

This is an Accepted Manuscript of an article published by Taylor & Francis in Journal of Technology in Human Services on 28/01/2019, available online:
<https://dx.doi.org/10.1080/15228835.2018.1536911>

Abstract

When young-people need health information they are increasingly likely to use online sources and health-apps. Yet, these are not necessarily well-designed, reliable or appropriate, and research has primarily focused on adult use. Our study is the first to use qualitative mixed-methods (focus groups and interviews) to apply the Technology Acceptance Model (TAM) to understand 26 young-people's uptake and use of a new, clinically-approved health-app for 16-25 year olds. We found that perceived usefulness, perceived ease-of-use, social influences and trust, all differently impacted CYP health-app acceptance and effectiveness. Implications for future research and young-person health-app development are discussed.

Keywords

Mobile application development, health-apps, health information, young-people, adolescents, technology acceptance model (TAM), National Health Service (NHS)

Introduction

In the last 15 years there has been a substantive rise in the use of the internet and smartphone apps amongst adolescents and young- people to source health information (Kontos, Blake, Chou and Prestin, 2014). In July, 2016, the UK's National Health Service (NHS) launched its first version of a health-app – NHSGo - for children and young-people (CYP) aged between 16-25 years-old, in an effort to improve access to credible health information and invest in lifespan disease/ill-health prevention (Campbell et al., 2014; Maher, Lewis, Ferrar, Marshall, DeBourdeauhuij & Vandelanotte, 2014). NHSGo was designed to provide physical and mental health information and advice, organized across 9 key themes (including 'sex and relationships', 'puberty', 'sleep', 'smoking, drugs and alcohol'), alongside information on how to access health services. NHSGo uses clinically-approved content from the Information Standards certified NHS-Choices¹, and was developed in consultation with CYP. This is important, given the failure of many health-apps to be evidence-based and tailored to end-users' specific needs (Chan, Kow & Cheng, 2017; Majeed-Ariss et al., 2015; Misra, Lewis & Aungst, 2013).

Enabling CYP to access health information and services via a clinically-approved app is a shrewd and timely move. Data suggests that 90% of 16-24 year-olds own a smartphone (OFCOM, 2015) and are more likely (compared with older groups) to go online and use apps to source information about health (Klein & Wilson, 2002; Kontos et al., 2014). There appear to be a number of reasons for this, including CYP concerns about discussing stigmatized health issues with the family doctor (Eastin, 2005; Eysenbach, 2008; Klein & Wilson, 2002; Rideout, 2001), and a preference for the anonymity, autonomy and privacy offered by health-apps (Barak & Grohol, 2011; Eastin, 2005; Kennard et al., 2015).

¹ The UK's biggest health website, receiving around 40 million visits per month (NHS Five Year Forward View, 2014)

Whilst it is encouraging that a major health service is developing its own CYP health-app, investment in such technology is only worthwhile if the app is accepted by young-people (Taiminen & Saraniemi, 2018), and used to improve health outcomes (Eysenbach, 2008). To date, there has been a dearth of research that focuses on the acceptance and effectiveness of CYP health-apps amongst target users, with most research centered on adult-usage (Free et al., 2013; Majeed-Ariss et al., 2015; Payne, Lister, West & Bernhardt, 2015). This is significant because research has found that health interventions that are developed for adult users are unlikely to engage young-people (Ambresin, Bennett, Patton, Sanci & Sawyer, 2013; Payne et al., 2015).

The Technology Acceptance Model (TAM: Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Venkatesh & Davis, 2000) provides a framework for understanding which features of a new technology promote uptake and acceptance. Originally devised to predict whether and why new work technologies were likely to be accepted or rejected by end-users (Lee, Kozar, & Larsen, 2003; Yousafzai, Foxall, & Pallister, 2007), TAM has since been successfully applied to other domains (including healthcare) (Gücin & Berk, 2015; Holden & Karsh, 2010). Whilst the variables of TAM have rarely been investigated using a qualitative approach, the small number of studies that have examined health-app uptake amongst CYP, have used qualitative evaluations to good effect (Chan et al., 2017; Majeed-Ariss et al., 2015).

In this study our aim is to use a mixed-methods qualitative approach (focus groups and interviews) to investigate key, relevant factors within the TAM, to provide greater depth of understanding of health-app acceptance in young-people in this particular context. In undertaking this research, we make 2 key contributions. Firstly, the present study is the first evaluation that uses TAM to identify factors that might influence CYP acceptance and use of a general health-app. Secondly, given the dearth of studies taking a qualitative approach to

researching technology uptake (Doarn & Merrell, 2013; Misra et al., 2013), our study has the potential to identify pertinent influences (based on TAM) relating to health-app engagement in young-people, that a quantitative analysis might overlook (Legris, Ingham & Colletette, 2003; Marangunic & Granic, 2015). As such, it is intended that (i) researchers can use our findings to develop understanding of the relative influence of key factors within TAM, concerning CYP health-app uptake, and (ii) practitioners will be able to use our findings to shape the design and development of health-apps for young-people in the future (Bin Dhim, Hawkey, & Trevena, 2015). To guide our research, we ask the question, “Using the TAM, what factors influence CYP’s uptake and use of the NHSGo health-app?”

