitative and quantitative research methods in order to meet these principles. Qualitative methods might include interviews or focus groups, product walkthroughs, usability testing, and field studies. The purpose of these methods is to determine gaps in the market, as well as identify the functionality of the device and the user's environment, culture, existing biases, communication styles and level of satisfaction or engagement. A number of studies, including those by the World Health Organization, have highlighted the value of the UCD process or the incorporation of



end-users alongside other frameworks in app development (Esser and Goossens, 2009, Gemert-Pijnen; et al., 2011, McCurdie et al., 2012, WHO, 2011).

5.4.2 FIVE PRINCIPLES OF SERVICE DESIGN THINKING

Service design thinking is an interdisciplinary way of thinking. It involves skills from design, management, and process engineering to create or improve existing services and products. It is built on the customer-focused framework of UCD and has five principles (Stickdorn and Schneider, 2011), which are outlined below.

USER-CENTRED

Your app should be user-focused. This requires you knowing your customers. This knowledge should go further than just knowing the demographic, and instead be a deeper understanding of their habits, culture, and social context. For example, not all 20-30 year old males in inner Melbourne who follow Nike on Instagram are going to be runners. You need to dig deeper to find out more about your audience. Focus groups, surveys, interviews, product testing, or perhaps a mix, are effective methods of gaining authentic customer insights.

CO-CREATIVE

In addition to end-users, all other stakeholders play an important role in the planning, development, and rollout of an app. There are many benefits of including a range of people in the app creation. Not only will 'common language' be created that has meaning to all parties but each stakeholder also has their own expertise. Give each stakeholder a sense of ownership and pride in the final product through combining their skills and listening to their ideas.

SEQUENCING

Planning, development and rollout all take a certain amount of time to complete and there are a number of crucial time periods in each stage. A timeline with short-term goals will help you stay on track and consequently help achieve the larger end-goals. A problem sequencing plan is also valuable – these are the steps that your user goes through to solve a particular problem or complete an activity in the app. By pre-empting possible issues and having a predefined solution or process, your app can appear more effective and efficient.

EVIDENCING

Evidencing refers to the creation of physical evidence that triggers positive associations with the brand or product. The idea is for the customer to have a sense of appreciation for the product or service you are offering them.

The most common implementation of evidencing in apps is through emails, such as ones that remind users to login and to take the next steps required to realise the behaviour change or provide product updates. However, these emails can have the opposite effect by frustrating the user if they are too frequent or not customised for the user's needs.

Other ways of providing this positive association is through the facilitation of social connection. Posting user achievements, like a completed workout, to social media platforms and providing the user with in-app rewards 'shows' users the results they are achieving. As apps are digital and nearly always lack tangible, immediate rewards, this is an area of service design that can be improved.



HOLISTIC

Having a holistic approach requires developers to think broadly about the use of the app and the app user. By having a clearly defined purpose and goal for your healthy living app, keeping up-to-date with market research, and periodically evaluating the development process, you will be able to anticipate what users want before they do and provide them with an app that meets their needs. This can be achieved through data analytics, reading user reviews, and conducting usability studies that involve app walkthroughs, interviews, and other tests.

5.4.3 HUMAN, ORGANIZATION AND TECHNOLOGY-FIT FACTORS (HOT-FIT)

HOT-fit is a Human Information System evaluation framework focused on the adoption factors of users and their particular environment (Yusofa et al., 2008). It highlights the importance of fit between the user, the relevant organisations, and the technology – it is sometimes also described as ‘product/organisation/market fit’. Failure to obtain this fit is known to result in technology adoption reluctance or rejection (Kaplan, 2001).

In order to assess the fit between the human and organisation factors, Yusofa et al. (2008) break technology into three factors:

- System quality
- Information quality
- Service quality

System quality refers to the accuracy of data, ease of use, security, flexibility and functionality.

Information quality covers the relevance of the technology, the reliability of the information and the usefulness.

Service Quality refers to how quickly and accurately concerns are answered.

The human factor is broken down into two items: system use and user satisfaction. These two items look at how long a consumer has used the app, how often, by whom, whilst also taking into consideration their satisfaction in terms of perceived usefulness and enjoyment.

Similarly, organisation is broken into two items: structure and environment. These items are concerned with describing the organisation, where they sit in the market, how they are run, and the overall culture.

