Free smoking cessation mobile apps available in Australia: a quality review and content analysis

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Abstract

Objectives: This review aimed to identify free, high-quality, smoking cessation mobile applications (apps) that adhere to Australian smoking cessation treatment guidelines.

Methods: A systematic search of smoking cessation apps was conducted using Google. The technical quality of relevant apps was rated using the Mobile Application Rating Scale. The content of apps identified as high quality was assessed for adherence to smoking cessation treatment guidelines.

Results: 112 relevant apps were identified. The majority were of poor technical quality and only six 'high-quality' apps were identified. These apps adhered to Australian treatment guidelines in part. The efficacy of two apps had been previously evaluated.

Conclusions: In lieu of more substantial research in this area, it is suggested that the high-quality apps identified in this review may be more likely than other available apps to encourage smoking cessation.

Implications for public health: Smoking cessation apps have the potential to address many barriers that prevent smoking cessation support being provided; however few high-quality smoking cessation apps are currently available in Australia, very few have been evaluated and the app market is extremely volatile. More research to evaluate smoking cessation apps, and sustained funding for evidence-based apps, is needed.

Key words: smoking cessation, mobile apps, review

Tobacco use remains a major health problem in Australia as it is responsible for an estimated 15,000 deaths in Australia each year.[1] There is strong evidence for the efficacy of face-to-face and telephone-based behavioural interventions (e.g. brief motivational advice, group or individual counselling, telephone counselling and quit lines) and pharmacotherapy (e.g. NRT, varenicline and bupropion) to support smoking cessation.[2] However, smoking cessation support is suboptimal across a number of healthcare settings in Australia.[3-6] Key barriers to health professionals providing smoking cessation support include: lack of access to smoking cessation resources; lack of clinician knowledge or skills; and lack of clinician time.[3,4]

Mobile-based approaches (e.g. mobile applications or apps) can potentially address many of these barriers. Mobile technologies, such as smartphones and tablets, have become an integral part of everyday life and many people use mobile apps to monitor and improve aspects of their health.[7] An effective, high-quality smoking cessation app is an easily accessible (often free) resource that can provide individualised smoking cessation support to large numbers of people, including those who are geographically isolated, at a convenient time and place.[8] While hundreds of apps purport to support smoking cessation, little information is available regarding their efficacy. The authors are aware of only three published studies that have reported the efficacy of smartphone apps for smoking cessation.[9-11] While these studies each describe promising results (e.g. quit rates of 13–18.9%) they also describe a number of areas for improvements. Ubhi et al found that few participants used their app on a daily basis as intended,[11] and Buller et al found a text messaging based intervention was associated with higher abstinence rates than the mobile app they tested.[9]

As so few evaluations of smoking cessation apps have been published to date, we are unable to rely solely on the peer-reviewed literature, and researchers have begun to conduct reviews of publicly available smartphone applications to identify apps that can be recommended to health professionals and consumers.[e.g.12,13-18] Abroms et al. conducted the first review of smartphone applications for smoking cessation in 2011,[12] assessing smoking cessation apps developed for iPhone. Abroms et al.,[12] as in subsequent reviews,[13-17] found that overall the apps they identified had low adherence

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with established best practices for smoking cessation.

Other smoking cessation app reviews have primarily rated apps according to their adherence to smoking cessation treatment guidelines,[12-17] with only two previous reviews also assessing the apps' technical quality (e.g. ease of use, performance, visual appeal).[17,18] This approach neglects the important question of real world effectiveness because even if an intervention has high adherence to treatment guidelines, if it is not engaging the target population then its potential effectiveness is limited. Factors that might influence engagement and utilisation are particularly important to consider for mobile app interventions, as 26% of apps are discontinued after first use, and 74% are used no more than 10 times.[19] In relation to smoking cessation, research suggests that the more that a smoking cessation app is opened and accessed, the more likely the user is to quit smoking.[10,20]