TAM and Young-people’s Acceptance of Health-apps

Using the TAM to frame the research, we focused on its two core beliefs that shape people’s uptake of new technologies. These relate to: (i) perceived ease-of-use (PEOU) – defined as the extent to which a person believes that using the system will be free of effort (in this instance, the app will be easy for CYP to access, navigate and read); and, (ii) perceived usefulness (PU) – defined as the extent to which CYP believe that using the system will enhance tangible outcomes (in this instance, improved access to health information and services). In addition, we identified two further factors that are likely to impact intention to use the app amongst CYP. These factors relate to (iii) social influences (what image is being conveyed in using the app, and would significant others approve?) (Chan et al., 2017; Eysenbach, 2008); and, (iv) trust (encompassing trust in both the technology provider and tool) (Ghazizadeh, Lee & Boyle, 2012; Karahanna, Straub & Chervany, 1999; Taiminen & Saraniemi, 2018).

Perceived ease-of-use (PEOU)

Given that 90% of people with limited literacy use a mobile phone (Bailey et al., 2014), and those with lower levels of education or socio-economic status are most likely to

access online health sites using their mobile phones (Kontos et al., 2014; Smith, 2015), health-apps must be simple and easy to read, especially amongst young-people, who have not necessarily finished their schooling. Too much text, poor search facilities, 'boring' designs, lack of navigation aids/hierarchical navigation, and irrelevant or inappropriate material reduce accessibility (Medhi, Patnaik, Brunskill, Gautama, Thies & Toyama, 2011; Meyer, 2016). PEOU is more predictive of uptake when the technology is especially new or complex (Schepers & Wetzels, 2007). Given the novelty of NHSGo, along with the likelihood that young-people need to have access to simple and straightforward technological features in app-use, it is expected that PEOU will impact CYP's intentions to use the app in the present study. We were interested in uncovering to what extent this is true amongst the under-explored CYP demographic, and whether different features of health-app are more or less related to CYP PEOU.

Perceived usefulness (PU)

Previous research has suggested that whilst online health information can contribute to a change in people's thinking or decision making, this doesn't always translate to fundamental changes in health outcomes (Sillence, Briggs, Harris, & Fishwick, 2007). When health sites provide a level of interaction - including use of forums, gamification and the ability to generate content - behavioral change is more often observed (Maher et al., 2014; Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011). This is very relevant in the context of CYP use – as CYP users reportedly value online tools that engage such content (Miller, Cafazzo & Seto, 2014). Across studies, PU has been found to be the most significant and reliable predictor of intention to use a new technology (King & He, 2006), and sustained use after uptake (Ghazizadeh et al., 2012). Research suggests that CYP, who are faced with many competing priorities in their lives, struggle to perceive the usefulness of general health

information apps (Chan et al., 2017). Understanding what shapes CYP's perceived usefulness of a health-app is important, in order to maximize the likelihood for sustained uptake and use.

Social influence

With regards to social influence, CYP are especially susceptible to the opinions and behaviors of others and are more likely to exhibit health behaviors that align with those with whom they socially identify (Stok, de Vet, de Ridder & de Wit, 2016). Seeing a health-app as lacking 'street credibility' (Eysenbach, 2008, p. 147) and perceiving that valued others do not use health-apps (Chan et al., 2017) directly dissuades CYP from using health-apps themselves. Exploring the role of social influence, especially with regard to different sources and their respective impact on CYP health-app uptake, was deemed to be worthwhile, in the present study.

Trust

In terms of trust, it is noteworthy that young-people are more likely to trust the information found on health websites compared with older groups (Hesse et al., 2005). This appears to be because they are less able to contextualize the information they find online owing to their limited life experience, lower education level, and less functional health literacy and topic knowledge (Eastin, 2005). We were therefore mindful of CYP potential to be more easily influenced by social norms (Schepers & Wetzels, 2007) and more trusting of new technology (Sillence et al., 2007) in contributing to their uptake of NHSGo. In light of this, we developed questions relating to confidence in using NHSGo, to understand how these factors manifest in CYP health-app acceptance.

Method

We used a mixed-methods qualitative approach to investigate the four factors of TAM with CYP-users of the NHSGo health information app. Focus groups and interviews have been used in conjunction in other areas of health research (Lambert & Loiselle, 2008), but to

date have not been pooled to investigate CYP uptake of health-apps. Combining these approaches has the potential to afford deeper understanding of health issues (Kennard et al., 2015). As such, we used both methods in the present study.

Participants

Twenty-six participants were recruited in total. This is a relatively large sample size for a qualitative research study (Majeed-Ariss et al., 2015)². Firstly, focus groups were run, offering the opportunity to collect rich and dynamic data, driven from participants' interactions with one another (Egan, Harcourt & Rumsey, 2011). Eleven participants were recruited to take part in 3 focus groups during July 2017. These were set-up according to principles of best-practice in focus group management: groups were small and arranged according to appropriate age categories (see Table 1) to facilitate open discussion when dealing with sensitive topics (Morgan, 1996; Krueger & Casey, 2014; Rabiee, 2004). Following this study phase, semi-structured interviews were used to allow individuals the opportunity to reflect on their experiences of NHSGo-use to a deeper level (Tracy, 2013). Fifteen participants were interviewed in August, 2017.

The inclusion criteria for both focus groups and interviews were that participants needed to (i) be between the ages of 14-25 years³; (ii) live in the London area⁴; and, (iii) have used the NHSGo app at least once before (as experience and use of a new technology can influence PEOU and PU beliefs: Ghazizadeh et al., 2012; Marangunic & Granic, 2015). For both focus groups and interviews, participants were recruited using purposive opportunity/snowball sampling methods (Collingridge & Gantt, 2008). Attempts were made to recruit a varied participant sample in terms of age, gender and ethnicity. Participant details are provided in Table 1 using pseudonyms. Participants were recruited using a range of

² Sample sizes ranged from N=4 to N=18 across four studies.

³ The NHS team requested including CYP up to two years younger than the target age, as they had received anecdotal feedback that children younger than aged 16 were finding the app to be useful.