All of these factors and items are considered in a two-way relationship to net benefits of the fit between human, organisation, and technology. For app developers, the HOT-fit model provides a mechanism to consider the overall quality of the app during the planning phase, including technical, user and organisational factors.

5.5 INCLUSION OF BEHAVIOUR CHANGE CONSTRUCTS AND INTERVENTION STRATEGIES TO PROMOTE HEALTHY LIFESTYLE CHOICES

Studies suggest that healthy living apps have the potential to be successful behaviour change tools, as smartphones are increasingly popular, important to the owner, and with them all the time (Boulos et al., 2011, Dennison et al., 2013).^β These factors, when combined with a quality healthy living app, can provide interaction with the user in context-specific ways, providing detailed self-monitoring capabilities, and motivation or reminders needed to make an active change (Dennison et al., 2013, Kennedy et al., 2012).



TABLE 1. INTERVENTION STRATEGIES BY BEHAVIOR CHANGE MODEL OR THEORY

INTERVENTION STRATEGIES	HEALTH BELIEF MODEL	TRANSTHEORETICAL MODEL	THEORY OF PLANNED BEHAVIOR	SOCIAL COGNITIVE THEORY
Knowledge				
General information	X	X	X	X
Cognitive strategies				
Perceived benefits	X	X	X	X
Perceived barriers	X	X		X
Perceived risks	X		X	
Self-efficacy		X	X	X
Self-talk		X		X
Perceived social norms		X	X	
Behavioral strategies				
Self-monitoring		X		X
Realistic goal setting				X
Time management				X
Stimulus control		X		X
Self-reward		X		X
Social support		X		X
Modeling/vicarious learning				X
Relapse prevention		X		X
Emotion-focused strategies				
Stress management				X
Negative affect management				X
Therapeutic interventions				
Skill building/overview		X		X
Increasing knowledge	X	X	X	
Motivational readiness		X		
Total possible points	25	70	30	80

*Five possible points per intervention strategy.

Reproduced from Doshi et al. (2003).



There are a number of ways in which behaviour change constructs can be integrated into healthy living apps. Cowan et al. (2013) identify twenty intervention strategies that can be incorporated into healthy living apps (adapted from the Doshi et al. (2003) website study) and make up the constructs of four different behaviour change theories (see Table 1, page 23). In addition to these intervention strategies, it is important to look at particular behaviour change models to see how they can effect your app development and design. The following are behaviour change constructs that good healthy living apps often include:

- Self-monitoring capabilities. These may include a diary, exercise log, or GPS tracker
- Relapse preventers, for example push notifications or reminders
- The ability to make realistic goals, and to track and alter these goals
- Modelling, demonstration and vicarious learning through the integration of recipes or exercise videos
- General knowledge and knowledge building using evidence-based information
- Social support by integrating social networks and sharing capabilities.

Additional behaviour change constructs and intervention strategies are provided in section 8.6 for further reference.

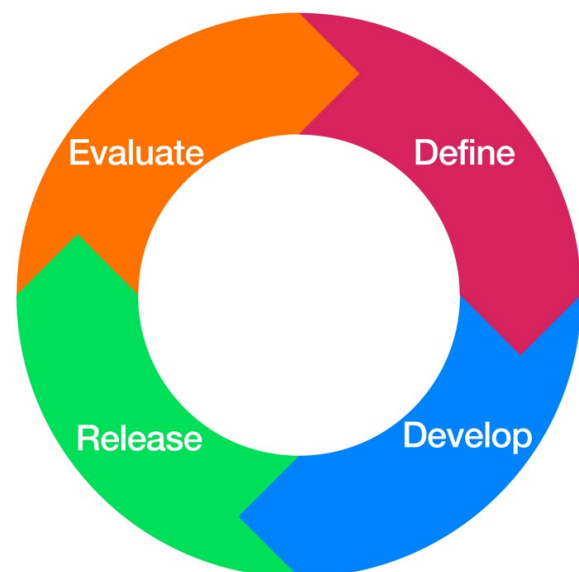
5.6 ENGINEERING YOUR APP

The agile or lean software development processes are commonly used when creating apps. In short, this process encourages short bursts of activity, and showing your product to the market (your prospective users) at the

earliest stage possible (Ries, 2011).

In general, it is best to try to identify a way to reduce your planned features down to a ‘minimum viable product’. This is the simplest product that you can launch onto the market to produce value to your app users. For example, an app promoting exercise might start by only allowing users to track the distance of their runs, and then add in more features like a social network of runners or shareable training plans if the initial idea is successful with customers.