Unfortunately, no previous review of smoking cessation apps has been conducted within an Australian context. While many mobile apps developed in the US and other countries are available to download in Australia, many cannot be legally downloaded in Australia. Apps developed in other countries may also not be relevant or appropriate to use in an Australian context. For example, Australian treatment guidelines regarding alcohol and other drugs are often very different to US guidelines. Additionally, many reviews have only included popular apps (as measured by the number of times the apps had been downloaded) in their reviews.[12,13,18] Unfortunately many factors unrelated to quality effect the popularity of an app with in the app marketplace. These include: advertising and revenue generated by the app; volume of ratings and reviews; how recently an app has been updated; and location.[21,22] This means the findings of previous reviews may only be generalisable to popular smoking cessation apps and that higher quality apps may have existed, but were not included in their reviews. Additionally, rankings within the leading app stores are extremely volatile, with research finding that app rankings within the 'Google Play' store move as much as 23 positions/ranks per day, while 'iTunes' app store rankings move by as much as 89 positions/ranks each day.[22] This extreme volatility means that the sample of apps extracted within the previous reviews may have been highly dependent on which apps were popular on the particular day their search was conducted. The current review builds on previous reviews by examining smoking cessation apps developed for any smartphone operating system, without restricting the review to popular apps only, and adapts them to an Australian context. It aimed to identify high-quality, well-functioning, and engaging smoking cessation apps, that are freely available in Australia, and that adhere with Australian smoking cessation treatment guidelines.

Methods

A systematic search of smoking cessation mobile apps freely available in Australia was conducted in July 2015. The search was conducted using the Google app search function. Search terms included: 'smoking', 'tobacco', 'cigarette', 'cold turkey' and 'quit', and excluded the terms: 'wallpaper', 'game', 'weed' and 'Rasta'. Each search was conducted twice, once with the term 'iOS' added and once with '–iOS' added, in order to identify both Apple (iPhone/iPad) and non-apple mobile applications.

Preliminary screening removed irrelevant apps (i.e. apps that did not target tobacco smoking), apps not in English and apps that were not free to download (on the grounds that they would be less likely to be used by a large number of users). Duplicate apps, including earlier versions, were also removed.

The remaining apps were then downloaded and reviewed independently by at least two authors (LT, BS, LB, CQ, AG, EF or MD). Apps were reviewed using a compatible device, as identified in the app store's description. Each app was used for a minimum of 10 minutes and rated on its technical quality using the Mobile App Rating Scale (MARS) (23).

The MARS is a multidimensional measure for classifying and assessing the objective and subjective quality of mobile health apps. Initial items of the MARS collect descriptive and technical information about the apps (e.g. price, target age group and health problem). The quality rating section of the MARS consists of 23 items in five categories: Aesthetics (e.g. graphics, layout, visual appeal); Engagement (e.g. entertainment, interactivity); Functionality (e.g. performance, navigation, ease of use); Information (e.g. quality and quantity of information, credibility); and Subjective quality (e.g. stimulates repeat use, worth recommending). Each item is rated using a five-point scale (1 – indaequate, 2 – poor, 3 – acceptable, 4 – good, 5 – excellent). In cases where an item may not be applicable for all apps, an option of 'not-applicable' is included.[23]

The MARS is scored by calculating the means scores for the engagement, functionality, aesthetics, and information quality subscales, and combining these to calculate an overall mean app quality total score. The mean of the subjective quality items is also calculated. The MARS total scores can be used to describe the overall quality of an app, while the subscale scores can be used to describe specific strengths and weaknesses of an app.[23]

Prior to rating the apps, all reviewers were trained in the use of the MARS and specific instructions and guidelines relating to smoking cessation apps were developed by the study team and trialled in a random subset of apps. In the current study there was high inter-rater reliability between raters (Intraclass correlation coefficient = 0.807, indicating strong agreement between raters) and mean quality total scores were averaged between the two raters.

For those apps whose MARS total scores indicated that they were of high quality (overall quality total score and subjective quality total score greater than, or equal to, 4), their content was then analysed in detail by adopting Abroms et al's method of assessing their adherence to smoking cessation treatment guidelines.[13] High-quality apps were coded on each item on the Australian Adherence Index (a modified version of the Adherence Index developed by Abroms et al. based on the Royal Australian College of General Practitioners' Smoking Cessation guidelines).[13,2] Each item was coded as 'present' or 'not present'.

Results

The google searches produced 2,644 results, including 651 potentially relevant apps (see figure 1). One author (LT) conducted preliminary screening of these apps and identified 112 apps for full review.