⁴ The first version of NHSGo included some services restricted to London.

methods, which included: an advert on the NHSGo app site (focus groups only), invitations to CYP in the NHS client team's network (focus groups and interviews), and use of personal contacts (interviews only). The incentive of receiving a £5 (equivalent to US\$7) Amazon voucher was offered to all participants. All participants had used NHSGo before participating in the study, although nine only downloaded it for the purpose of participating in the study.

[INSERT TABLE 1 ABOUT HERE]

Procedure and Questions

Prospective participants, responding to our recruitment calls, were sent an information sheet with full details about the project, including information about: the NHSGo app; how the focus group/interview would run; timings; ethical information and reassurances; details about the research team, and how to contact them; and, what to expect in terms of the project purpose (*"we would like to know what young-people using the app think of it, and whether the app is achieving what it was designed to do"*). If participants were happy to sign-up, they were asked to read and complete an informed consent form⁵.

Focus groups (up to 2-hours) were held in neutral spaces in three different locations outside of school hours, with two researchers available to facilitate the groups. Interviews (up to a1-hour) took place after focus group data had been collected; these were conducted face-to-face with one researcher, via skype and telephone. A semi-structured interview/focus-group framework, informed by the TAM, was used. In the interviews only, participants were asked to talk the interviewee through one of three pages on the NHSGo app and discuss their experience of this. Full details of methods used and question frameworks are available from the first author. Focus groups and interviews were recorded with permission and then transcribed verbatim by an independent transcriber (Saldana, 2015).

Ethics

⁵ Extended to include parents or guardians for those under the age of 18.

This study adhered to professional and university ethics standards and was approved by the university ethics committee.

Analysis

For pragmatic reasons, and to enhance data completeness (Adami, 2005; Lambert & Loiselle, 2008), data from the focus groups and interviews was combined and given equal status (Barbour, 1998). Data was interpreted using a thematic analysis approach and a staged coding process (Braun & Clarke, 2006; Saldana, 2015). Participants' comments were initially decoded and grouped into detailed themes by the second author, who also considered whether the source of the data (e.g. from a particular focus group or contributor was noteworthy: Lambert & Loiselle, 2008). After discussion with the first author, inductive themes were encoded into broader sub-themes (concepts), which were placed under four main category headings, deductively representing the four main TAM factors (categories). This process involved a number of iterations and discussions between the first and second authors. The coding frame was then presented to the third and fourth authors. The entire research team cross-checked and discussed the appropriateness of themes across a number of iterations, until agreement was reached (Kennard et al., 2015). Discussions between the research team were logged via meeting summaries, and by providing comments or 'tracked changes' on document copies of the coding frame.

Results

The thematic analysis arranged the sub-themes (concepts) across four main category themes, reflecting the TAM factors. The themes and sub-themes are outlined below and illustrated with sample quotes.

Perceived Usefulness

This theme highlighted the need for a health-related app that can be used for a variety of purposes, targeted to the needs of CYP. Four sub-themes of perceived usefulness were

identified: multi-purpose; convenience; privacy/anonymity and appropriateness for diverse users.

Multi-purpose

Participants reported that the NHSGo health-app could be used to access general health information when browsing, but also to specifically search out health information on a particular issue or complaint that was concerning them, or a friend/family member. NHSGo was considered to be useful for CYP starting conversations with others, as a means of opening dialogue about a health issue or concern.

“Yeah my friend (has) had depression, so when they're stressed out they can read this and it helps me too.” (Oadira, female, 16)

Most of the comments about whether NHSGo would assist CYP in changing their health outcomes were non-committal. Seven CYP using NHSGo expressed that after reading about/learning about health information and services, they were unlikely to act upon the information provided.

“I wasn't ill, so like - I think - maybe, if I had a specific reason, then I might have (acted on the information), but I was just gathering information because it's handy.” (Aafa, female, 16)

Convenience

CYP liked the fact that NHSGo could be easily consulted when a health concern first emerged, without needing to visit a health practitioner. Only 5 participants stated that they would use traditional face-to-face clinical advice as the first port-of-call. There were also comments made about how the app was convenient to use 'on the go'.

“Yeah - I think there is really useful information on there and you can access it on the bus, at home, it's not limited to where you are.” (Sally, female, 23)

Privacy/anonymity

CYP reported that they might find it embarrassing to discuss certain health issues with a clinical professional in a face-to-face setting. This might be due to stigma surrounding the health issue itself, or because of anonymity concerns associated with seeing a family doctor.

“I’m Asian and Muslim... and it’s really kind of awkward if you’re a young woman - especially if you are a young, unmarried woman - looking for contraception... it’s like, whoa what are you up to?... So you want to have that information freely accessible in a private way.” (Sasha, female, 22)

Appropriateness for diverse users

NHSGo was viewed to be topical and timely for CYP wanting relevant advice relating to current issues (e.g. exams, festival season, fasting). It was considered to be inclusive to different faiths/cultures/genders/sexual-orientations, etc., with 10 participants describing the app content as suitable and relevant to them.

“... with exam season, it’s got like, how to keep healthy during exams, as well. So yeah, I think it’s good for the things people our age are going through, in which they need – like - health advisors and stuff like that.” (Aafa, female, 16)

“When I downloaded the app, it was the first week of Ramadan, I was fasting, so I looked at it, and it had a page on it for Ramadan, and it was useful. Like being dehydrated, and a few other posts as well, like the type of food I should eat afterwards, so yeah, was appropriate...” (Alisha, female, 15)

However, on the whole, it was considered that NHSGo was pitched more towards the younger people in the 16-25 year age range. Those aged from 21 upwards (10 participants) felt that content was less relevant for them.