The agile process involves four steps in a continuous cycle: define, develop, release and evaluate. More information on each stage is provided below.



The agile process

5.6.1 DEFINE

During this stage, you define what you are going to release. This is usually done in the form of ‘user stories’ which are from the frame of the intended user. For example: ‘As a mother, I want to be able to compare products so that I can choose the ones that are best for my family’ – rather than



'compare products based on health benefits'. This encourages your team to always think in the mind of your target audience.

5.6.2 DEVELOP

During this stage, you build the feature(s) required to deliver each of the user stories or requirements that you have specified.

5.6.3 RELEASE

After developing the feature(s), you release them to the market, whether initially launching the app or releasing an update.

5.6.4 EVALUATE

After release, it is important to evaluate the impact of the changes – do users use the new features? Have you achieved your goals? Evaluation will feed back into defining the next iteration of the product, and the process continues.



—6—

Launching your app



Once your app has been developed, it is time to launch it onto the market. As with any product, having a rollout strategy is integral to success, and the way that you are going to communicate and advertise the features of the app will be an important factor in encouraging user adoption.

6.1 BEST PRACTICE FOR HEALTHY LIVING APP MARKETING

6.1.1 CREATING VALUE

There has been a recent shift in the way apps are marketed, away from a sales orientation – where the product was the focus – to a market orientation, where the customer is key (Pride et al., 2012). As a result, you need to differentiate your app's offering so that it will provide a high perceived value to your target market.

Increasing value to the customer while reducing the product's cost creates high value. A 'cost' is not necessarily a dollar amount. Costs can refer to anything the user must surrender to obtain the benefits of the product, including:

- Monetary costs
- Time – how long it takes to get the product and/or research it
- Effort – how much effort the consumer needs to achieve the benefits of the product
- Risk – the risk is involved with using the product

If you need to charge consumers a monetary amount to use your app, a reduction in other costs may be necessary in order for the app to succeed at market. Similarly, increasing the benefits that the customer receives can create value.

Benefits are obtained through the experience

of using your app. This can be through the interface itself, customer service, the atmosphere/aesthetic design of the app, or customisation.

Marketers traditionally refer to four marketing variables, known as the 4 Ps: Product, Price, Promotion, and Place. However, strategic marketers have added an additional four Ps – People, Physical evidence, Processes, and Partnerships. These help companies become more flexible and able to provide customers with increased value (Pride et al., 2012, Stickdorn and Schneider, 2011).

6.1.2 PRODUCT

The app must address the end-user's wants and needs, and should be designed to fit a gap in their lives. You should ensure that you communicate to the customer that a gap exists and that your app can fill it. Ideally, this should be conducted in the first few sentences of the app description.

6.1.3 PRICE

Price gives consumers an idea of the app's value. Apps are priced in a number of ways. They can be free with advertising, free without advertising, cost a fixed amount, or be available on a subscription. Free apps that do not include advertising are sometimes developed by government bodies or companies to change behaviour and/or raise awareness, or may be a 'freemium' app, where the initial download is free but users must make further purchases (one-off or on a subscription) to unlock all of the app's features. Consumers usually prefer to download a free or 'freemium' app as this reduces the risk associated with buying an app that may not meet expectations.

6.1.4 PROMOTION

Promotion is the way you inform potential



users about the availability, functionality, features, cost and unique service aspects of your app. Promotion strategies are vital, because if they are not well executed, your target market will not know about your product. Promotion strategies are numerous and must align with the market research conducted at the outset of app development. This research will let you know where your customers are and how best to reach them, most typically by advertising across different forms of media (online, print, radio or television), public relations or partnerships with other organisations that your users interact with. This research also informs how much budget is required for promotion.

6.1.5 PLACE

Refers to the place of distribution. The product needs to be available to users at the time and place of their choosing. For apps, this refers to being available on the right platform and app store, and for the devices that are used by your target market.

6.1.6 PEOPLE

Refers to the human element of a product: what the consumer expects of the organisation and what the organisation expects of the consumer. For example, customer service needs to be swift and positive. If a consumer has a problem, fix it quickly and courteously.