App classification

The majority of apps were designed to be used by an iPhone and/or iPad (n=81, 72.32%), however a number of apps designed for Android phones were also identified (n=31, 27.68%). The majority of included apps were affiliated with a commercial company (n = 57, 50.1%), while 10.7% were

affiliated with a university, 8.0% with a government department and 7.1% with a non-government organisation (NGO). The affiliations of 39 apps (34.8%) were unable to be determined.

The most common strategies employed to promote smoking cessation were monitoring and tracking (81.4%), offering advice, tips, strategies or skills training (46.2%), providing information or education (45.9%), providing feedback (41.6%) and goal setting (37.9%). Therapeutic techniques such as cognitive behaviour therapy (CBT), acceptance commitment therapy (ACT), and mindfulness were infrequently explicitly identified (1.4%, 1.4% and 2.7% respectively).

Overall app quality

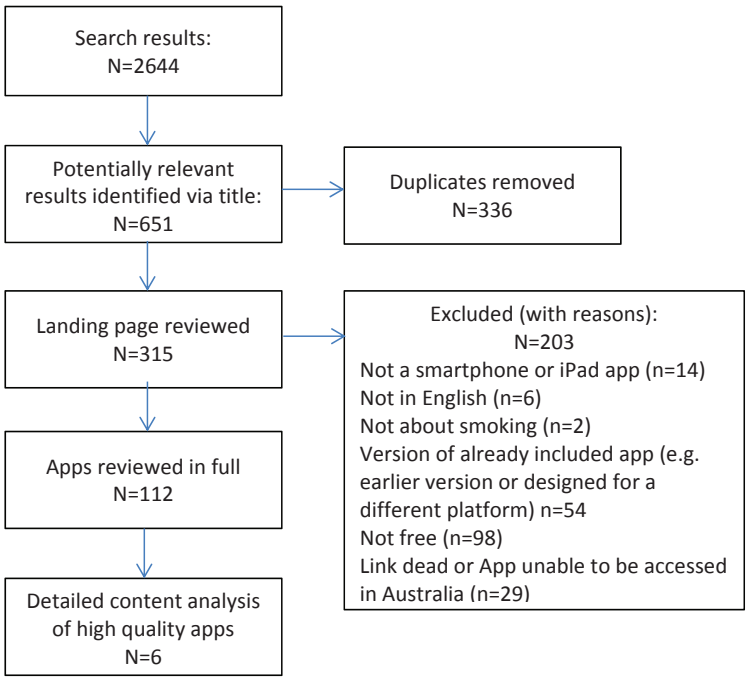
The mean MARS overall quality total score for rated apps was 2.88 (SD=0.83) indicating *poor* to *acceptable* quality. A cut off of 3.0 has been previously identified as a minimum acceptability score. The majority of included apps (57.1%, n=64) failed to meet this threshold. Similarly, the mean subjective quality total score of rated apps was found to be *poor* at 2.09 (SD=1.00). Only six apps achieved a score of 4 or more on both the overall quality and subjective scales indicating high or excellent quality.

Features of high-quality apps

The six 'high-quality' apps identified included three apps (SF28, SmokeFree Baby and SmartQuit) that were developed by research groups in the UK and US. SF28 and Smoke Free Baby were both developed by Robert West and colleagues at University College London. SF28 monitors users' progress towards smoking goals, and provides advice on the use of stop-smoking medication, inspirational stories, a distraction game, and other tips to quit smoking. It is one of the few smoking cessation apps for which efficacy data is available, with 18.9% of users reporting being abstinent from smoking for the target of 28 days, or longer.[11]

SmokeFree Baby is designed to help pregnant women to quit smoking. It uses evidence-based behaviour change techniques[24] to help users to quit smoking including: fostering a new 'non-smoker' identity; improving knowledge of health consequences of smoking and benefits of quitting; facilitating uptake of stop-smoking support resources; and providing distraction from urges to smoke. Users can also view videos of a pregnant woman who quit smoking and a quit-smoking adviser as well as create their own video diary.

Figure 1: App Selection.