“For me, at this point in my life at 25, not sure if it’s already there, but it could be more about workplace health, or worrying about buying your first home.” (Margaret, female, 25)

Perceived Ease-of-use

This main category theme suggests that CYP participants currently believe that NHSGo isn’t optimal in terms of ease-of-use. Participants outlined a number of

improvements that have been clustered into three sub-themes: improving functionality, improving interactivity, and presentation variability.

Improving functionality

Some participants felt that additional functionality would make the app more engaging, personalized, and therefore likely to increase their use. In particular, 6 users felt that a symptom-checker would be useful. Five individuals suggested the search function should include recommendations.

“One thing, looking at other apps, is having a suggestion section, based on previous searches, e.g. if you looked up something like ‘eating disorders’ then it would have suggestions on healthy eating and guides like that.” (Jay, male, 21)

Finally, enabling offline functionality (suggested by 4 people) was considered to be a useful progression.

“I was in the car and I opened the app and because I didn't have the internet nothing worked, so... an option to use it in offline mode, I think that would be useful and a cool feature.” (Lee, male, 19)

Improving interactivity

This sub-theme explained participants' desire to have a more interactive app, to engage directly with healthcare professionals, and be able to personalize the app to meet their needs. *Live chat* was discussed by 8 participants, although there was concern that lay comments could influence the credibility of the app. Participants were keen, however to have the facility to ask healthcare professionals questions in real-time.

“...maybe in terms of an emergency you could contact somebody for help, if it's a call or text thing.” (Ellone, female, 18)

“Maybe chat rooms.... But I think that would be hard to filter out, like, irrelevant comments or things that could offend anyone else.” (Ieasha, female, 17)

Presentation variability

Whilst it is important that the app provides comprehensive information, individuals felt that this could be presented better. NHSGo is primarily text-based, and 10 CYP found this too dense, specifically highlighting a preference for video and visual content, to make the app more accessible.

"... there's way too much reading in that sense; it wasn't easy to use and it wasn't a pleasure to use it, because it is just a bombardment, just black and white text and that's it!" (Lisa, female, 25)

"...more videos, and that makes it more interesting to look at, as opposed to just straight reading everything..." (Alisha, female, 15)

Social Influence

CYP participants in the present study referred to social influences on their use of NHSGo, in relation to two sub-themes relating to: uptake, and sustained use.

Uptake

On initial launch, prominent *YouTubers* were paid to promote NHSGo to their followers. However, 5 participants had been unaware of NHSGo prior to participating in the study. Some CYP participants commented that (as well as *YouTube*), a larger breadth of advertising channels was needed to ensure CYP across the 16-25-year age bracket were targeted, using appropriate influences.

"... maybe if you went to school and did a presentation, so then they knew a bit about the app, and when they saw the advert they'd be like, oh let's just download it now..."
(Bill, male, 16)

Sustained use

In encouraging continued use of the app, 2 participants suggested that incorporating *trending* would enable users to see current 'most viewed' and 'searched for' topics, which would subsequently impact other users' activity.

"Trending I think would be quite good. Yeah, things that people have got wrong with them, it's a good way to identify if something is spreading around." (Seth, male, 16)

The ability to view 'comments' made by users on the different pages of the app was also considered to be appealing. Understanding how other CYP are using the app appears to be important for young-people, and was considered to promote greater use of the tool over time.

Trust

The fact that NHSGo was developed by the NHS was perceived very positively by participants. A total of 11 participants spoke about the high level of trust that they had in the NHS. NHSGo was reported to be chosen above other generic health sites because of its perceived credibility and trustworthiness:

"Yeah 100%, I can trust it. I assume it's the same information that the GP will give you."

(Adam, male, 23)

"Yeah, that's what I like about the app, you know it's NHS, it's proper information."

(Lorelle, female, 16)

"... I don't like to use the American ones, or – like - 'Net Doctor', 'cause I don't know it. I tend to prefer NHS sites." (Hazel, female, 22)

"...after they (diagnosed) me Cancer for the 15th time - no more Web MD!" (Tabatha, female, 21)

The high value placed on the credibility of the site was very much related to the trust in the provider, with the NHS logo acting as a stamp of approval for the reliability of the content.

Discussion

This is the first qualitative study that has used TAM to examine CYP uptake of a new health-app. In examining the four key TAM factors of 'perceived usefulness', 'perceived ease-of-use', 'social influences' and 'trust', we uncovered a range of sub-themes and four novel findings that progress understanding relating to the acceptability of health-apps for young-people. These are discussed under the four headings that follow, and future research directions are suggested to further elucidate these.

Perceived Usefulness and Target Demographics

The perceived usefulness of the app was judged positively by CYP, as it enabled them to access a wide range of health information (Militello, Kelly & Melnyk, 2012; Dirieto, Jiang, Whittaker & Maddison, 2015) in a discrete and convenient way (Barak & Grohol, 2011). Our sample was diverse (ethnically, and in terms of age and gender), and so it was gratifying to learn that the app was perceived to be inclusive and appropriate for most CYP. However, one group (the 21-25 year olds) reported that NHSGo was less useful for their current needs. This confirms how important it is to align app content with the personal needs of the target group, if acceptance is to be optimized (Taiminen & Saraniemi, 2018). We did not capture data about our CYP's backgrounds outside of the categories of ethnicity, age and gender. However, in light of our findings and given that other research has found that those from lower socio-economic groups, educational backgrounds and isolated circumstances have different experiences of health-apps (Barak & Grohol, 2011; Coutler & Ellins, 2007; Kontos et al., 2014), it would be useful now for future researchers to capture a diverse range of demographic features in order to delineate how well health-apps meet the needs of the target audience.