6.1.7 PHYSICAL EVIDENCE

Quality is demonstrated by how effectively the target audience can use your app. This can be achieved through the aesthetic design, but more crucially through creating results for the user. Health behaviour is difficult to change or improve, and often it takes several weeks or longer for evidence of the positive

change to be apparent to the individual. The challenge for healthy living apps is to convince the user that it will produce change during the initial phase where no obvious results may be visible. This can be achieved through the app's usability, functionality, self-tailoring capabilities, positive individualised feedback, and other qualities as discussed in *building and testing your app* (section 5).

6.1.8 PROCESSES

Processes are ways in which all app-related interactions can be streamlined so that they are efficient and satisfying for the customer. This largely refers to customer service, but can also refer to the sign up process and other within-app processes. For example, calorie-counting apps that have barcode scanning capabilities reduce the time needed to fill in product details, providing value to the user by saving them time.

6.1.9 PARTNERSHIPS

Partnerships are not always essential, but can be useful. For example, a partnership with some form of media can help increase product awareness, or get your product featured on the front page of the app store. The credibility of your app can be increased by creating a partnership with a government body, or an organisation that your target audience respect and respond to, such as a not-for-profit or charity. Partnerships can be especially effective for apps from new developers without a track record with users, as they can gain the trust of a user base through association with known and trusted organisations. Positive product reviews from respected publications are also a type of promotional partnership.



6.2 PRODUCT ADOPTION PROCESS

Before purchase, consumers must go through the product adoption process. The five steps of this process are outlined below.

Awareness – consumers need to know that the product exists.

Interest – consumers actively seek information about the product and / or are interested in being informed about the product.

Evaluation – consumers weigh up the benefits against the costs of the product.

Trial – consumers test, examine, and sample the product to see if it suits their needs.

Adoption – consumers purchase/download the product if it has passed the previous four steps.

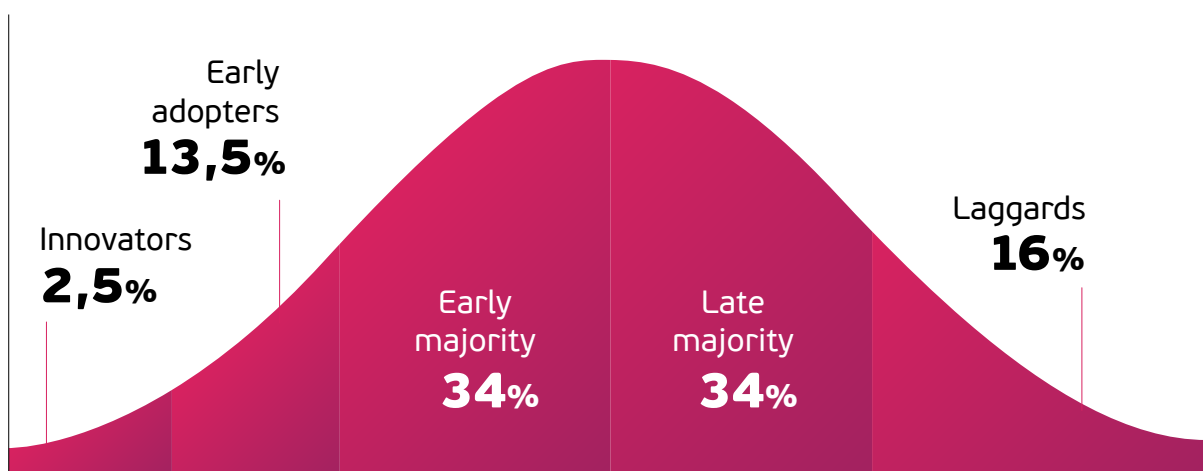
(Michman and Mazze, 2001)

6.2.1 TYPES OF CUSTOMERS

Some consumers pass through this five-step adoption process (illustrated below) very quickly, while others take more time. A common model identifies five types of users,

depending on how long it takes them to go through this process.

Innovators represent 2.5% of adopters and are the first to adopt a new product. They love trying new products and will give anything a go if it sounds interesting. Early adopters follow soon after, typically signifying 13.5% of consumers. Early adopters are more selective in their choice of products, and as such are considered to be trendsetters. Engaging these two groups early in your app development process will help improve the app, as these groups will usually give detailed feedback about their experiences and are interested to see how the app grows and changes over time. More information on the product adoption curve and how it can be used to market apps can be found in the book *Crossing the Chasm* (Moore, 2006).