SmartQuit uses ACT to help people to plan, and quit, smoking. The app allows users to develop a personalised quit plan, identify social support for quitting, identify values influencing their motivation to quit and upload photos that symbolise that value. The app provides information on selecting medications to assist with the quit attempt and users are awarded 'badges' for achieving milestones, e.g. creating a quit plan. This app is also one of the few apps around which research has been conducted.[10] In a comparison between the National Cancer Institute's mobile app for smoking cessation (QuitGuide) and SmartQuit, Brickner et al. found that participants accessed SmartQuit more than double the number of times they accessed the Quitguide app (37.2 times vs 15.2 times) and reported greater quit rates (13% for SmartQuit compared to 8% for Quitguide), though this difference was not significantly different.[10]

The other three apps were developed by Government departments, and no efficacy or effectiveness data currently exists to indicate the benefits of these apps. The HPB I Quit was an iPhone app developed by the Singapore Government Health Promotion Board. Unfortunately, between the time when MARS ratings were conducted and the second stage of coding (adherence to smoking cessation guidelines), the HPB I Quit app became inaccessible. My Quit Buddy, developed by the Australian National Preventive Health Agency, aims to help people quit smoking and stay abstinent by providing information about the impact of smoking on health, tips and distractions to help users overcome cravings, and helps users to monitor their tobacco use. QuitStart was developed by the National Cancer Institute in collaboration with US Food and Drug Administration. It aims to help teens to quit smoking, and live a healthier life by providing tips, inspirational messages and challenges (e.g. turn on some music and dance for 15 minutes) to help users deal with cravings, feelings of depression and relapses.

As can be seen in Table 1, all six of the 'high-quality' apps used goal setting and advice, tips, or skills training, to encourage smoking cessation. Additionally, most apps provided information and asked users to monitor their smoking. None explicitly mentioned using CBT or mindfulness techniques, or strategies to facilitate smoking cessation, however SmartQuit described using ACT and featured daily lessons teaching key ACT skills.

The most common technical features of the 'high-quality' apps were having an app community associated with it to boost support for change, sending reminders, and allowing sharing on social network sites like Facebook.

Table 1 also presents the MARS subscale and total scores for the high-quality apps. My Quit Buddy was the highest-performing app with an overall quality total score of 4.9 out of 5 and a subjective quality total score of 4.4. It also performed consistently well across all four subscale domains (i.e. engagement, functionality, aesthetics and information).

As can be seen in Table 2, all the high-quality apps adhered to the Australian treatment guidelines for smoking cessation, at least in part. All apps asked users about their tobacco status and assessed their willingness to quit. While all apps implied that users should quit smoking, only SmokeFree baby explicitly advised all users to quit in a clear, non-confrontational and personalised way. While all apps asked users how many cigarettes they smoked per day, only SmokeFree Baby clearly assessed nicotine dependence by also asking how soon after waking users smoked their first cigarette. All apps highlighted the benefits of quitting or risks of continued smoking, used techniques to enhance motivation to quit, explored barriers to quitting, affirmed and encouraged users' choice to quit, assisted users to formulate a quit plan and provided information regarding relapse prevention.

Table 1: Details of high-quality apps.

	SF28	HPB I Quit	My Quit Buddy	QuitStart	SmartQuit	SmokeFree Baby
Strategies						
Assessment					x	x
Feedback	x				x	x
Information/education	x		x	x	x	x
Monitoring	x	x	x	x	x	x
Goal Setting	x	x	x	x	x	x
Advice/tips/skills training	x	x	x	x	x	x
CBT						
ACT					x	
Mindfulness						
Technical aspects						
Allows sharing		x		x	x	
App community		x	x		x	
Password protection					x	
Requires login					x	
Sends reminders	x		x		x	x
Needs web access to function						
Uses automatic sensing						
MARS scores						
Engagement	3.8	4.2	4.9	5.0	4.0	4.3
Functionality	4.4	4.0	5.0	4.5	4.4	4.1
Aesthetics	4.2	4.0	5.0	4.7	4.5	4.0
Information	4.0	4.5	4.8	4.3	4.1	4.5
Overall quality total	4.1	4.2	4.9	4.6	4.3	4.2
Subjective quality total	4.1	4.0	4.4	4.3	4.1	4.1

Table 2: Adherence to Australian Guidelines.