CYP and the Need for Engaging, Interactive, 'Easy-to-Use' Apps

The perceived ease-of-use of NHSGo was considered to be less than optimal. CYP suggested that the app needed to be more visually interesting and varied, interactive and engaging, presenting information in a way that is easy to navigate and read. Previous research with adult-users concurs with our CYP participants, indicating that these are features that are desirable in encouraging app uptake across generations (Deterding et al., 2011; DeWalt et al., 2006; Lefebvre, Tada, Hilfiker & Bauer, 2010; Maher et al., 2014; Medhi et al., 2011; Meyer, 2016; Sillence et al., 2007). Such features have also previously been found to facilitate improvements in health outcomes (Barak & Grohol, 2011; Free et al., 2011; Maher et al., 2014; Sillence et al., 2007). Given that our CYP reported they were unlikely to act on

the advice contained within the app, it appears that promoting the above 'ease-of-use' features, is highly necessary for health-apps to be both accepted and effective.

In terms of interactivity, our CYP suggested that 'live chats' with health professionals, and social media forums would make the app more appealing and easy to use. This reveals that CYP, who might otherwise have difficulty/reservations about meeting with clinicians, could potentially be reached through optimizing app-based interactive functions. However, CYP also showed an awareness of the potential for misuse in using social networking with peers to discuss health topics (as per Chan et al., 2017), a potential advancement in understanding since Eysenbach's (2008) study, and indicating that CYP needs, regarding app functions, are likely to change as online cultures and awareness evolve. This indicates that CYP research needs to be updated regularly, to ensure that understanding of their needs maintains currency and relevance.

Differences in Social Influences in Uptake and Sustained Use

In our study, we found that for CYP, 'authority figures' appeared to be important in promoting uptake of a health-app, but peers were important in encouraging sustained use. NHSGo heavily utilized social media in its launch campaign; *YouTube* was the main launch forum with prominent vloggers and videos of CYP-users promoting the app. However, our CYP were not necessarily aware of this campaign, and indicated that schools and surgeries could have been better utilized to encourage uptake. In terms of sustained use, however, CYP wanted to know what other young-people were looking at on the app (trending and tailored searches) and wanted to share experiences (forums and chats). Our findings confirm that social influence can be an important factor in determining both initial uptake *and* continued use of a health-app in CYP (Ghazizadeh et al., 2012), but we especially highlight the need to consider the source of the influence at different stage of app acceptance.

We suggest that the role of traditional 'authority' figures, such as schools and health professionals, are more important to help facilitate uptake decisions, because young people tend to trust such figures, when it comes to important issues such as health (Hesse et al., 2005). Indeed, in our study, we found that for 5 participants, making a face-to-face appointment with a clinician before using NHSGo was considered to be preferable, indicating the value that some CYP still place on traditional sources of health information and advice (Eysenbach, 2008). Whilst previous research has suggested that this is more likely to be the case for younger CYP (Lenhart, Madden & Hitlin, 2005), we did not note any demographic differences in participants who showed this preference in the present study. A future research direction will be to explore the role of traditional versus social media, and peer versus authority figures, in helping CYP decide when and whether to use health-apps.

Trust Supplants PEOU in Determining Sustained Use

In our study, we found that trust appeared to supersede flaws in the app design and features (PEOU) in terms of intention to continue use. Most of the CYP expressed that they would access the app again and in favor of other health-information apps available, even though they found it hard to use. Therefore, whilst we know that CYP can be overly trusting of new technologies on the basis of superficial design (Eysenbach, 2008), our study suggests that the strong and credible reputation of the technology provider can potentially override shortcomings in the design, prompting greater acceptance for young-people. This indicates that developing sites with credible clinical content, and providing recognition of this in the affiliation of the health-app, is important for CYP. We agree with McMillan, Hickey, Patel & Mitchell (2014) that it would be useful to provide clinically-accredited seals of approval to health-apps, to help guide CYP towards appropriate sites.

Limitations

There were difficulties in attracting participants to attend the focus groups. This might also reflect a lack of motivation or interest in the app and/or in discussing health issues. If the latter is true then the restricted sample may have confounded our findings by being more articulate and positive about the app than is truly reflective of CYP. Our findings were based on 26 participants. As such, whilst this is a relatively robust sample size in this context, representing a diverse range of CYP, caution should be applied in generalizing our findings.

Conclusion and Recommendations

This mixed-method, qualitative study was the first to utilize the TAM to understand which factors influence CYP acceptance and use of a new general health-app. We examined perceived usefulness, perceived ease-of-use, social influence and trust, and - based on their use of NHSGo - uncovered four novel contributions in terms of understanding CYP health-app acceptance and effectiveness: (i) ensuring the app attends to the target demographic groups' priorities; (ii) designing the app to be interactive, engaging, visually clear, varied, and easy to read and navigate⁶; (iii) encouraging 'authority' figures to help promote health-app uptake, and allowing for monitored peer interaction to encourage sustained use; and, (iv) evidencing the clinical credibility of the app, which can 'trump' ease-of-use as a reason for CYP to continue use.

Because of the exploratory nature of this research, we now recommend that scholars attend to the suggested future research directions set out in the Discussion, to further explicate and validate our findings. This will help support our recommendations that CYP health-app developers focus on providing tools that are: interactive, engaging and readable; recognized as credible and trustworthy; targeted to demographic-appropriate health needs; and, promoted by a range of influencers, from peers and prominent vloggers, to health

⁶ Although, such findings have been found amongst adult-populations use of health-apps, there has been a dearth of studies to acknowledge that CYP have similar needs.

professionals and teachers. This research suggests that attending to these issues has the potential to positively enhance uptake and sustained use of health information apps in young-people.