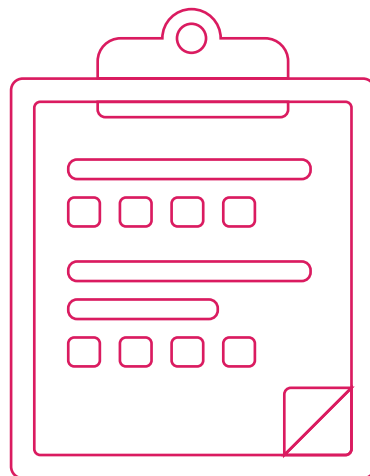


DISTRIBUTION OF PRODUCT ADOPTER CATEGORIES (PRIDE ET AL., 2012)



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Updating and improving your app

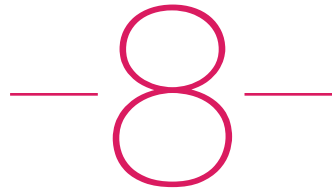


With your app now released and in the marketplace, it is likely that the need to update it will surface almost immediately. Crash reports and user feedback can tell you what needs adjusting, or you may have already identified the next step in your roadmap. It is also vital to keep yourself abreast of what similar apps are doing to stay ahead of the competition.

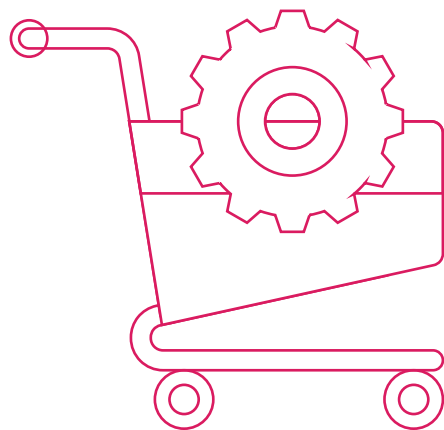
Make sure you have something in place (such as surveys or analytics on what features are used) to collect data on how and why consumers are using your app. Analysing this information will help you prioritise your next activities and identify the areas you need to improve the most.

Both Apple and Android allow you to provide 'release notes' about the changes associated with the app update – you should make it clear in the release notes what has changed and why a user should update (such as new features or improved stability). When you update your app, you should also think about whether you need to change the app description, particularly if you have launched new features that users will find valuable.





Resources for app developers



8.1 DEVELOPER GUIDELINES

APPLE. 2015. App Store Review Guidelines. Available: <https://developer.apple.com/app-store/review/guidelines/> [Accessed 20 August 2015].

A developer account and login are required – registration incurs a fee.

ANDROID. n.d. Core App Quality Guidelines. 2015. Available: <http://developer.android.com/distribute/googleplay/quality/core.html> [Accessed 20 August 2015].

In particular, see the Launch Checklist: <http://developer.android.com/distribute/googleplay/publish/preparing.html>

APP QUALITY ALLIANCE. 2013. Best Practice Guidelines for producing high quality mobile applications. Available: http://www.appqualityalliance.org/files/AQuA_best_practices_doc_v2_3_final_june_2013.pdf [Accessed 28 June 2015].

8.2 FRAMEWORKS FOR DEVELOPERS

8.2.1 USER-CENTRED DESIGN

PRATT, A. & NUNES, J. 2012. Interactive design : an introduction to the theory and application of user-centered design, Beverly, MA, Rockport Publishers.

WILSON, C. 2013. Credible checklists and quality questionnaires : a user-centered design method, Waltham, MA, Morgan Kaufmann.

HOM, J. 1998. *The Usability Methods Toolbox* [Online]. Available: <http://usability.jameshom.com/> [Accessed 13 August 2015].

8.2.2 SERVICE DESIGN THINKING

STICKDORN, M. & SCHNEIDER, J. 2011. *This is service design thinking. Basics - Tools - Cases*, New Jersey and Canada, John Wiley & Sons, Inc.

8.2.3 HOT-FIT

YUSOFA, M. M., KULJISB, J., PAPAFAFEIROPOULOU, A. & STERGILOULAS, L. K. 2008. An evaluation framework for Health Information Systems: human, organization and technology-fit factors (HOT-fit). *International Journal of Medical Informatics*, 77, 386-398.

8.3 ISO STANDARDS

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION 2011. ISO/IEC 25010:2011 Systems and software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- System and software quality models.