	SF28	My Quit Buddy	QuitStart	SmartQuit	SmokeFree Baby
Ask for tobacco use status	x	x	x	x	x
Assess willingness to quit/ stage of change	x	x	x	x	x
Assess nicotine dependence					x
Advise every user to quit	x	x	x	x	x
Advise every user to quit – clear					x
Advise every user to quit – non-confrontational					x
Advise every user to quit – personalized					x
Assist – discuss the benefits of quitting / risk of continued smoking	x	x	x	x	x
Assist – provide information about not exposing others to passive smoking			x		x
Assist – Advise that help is available	x	x		x	x
Assist – Enhance motivation to quit	x	x	x	x	x
Assist- explore any doubts	x			x	
Assist – Explore barriers to quitting	x	x	x	x	x
Assist – affirm and encourage choice to quit smoking	x	x	x	x	x
Assist – discuss a quit plan	x	x	x	x	x
Assist- Recommend pharmacotherapy to nicotine dependent smokers	x			x	x
Assist – Discusses relapse prevention	x	x	x	x	x
Assist – Refer to a recommended treatment (e.g. Quitline)	x	x			x
Arrange for follow-up		x			

Discussion

The current study found that the majority of available smoking cessation apps were of suboptimal quality in relation to the app's aesthetics, usability, ability to engage users and quality of information provided. From a total of 112 reviewed smoking cessation apps, six 'high-quality' apps were identified, and further judged according to adherence to smoking cessation guidelines. In lieu of more substantial research in this area, it is suggested that, as the six high-quality apps identified were found to be of high technical quality and adhere to many of the Australian treatment guidelines for smoking cessation recommendations, they may be more likely than other available smoking cessation apps to encourage smoking cessation in people motivated to make a quit attempt.

It is a concern that the market for smoking cessation apps is flooded with products of such low quality, potentially preventing the higher quality apps from being found, except perhaps by the most discerning of users. Only one of the six 'high-quality' apps identified (MyQuitBuddy) appears in the top 10 recommended smoking cessation apps in the app stores. There is also the danger that exposure to poor-quality smoking cessation apps undermines perceptions of the burgeoning eHealth field more broadly, by either reducing a person's confidence in persisting with a quit attempt or affecting their willingness to pursue other (better) apps, web-based programs or traditional forms of support. Tobacco is frequently cited as one of the most difficult drugs to quit,[25,26] and the potential for low quality apps to make this process more difficult or discourage engaging supports through a quit attempt is a genuine concern for the field.

Another key issue is the lack of research evidence to support the use of any of

the identified apps. Empirical research regarding two of the apps identified (SF28 and SmartQuit) indicates that they may be effective as smoking cessation interventions.[10,11] Outside these trials, these two apps have a number of limitations, which may decrease their appeal for a consumer or a clinician wanting to identify an app to recommend to an Australian client. While available for download in Australia, SF28 was designed for British users, who are asked to record how much they spend on cigarettes in British Pounds. Only links to British smoking cessation services are provided in this app. On the other hand, while SmartQuit was less obviously developed within an American context, much of the app's content is locked and only accessible after buying a subscription to the app, making it less accessible to socioeconomically disadvantaged Australian smokers who potentially might be most in need. It is unclear if the minimal free version of the app evaluated in this current review would be associated with the same benefits described in Bricker et al's evaluation of the app.[10]

In the rapidly changing landscape of technological innovation, the standard approach to evaluating efficacy (the randomised controlled trial, RCT) may not be the most appropriate method to establish an evidence base for mobile apps. It is often the case that, by the time an RCT is ready for publication, the technology on which the intervention was based is obsolete. This does not undermine the pressing need for rigorous research to be carried out on apps, for reasons noted above, however, the challenge facing the eHealth field more broadly is to develop or adapt existing research methods to this new and important area to ensure that app users have access to resources that not only have aesthetic and functional appeal, but that actually deliver what they purport to deliver.