References

- Adami M.F. (2005). The use of triangulation for completeness purposes. *Nurse Researcher* 12(4), 19–29. <https://doi.org/10.7748/nr2005.04.12.4.19.c5956>
- Ambresin, A. E., Bennett, K., Patton, G. C., Sanci, L. A., & Sawyer, S. M. (2013). Assessment of youth-friendly health care: a systematic review of indicators drawn from young people's perspectives. *Journal of Adolescent Health*, 52(6), 670-681. <https://doi.org/10.1007/s00417-012-2090-9>
- Bailey, S. C., O'Connor, R., Bojarski, E. A., Mullen, R., Patzer, R. E., Vicencio, D., Wolf, M. S. (2014). Literacy disparities in patient access and health-related use of Internet and mobile technologies. *Health Expectations*, 18(6), 1-9. <https://doi.org/10.1111/hex.12294>
- Barak, A., & Grohol, J. M. (2011). Current and Future Trends in internet-Supported Mental Health Interventions. *Journal of Technology in Human Services*, 29(3), 155–196. <https://doi.org/10.1080/15228835.2011.616939>
- Barbour R.S. (1998). Mixing qualitative methods: quality assurance or qualitative quagmire? *Qualitative Health Research* 8(3), 352–361. <https://doi.org/10.1177/104973239800800306>
- Bin Dhim, N. F., Hawkey, A., & Trevena, L. (2015). A systematic review of quality assessment methods for smartphone health-apps. *Telemedicine and Health*, 21(2), 97-104. <https://doi.org/10.1089/tmj.2014.0088>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Using Qualitative Research in Psychology*, 3, 77–101. <http://dx.doi.org/10.1191/1478088706qp063oa>
- Campbell, F., Conti, G., Heckman, J. J., Moon, S. H., Pinto, R., Pungello, E., & Pan, Y. (2014). Early childhood investments substantially boost adult health. *Science*, 343(6178),

- 1478–1485. <https://doi.org/10.1126/science.1248429>
- Chan, A., Kow, R., & Cheng, J. K. (2017). Adolescents' Perceptions on Smartphone Applications (Apps) for Health Management. *Journal of Mobile Technology in Medicine*, 6(2), 47-55. <https://doi.org/10.7309/jmtm.6.2.6>
- Collingridge, D. S., & Gantt, E. E. (2008). The quality of qualitative research. *American Journal of Medical Quality*, 23(5), 389–395. <https://doi.org/10.1177/1062860608320646>
- Coulter, A., & Ellins, J. (2007). Effectiveness of strategies for informing, educating, and involving patients. *British Medical Journal*, 335(7609), 24-27. <https://doi.org/10.1136/bmj.39246.581169.80>
- Davis, F. (1989). Perceived usefulness, perceived ease-of-use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340. [https://doi.org/10.1016/S0305-0483\(98\)00028-0](https://doi.org/10.1016/S0305-0483(98)00028-0)
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35(8), 982-1003. <https://doi.org/10.1287/mnsc.35.8.982>
- Deterding, S., Sicart, M., Nacke, L., O'Hara, K., & Dixon, D. (2011). Gamification. using game-design elements in non-gaming contexts. *Extended Abstracts on Human Factors in Computing Systems*, 7(12), 2425-2428. <https://doi.org/10.1145/1979742.1979575>
- DeWalt, D. A., Malone, R. M., Bryant, M. E., Kosnar, M. C., Corr, K. E., Rothman, R. L., ... & Pignone, M. P. (2006). A heart failure self-management program for patients of all literacy levels: a randomized, controlled trial. *BMC Health Services Research*, 6(1), 30-40. <https://doi.org/10.1186/1472-6963-6-30>
- Direito, A., Jiang, Y., Whittaker, R., & Maddison, R. (2015). Smartphone apps to improve fitness and increase physical activity among young-people: Protocol of the Apps for Improving FITness (AIMFIT) randomized controlled trial. *BMC Public Health*, 15(1).

- <https://doi.org/10.1186/s12889-015-1968-y>
- Doarn, C.R. & Merrell, R.C. (2013). There's an app for that. *Telemedicine Journal and e-Health*, 19, 811-812. <https://doi.org/10.1089/tmj.2013.9983>
- Eastin, M. S. (2005). Teen internet Use: Relating Social Perceptions and Cognitive Models to Behavior. *CyberPsychology & Behavior*, 8(1), 62–75.
<https://doi.org/10.1089/cpb.2005.8.62>
- Egan, K., Harcourt, D., Rumsey, N. & Appearance Research Collaboration (2011). A qualitative study of the experiences of people who identify themselves as having adjusted positively to a visible difference. *Journal of Health Psychology*, 16, 739-749.
<https://doi.org/10.1177/1359105310390246>
- Eysenbach, G. (2008). Credibility of Health Information and Digital Media: New Perspectives and Implications for Youth. In *Digital Media, Youth, and Credibility* (pp. 123–154). <https://doi.org/10.1162/dmal.9780262562324.123>
- Free, C., Phillips, G., Galli, L., Watson, L., Felix, L., Edwards, P., ... & Haines, A. (2013). The effectiveness of mobile-health technology-based health behaviour change or disease management interventions for health care consumers: a systematic review. *PLoS Medicine*, 10(1), 1-45. <https://doi.org/10.1371/journal.pmed.1001362>
- Ghazizadeh, M., Lee, J., & Boyle, L. (2012). Extending the Technology Acceptance Model to assess automation. *Cognition, Technology & Work*, 14(1), 39–49.
<https://doi.org/10.1007/s10111-011-0194-3>
- Gücin, N. Ö., & Berk, Ö. S. (2015). Technology acceptance in health care: An integrative review of predictive factors and intervention programs. *Procedia-Social and Behavioral Sciences*, 195, 1698-1704. <https://doi.org/10.1016/j.sbspro.2015.06.263>
- Hesse, B. W., Nelson, D. E., Kreps, G. L., et al., Croyle, R. T., Arora, N. K., ... Viswanath, K. (2005). Trust and sources of health information: The impact of the internet and its