This ISO standard defines:

- A quality in use model composed of five characteristics (some of which are further subdivided into subcharacteristics) that relate to the outcome of interaction when a product is used in a particular context of use. This system model is applicable to the complete human-computer system, including both computer systems in use and software products in use.



- A product quality model composed of eight characteristics (which are further subdivided into subcharacteristics) that relate to static properties of software and dynamic properties of the computer system. The model is applicable to both computer systems and software products.

The Australian evaluation standards (AS/NZS 25040:2013) are also available: <http://infostore.saiglobal.com/store/details.aspx?ProductID=1630878>

8.4 PRIVACY AND DATA SECURITY

OFFICE OF THE AUSTRALIAN INFORMATION COMMISSIONER. 2013. Mobile privacy: A better practice guide for mobile app developers. Available: <http://www.oaic.gov.au/privacy/privacy-resources/privacy-guides/guide-for-mobile-app-developers> [Accessed 29 August 2015].

Includes a checklist for app developers.

OFFICE OF THE AUSTRALIAN INFORMATION COMMISSIONER. 2014. Guide to undertaking privacy impact assessments. 2015. Available: <http://www.oaic.gov.au/privacy/privacy-resources/privacy-guides/guide-to-undertaking-privacy-impact-assessments> [Accessed 29 August 2015].

OFFICE OF THE AUSTRALIAN INFORMATION COMMISSIONER. 2014. Privacy fact sheet 17: Australian Privacy Principles. 2015. Available: <http://www.oaic.gov.au/privacy/privacy-resources/privacy-fact-sheets/other/privacy-fact-sheet-17-australian-privacy-principles> [Accessed 29 August 2015].

Developers are also encouraged to review the relevant Health Privacy Principles (or equivalent) in each state.

8.5 BEHAVIOUR CHANGE CHECKLISTS

MICHIE, S., ASHFORD, S., SNIEHOTTA, F. F., DOMBROWSKI, S. U., BISHOP, A. & FRENCH, D. P. 2011. A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: The CALO-RE taxonomy. *Psychology & Health*, 26, 1479-1498.

YANG, C. H., MAHER, J. P. & CONROY, D. E. 2015. Implementation of behavior change techniques in mobile applications for physical activity. *American Journal of Preventative Medicine*, 48, 452-5.

8.6 BEHAVIOUR CHANGE CONSTRUCTS AND INTERVENTION STRATEGIES

8.6.1 GENERAL MODELS

Precede/proceed model

GIELEN, A. C., MCDONALD, E. M., GARY, T. L. & BONE, L. R. 2008. Using the precede-proceed model to apply health behavior theories. *Health Behavior and Health Education: Theory, Research, and Practice*. Fourth ed. San Francisco, CA: Jossey-Bass.



Functional triad

FOGG, B. J. 2003. The Functional Triad: Computers in Persuasive Roles. *Persuasive Technology: Using Computers to Change What We Think and Do*. Morgan Kaufmann Publishers.

Theory of planned behaviour

AJZEN, I. 1991. The Theory of Planned Behavior. *Organizational behaviour and human decision processes*, 50, 179-211.

Transtheoretical model

PROCHASKA, J. O., REDDING, C. A. & EVERS, K. E. 2008. The Transtheoretical Model and Stages of Change. *Health Behavior and Health Education: Theory, Research, and Practice*. Fourth ed. San Francisco, CA: Jossey-Bass.

Health belief model

JANZ, N. K. & BECKER, M. H. 1984. The Health Belief Model: A Decade Later. *Health Education Quarterly*, 11, 1-47.

Social cognitive theory

BANDURA, A. 2004. Health Promotion by Social Cognitive Means. *Health Education & Behavior*, 31, 143-164.

8.6.2 USE OF CONSTRUCTS IN HEALTH APPS

STOYANOV, S. R., HIDES, L., KAVANAGH, D. J., ZELENKO, O., TJONDRONEGORO, D. & MANI, M. 2015. Mobile app rating scale: a new tool for assessing the quality of health mobile apps. *JMIR Mhealth and Uhealth*, 3, e27.

KENNEDY, C. M., POWELL, J., PAYNE, T. H., AINSWORTH, J., BOYD, A. & BUCHAN, I. 2012. Active Assistance Technology for Health-Related Behaviour Change: An Interdisciplinary Review. *Journal of Medical Internet Research* 14, 23.