The app with the highest rated technical quality was the My Quit Buddy app developed by the Australian National Preventive Health Agency. This app adheres to many Australian treatment recommendations and has received overwhelmingly positive reviews from users. It is also endorsed by numerous Government departments (http://www.quitnow.gov.au/internet/quitnow/publishing.nsf/Content/quit-buddy), health insurance companies (https://www.allianz.com.au/life-insurance/news/5-iphone-apps-to-help-you-quit-smoking), blogs (http://www.techguide.com.au/news/internet-news/my-quit-buddy-app-can-help-you-ditch-cigarettes-for-good/), and news articles (http://www.smh.com.au/digital-life/digital-life-news/top-apps-for-quitting-smoking-20130807-2rhd8.html). However, to date, no evaluation data related to the app's effectiveness has been published. While the results of the current review indicate that My Quit Buddy could be a useful and effective app to help Australians quit smoking, the lack of evaluation is concerning, albeit a common concern for the field. Tobacco treatment providers generally agree that mobile apps hold promise for helping people to quit smoking, and that they would recommend an app to their clients if it was empirically validated (89.4%).[27] However, relatively few providers believe that effective smoking cessation apps currently exist (42.4%),[27] and the results of this review is supportive of this belief. While the endorsement by Government and respected organisations like Quitline may carry some weight, if empirical evidence in support of My Quit Buddy was made available, potentially a larger number of smokers seeking help to quit smoking would be provided with this help via a recommendation to access the app, and clinicians could prescribe My Quit Buddy with a degree of confidence that they would be recommending a high-quality, effective, and culturally relevant app.

With many smokers attempting to quit without seeking treatment or overt assistance, it is also important to consider wider dissemination of effective mobile applications. The popularity of an app within app market stores influences its accessibility, as it directly affects the rank order of apps in search engine results, and hence the likelihood that the app will be downloaded and used. This popularity ranking is heavily influenced by advertising expenditure,[21] keyword searching (and hence familiarity with the app's title) and how frequently the app is updated.[22] Therefore, in addition to creating or identifying viable apps that may facilitate smoking cessation, to maximise the download potential of an app, endorsement and advertising through key government agencies and respected organisations is imperative, as is continued funding to ensure regular updates to the app.

This review also highlights a key issue facing mobile health and eHealth in general: the volatility of the health app environment. While the HPB I Quit app was highly rated, by the time content analyses of identified apps occurred, this app was no longer available. In a recent study examining the longevity and rate of turnover of mental health apps, Larsen, Nicholas and Christensen highlight this instability, finding search results in the Android and iOS app stores change rapidly, with as many as 25% of clinically relevant depression apps no longer available after 9 months.[28] Their results, and the results of the current review, highlight the need for sustained funding for evidence-based health apps, including smoking cessation apps, as well as some of the challenges faced by consumers and clinicians when attempting to identify relevant and useful health apps.

While those apps identified in this review as 'high-quality' were individually assessed for their adherence to Australian treatment guidelines regarding smoking cessation, this process was not undertaken for the other apps included in this review. For practical reasons, we adopted the method that the apps had to first meet an acceptable threshold for quality (with MARS overall and subjective quality scores over 4) before they were further assessed for adherence to treatment guidelines. It is possible that there may have been apps of minimally acceptable quality that did adhere to smoking cessation treatment guidelines and that these apps, if they exist, could be potentially useful to consumers.

This study was the first to systematically review the quality and effectiveness of smoking cessation apps freely available in Australia. Apps related to smoking cessation identified in this review were generally those that included features of monitoring tobacco use, sometimes against nominated goals, and the provision of information about smoking cessation. This corresponds somewhat to the 'brief, behavioural advice' approaches abundant in the literature on traditional smoking cessation strategies (e.g. Roberts et al.)[29] that, when combined with pharmacotherapy to assist with a tobacco attempt, do have demonstrated efficacy.

Overall, there was a large number of smoking cessation apps in the sample, yet the vast majority were of very poor technical quality. Six apps were of high technical quality, and adhered to a number of recommendations provided by Australian treatment guidelines regarding smoking cessation. If recommending a smoking cessation app to a client, clinicians should consider recommending one of these apps. However, it should be noted that only two of the

identified apps had demonstrated efficacy in the peer-reviewed literature. Overwhelmingly, the results of this review highlight the need for more research to evaluate the efficacy of mobile apps for smoking cessation. There is a particular need for this research to take into account real world application and usability in order to be useful for app users, and those supporting them through the process of smoking cessation.

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