- implications for health care providers: findings from the first health information national trends survey. *Archives of Internal Medicine*, 165(22), 2618–2624.
<https://doi.org/10.1001/archinte.165.22.2618>
- Holden, R. J., & Karsh, B. T. (2010). The technology acceptance model: Its past and its future in health care. *Journal of Biomedical Informatics*, 43(1), 159-172.
<https://doi.org/10.1016/j.jbi.2009.07.002>
- Karahanna, E., Straub, D. W., & Chervany, N. L. (1999). Information technology adoption across time: A cross-sectional comparison of pre-adoption and post-adoption beliefs. *MIS Quarterly*, 23, 183-213. <https://doi.org/10.2307/249751>
- Kennard, B. D., Biernesser, C., Wolfe, K. L., Foxwell, A. A., Craddock Lee, S. J., Rial, K. V., ... & Blastos, B. (2015). Developing a brief suicide prevention intervention and mobile phone application: a qualitative report. *Journal of Technology in Human Services*, 33(4), 345-357. <https://doi.org/10.1080/15228835.2015.1106384>
- King, W. R., & He, J. (2006). A meta-analysis of the technology acceptance model. *Information & Management*, 43(6), 740-755. <https://doi.org/10.1016/j.im.2006.05.003>
- Klein J.D. & Wilson, K.M. (2002). Delivering quality care: adolescents' discussion of health risks with their providers. *Journal of Adolescent Health*, 30, 190-195.
[https://doi.org/10.1016/S1054-139X\(01\)00342-1](https://doi.org/10.1016/S1054-139X(01)00342-1)
- Kontos, E., Blake, K. D., Chou, W. Y. S., & Prestin, A. (2014). Predictors of ehealth usage: Insights on the digital divide from the health information national trends survey 2012. *Journal of Medical internet Research*, 16(7). <https://doi.org/10.2196/jmir.3117>
- Krueger, R. A., & Casey, M. A. (2014). Focus Groups: A practical guide for applied research. London: Sage publications.
- Lambert, S. D., & Loiselle, C. G. (2008). Combining individual interviews and focus groups to enhance data richness. *Journal of advanced nursing*, 62(2), 228-237.

- <https://doi.org/10.1111/j.1365-2648.2007.04559.x>
- Lee, Y., Kozar, K. A., & Larsen, K. (2003). The technology acceptance model: Past, present, and future. *Communications of the Association for Information Systems, 12*(50), 752–780.
- Lefebvre, R. C., Tada, Y., Hilfiker, S., & Baur, C. (2010). The assessment of user engagement with ehealth content: The eHealth Engagement Scale. *Journal of Computer-Mediated Communication, 15*(4), 666-681. <https://doi.org/10.1111/j.1083-6101.2009.01514.x>
- Legris, P., Ingham, J., & Colletette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information and Management, 40*(3), 191-204. [https://doi.org/10.1016/S0378-7206\(01\)00143-4](https://doi.org/10.1016/S0378-7206(01)00143-4)
- Lenhart, A., Madden, M. and Hitlin, P. (2005). *Teens and technology: Youth are leading the transition to a fully wired and mobile nation*, July 27, 2005. Retrieved from: [http://www.pewinternet.org/pdfs/PIP Teens Tech July2005web.pdf](http://www.pewinternet.org/pdfs/PIP%20Teens%20Tech%20July2005web.pdf). Archived at: <http://www.webcitation.org/5NBw8JH3M>.
- Maher, C. A., Lewis, L. K., Ferrar, K., Marshall, S., Bourdeaudhuij, I. De, & Vandelanotte, C. (2014). Are health behavior change interventions that use online social networks effective? A systematic review. *Journal of Medical internet Research*. <https://doi.org/10.2196/jmir.2952>
- Majeed-Ariss, R., Baidam, E., Campbell, M., Chieng, A., Fallon, D., Hall, A., McDonagh, J.E., Stones, S.R., Thomson, W. & Swallow, V. (2015). Apps and adolescents: a systematic review of adolescents' use of mobile phone and tablet apps that support personal management of their chronic or long-term physical conditions. *Journal of Medical Internet Research, 17*(12), e287. <https://doi.org/10.2196/jmir.5043>
- Marangunić, N. & Granić, A. (2015). Technology acceptance model: a literature review from 1986 to 2013. *Universal Access in the Information Society, 14*, 81-95.