COWAN, L., VAN WAGENEN, S., BROWN, B., HEDIN, R., SEINO-STEPHAN, Y., HALL, P. & WEST, J. 2013. Apps of steel: are exercise apps providing consumers with realistic expectations?: a content analysis of exercise apps for presence of behavior change theory. *Health Education & Behavior: The Official Publication Of The Society For Public Health Education*, 40, 133-139.

DOSHI, A., PATRICK, K., SALLIS, J. & CALFAS, K. 2003. Evaluation of Physical Activity Web Sites for Use of Behaviour Change Theories. *Annals of Behavioral Medicine*, 25, 105-111.

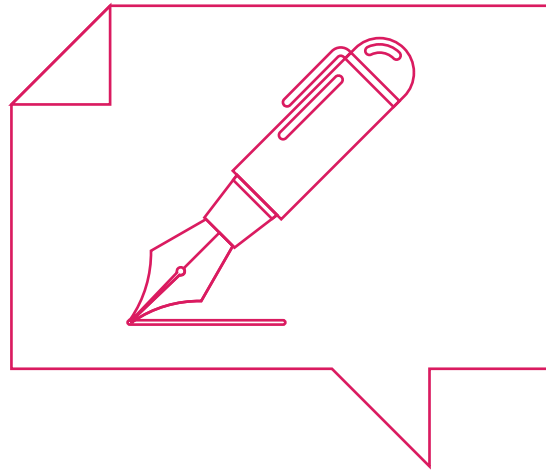
ABRAHAM, C. & MICHIE, S. 2008. A taxonomy of behavior change techniques used in interventions. *Health Psychology*, 27, 379-387.

CONROY, D. E., YANG, C.-H. & MAHER, J. P. 2014. Behavior change techniques in top-ranked mobile apps for physical activity. *American Journal of Preventive Medicine*, 46, 649-652.



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ANDROID. n.d.-b. Essentials for a successful app. 2015. Available: <http://developer.android.com/distribute/googleplay/quality/index.html> [Accessed 30 August 2015].

ANDROID. n.d.-c. Improving App Quality After Launch. 2013. Available: <http://developer.android.com/distribute/googleplay/strategies/app-quality.html> [Accessed 19 August 2015].

APP QUALITY ALLIANCE. 2013. Best Practice Guidelines for producing high quality mobile applications. Available: http://www.appqualityalliance.org/files/AQuA_best_practices_doc_v2_3_final_june_2013.pdf [Accessed 28 June 2015].

APPLE. 2015a. App Store Review Guidelines. Available: <https://developer.apple.com/app-store/review/guidelines/> [Accessed 20 August 2015].

APPLE. 2015b. HealthKit - Apple Developer. 2015. Available: <https://developer.apple.com/healthkit/> [Accessed 26 August 2015].

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COWAN, L., VAN WAGENEN, S., BROWN, B., HEDIN, R., SEINO-STEPHAN, Y., HALL, P. & WEST, J. 2013. Apps of steel: are exercise apps providing consumers with realistic expectations?: a content analysis of exercise apps for presence of behavior change theory. *Health Education & Behavior: The Official Publication Of The Society For Public Health Education*, 40, 133-139.

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DENNISON, L., MORRISON, L., CONWAY, G. & YARDLEY, L. 2013. Opportunities and Challenges for Smartphone Applications in Supporting Health Behavior Change: Qualitative Study. *Journal of Medical Internet Research*, 15, e86.

DEPARTMENT OF HEALTH AND AGEING. 2013. Reduce your risk: new national guidelines for alcohol consumption. 2015. Available: <http://www.alcohol.gov.au/internet/alcohol/publishing.nsf/Content/guide-adult> [Accessed 29 August 2015].

DEPARTMENT OF HEALTH AND AGEING. 2014. Physical Activity Guidelines. 2015. Available: <http://www.health.gov.au/internet/main/publishing.nsf/content/health-pubhlth-strateg-phys-act-guidelines> [Accessed 28 August 2015].

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- ESSER, P. & GOOSSENS, R. 2009. A framework for the design of user-centred teleconsulting systems. *Journal Of Telemedicine And Telecare*, 15, 32-9.
- GAY, V. & LEIJDEKKERS, P. 2011. The Good, the Bad and the Ugly About Social Networks for Health Apps. *11 Ninth IEEE/IFIP International Conference on Embedded and Ubiquitous Computing*. Melbourne, Australia: IEEE Computer Society.
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