<https://doi.org/10.1007/s10209-014-0348-1>

- McMillan, B., Hickey, E., Patel, M. G., & Mitchell, C. (2016). Quality assessment of a sample of mobile app-based health behavior change interventions using a tool based on the National Institute of Health and Care Excellence behavior change guidance. *Patient Education and Counseling*, 99(3), 429–435. <https://doi.org/10.1016/j.pec.2015.10.023>
- Medhi, I., Patnaik, S., Brunskill, E., Gautama, S. N., Thies, W., & Toyama, K. (2011). Designing mobile interfaces for novice and low-literacy users. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 18(1), 2. <https://doi.org/10.1145/1959022.1959024>
- Meyer, K. (2016). *Reading content on mobile devices*. [Available at: <https://www.nngroup.com/articles/mobile-content/>]
- Militello, L. K., Kelly, S. A., & Melnyk, B. M. (2012). Systematic review of text-messaging interventions to promote healthy behaviors in pediatric and adolescent populations: Implications for clinical practice and research. *Worldviews on Evidence-Based Nursing*, 9(2), 66-77. <https://doi.org/10.1111/j.1741-6787.2011.00239.x>
- Miller, A. S., Cafazzo, J. A., & Seto, E. (2016). A game plan: gamification design principles in mHealth applications for chronic disease management. *Health Informatics Journal*, 22(2), 184-193. <https://doi.org/10.1177/1460458214537511>
- Misra, S., Lewis, T. L., & Aungst, T. D. (2013). Medical application use and the need for further research and assessment for clinical practice: creation and integration of standards for best practice to alleviate poor application design. *JAMA Dermatology*, 149(6), 661-662. [https://doi.org/ doi:10.1001/jamadermatol.2013.606](https://doi.org/doi:10.1001/jamadermatol.2013.606)
- Morgan, D. L. (1996). *Focus groups as qualitative research* (Vol. 16). London: Sage publications.
- NHS Five Year Forward View (FYFV) (2014). [Available at:

- <https://www.england.nhs.uk/wp-content/uploads/2014/10/5yfv-web.pdf>
- OFCOM (2015). [Available at: <https://www.ofcom.org.uk/about-ofcom/latest/media/media-releases/2015/cmr-uk-2015>]
- Payne, H. E., Lister, C., West, J. H., & Bernhardt, J. M. (2015). Behavioral functionality of mobile apps in health interventions: a systematic review of the literature. *JMIR mHealth and uHealth*, 3(1), e20. <https://doi.org/10.2196/mhealth.3335>
- Rabiee, F. (2004). Focus-group interview and data analysis. *Proceedings of the Nutrition Society*, 63(04), 655-660. <https://doi.org/10.1079/PNS2004399>
- Rideout, V. (2001). *Generation Rx. com: How young-people use the internet for health information*. Menlo Park, CA: Kaiser Family Foundation.
- Saldaña, J. (2015). *The Coding Manual for Qualitative Researchers*. London: Sage.
- Schepers, J. & Wetzels, M. (2007). A meta-analysis of the technology acceptance model: Investigating subjective norm and moderation effects. *Information and Management*, 44, 90-103. <https://doi.org/10.1016/j.im.2006.10.007>
- Sillence, E., Briggs, P., Harris, P.R. & Fishwick, L. (2007). How do patients evaluate and make use of online health information? *Social Science & Medicine*, 54, 1853-1862. <https://doi.org/10.1016/j.socscimed.2007.01.012>
- Smith, A. (2015). *US smartphone use in 2015*. [Retrieved from: <http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/>]
- Stok, F. M., de Vet, E., de Ridder, D. T., & de Wit, J. B. (2016). The potential of peer social norms to shape food intake in adolescents and young adults: a systematic review of effects and moderators. *Health Psychology Review*, 10(3), 326-340. <https://doi.org/10.1080/17437199.2016.1155161>
- Taiminen, H., & Saraniemi, S. (2018). Acceptance of online health services for self-help in the context of mental health: Understanding young adults' experiences. *Journal of*

Technology in Human Services, 1-15. <https://doi.org/10.1080/15228835.2018.1426081>

Tracy, S.J. (2013). *Qualitative research methods: Collecting evidence, crafting analysis, communicating impact* (1st Ed.). Chichester, West Sussex: Wiley-Blackwell.

Venkatesh, V., & Davis, F. (2000). A theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. *Management Science*, 46(2), 186–204.

<https://doi.org/WOS:000086130700002>

Yousafzai, S. Y., Foxall, G. R., & Pallister, J. G. (2007). Technology acceptance: A meta-analysis of the TAM: Part 2. *Journal of Modelling in Management*, 2(3), 281-304.

<https://doi.org/10.1108/17465660710834462>

Table 1. Participants attending a focus group or interview to discuss the NHSGo app.

Pseudonym	Age	Gender	Self-reported Ethnicity	Focus Group/Interview
Bill	16	Male	White English	Focus Group 1
Aafa	16	Female	Pakistani	Focus Group 1
Seth	16	Male	White English	Focus Group 1
Alisha	15	Female	Black British	Focus Group 1
Anna	15	Female	White British	Focus Group 1
Lakita	18	Female	Black Caribbean & Indian	Focus Group 2
Naomi	20	Female	White English	Focus Group 2
Ieasha	17	Female	Middle Eastern	Focus Group 2
Bob	20	Male	'Very mixed'	Focus Group 2
Sasha	22	Female	Bangladeshi	Focus Group 3
Tabatha	21	Female	Caribbean	Focus Group 3
Oadira	16	Female	African	Interview
Ellone	18	Female	White & Black African	Interview
Hazel	22	Female	White English	Interview
Adam	23	Male	White British	Interview
Liam	15	Male	White English	Interview
Lee	19	Male	White English	Interview
Seb	17	Male	White English	Interview
Margaret	25	Female	White Welsh	Interview
Jackie	18	Female	African	Interview
Sally	23	Female	White English	Interview
Brian	21	Male	Indian	Interview
Lisa	25	Female	Greek	Interview
Jack	25	Male	Asian	Interview
Lorelle	16	Female	Pakistani	Interview
Jay	21	Male	White Welsh	Interview

N.b. Participants self-reported their ethnicity.