Health promotion using smartphone apps for people who use communication supports

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Introduction

The work discussed here is investigating the role of technology in the delivery of health promotion information via smartphone technology for people with intellectual disabilities (ID) or mild cognitive impairments (MCI). It looks at access to technology by people with MCI and ID and currently available health apps for these client groups. The development and evaluation of two prototype health apps are described, specifically a health and fitness app and a photographic food diary app designed to meet the needs of these client groups.

Participants

The participants taking part in these investigations included people who used communication supports such as symbol-based boards and planners. They had associated conditions including:

- cognitive impairment associated with autism spectrum disorder and difficulties in processing information
- intellectual disabilities, with difficulties understanding or expressing themselves
- developmental disabilities and difficulties with communication
- literacy difficulties, with possible sensitivity about language simplification

People with acquired conditions (e.g. aphasia and dementia) were not included in these evaluations as the clinical considerations concerning their support are different to people with lifelong conditions.

Health Inequalities

Adults with mild ID and MCI have health inequities compared to the general population. They tend to be exposed to and affected by the most challenging determinants of health, such as poverty, poor diet and poor living conditions (Emerson & Baines, 2016). They are noted to have higher incidence of long term illness and additional conditions (Carey *et al.,* 2016) and their life expectancy is much lower (Emerson & Baines, 2010).

Access to health promotion is adversely affected by communication and literacy difficulties. For people with MCI and ID this may mean they are unable to read instructions on medicine bottles, understand appointment information, be unable to use web-based information or leaflets about the conditions they have or investigations they are about to receive. As a result people become reliant on others for their own self-management. This in turn assumes that carers, friends or relatives who support them are health literate also.

Using health apps to improve health and fitness

Higgins (2016) found that app technology was effective in improving patients' health outcomes. Fitness apps are very popular and accessed regularly by groups in the general population. For example, the use of health and fitness apps on Apple devices increased by 62% in 2014 compared to 33% for apps in general. There is evidence that the use of apps can improve health outcomes. In a trial of an app to increase the activity levels of people aged over 50 years, the group with the app improved by 178 minutes of activity compared to 80 minutes for the control group. Overall there are modest improvements in physical activity for the general population when using fitness apps (Coughlin *et al.,* 2016) and apps designed to improve diet and understanding of healthy foods were successful (Coughlin *et al.,* 2015). However, there is a need for apps to be designed to meet the needs of people who have specific requirements including those with literacy difficulties and difficulties in understanding.

Currently available apps are often too complex for a person with MCI or ID to use. Apps can require literacy skills to understand how the app works and to enter data or can require access to social media to get features of the app. The layout and navigation of an app can be complex, or the data gathered can be cognitively difficult to understand. Apps often use symbols which are too abstract. Aspects such as these may make an app difficult for a person with MCI or ID to use.

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Lussier-Desrochers *et al.* (2017) show there is a digital divide between connected citizens and people with ID. Examples of the use of technology to improve the health outcomes of people with disabilities can however be found; Pérez-Cruzado *et al.* (2013) describe a smartphone reminder app to improve people with ID's adherence to exercise and Lazar *et al.* (2018) designed an app to assist people with Down's syndrome to manage their nutritional habits and make healthy food choices.

Apps designed for people with ID or MCI should consider factors such as the following. User interfaces should be accessible and engaging. Messages should be made easy to understand, reducing reliance on reading and spelling and simplifying the language and vocabulary used. Navigation should be straightforward, reducing cognitive demands on the user. Apps should be independently usable, reducing the need for carer support. A reward system should acknowledge the user for achievement in a way that they find engaging and motivating. Care should be taken where abstract thinking is required, e.g. during design and evaluation, such that participants feel able to contribute easily their views in the development iterations of the apps being developed. Simplified language should be used throughout testing and evaluation with participants.

Mobile App Development for Special Populations

Two prototype health promotion apps were designed for people with MCI and ID, each with a main theme:

- health and fitness theme
- photographic food diary theme

The first app was designed to provide health-related messages and help users to register activities such as eating healthy foods, undertaking physical activity and drinking fluids in order to help them keep track of health-related activity and provide motivation for adopting healthier behaviour (Lloyd *et al.*, 2017). Symbols were used extensively throughout the interface design. A sample page from this app is shown in Figure 1. It shows the number of user steps counted by the app for the day, with a progress circle showing the achievement level for walking for that day. Rewards (bronze, silver and gold stars and trophies) are awarded for meeting targets, with the trophies being awarded for consistent cumulative performance. There is an option for audio output of results.

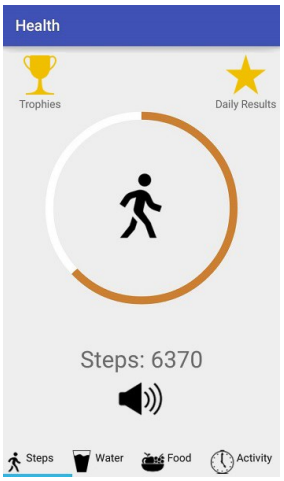

Figure 1: Prototype Health and Fitness app, in step-counting mode

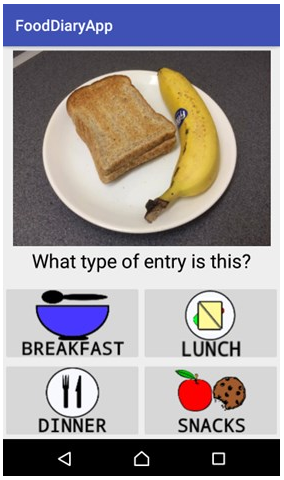

Figure 2: Prototype app to deliver dietary information and advice, with creation of Photographic Food Diary

A further prototype application (Figure 2) was developed to deliver dietary information and advice (e.g., Brown, 2016; NHS, 2016) to people with intellectual disabilities, facilitating the creation of a photographic food diary and giving targets for food consumption each day. Targets could be presented in a very visual way using images and symbols. The app could give information about healthier foods and drinks and ones to avoid, while also supporting user interaction with a dietitian. The user can photograph an item, specify whether it is food or drink, associate it with a meal type (breakfast, lunch, dinner or snack) and enter optional comments. The photograph and associated information can then be sent to the dietitian for review. A tutorial was included which could give feedback based on the user's recognition of fruit, vegetables, and healthy drinks.

Evaluation

Part of the process of taking part in evaluation requires participants to understand consent forms and information sheets. Such documents are usually text-based and express complex ideas about the processes involved; they were therefore adapted with symbols and simplified language to help make the evaluation process accessible and comprehensible to participants with ID and MCI. Simplifying language and using visual supports (symbols) to make these forms accessible meant that participants were able to understand the information and give consent to aspects of taking part in the evaluation. Symbols used were produced using Boardmaker for PCS™ symbols (© **tobii**dynavox).

In pilot evaluations, training was given to participants on using the apps and they were asked to use the apps to record information. They were then asked to complete adapted evaluation forms and give feedback about the apps using their preferred communication means. Carers were also asked for views and evaluations of the apps. Feedback indicated that the prototype apps had good potential for encouraging an improved approach to health-related matters for these populations. The first app (health and fitness theme) was approved by participants. It was said to improve motivation through the reward system, with the users also comparing their scores with each other. One participant would often walk rather than take the bus in order to increase their step count. Another said they were drinking more water as a result of using the app. Feedback indicated that the app had acceptable usability and could have a positive effect on health-related activities of people with MCI, encouraging a healthy lifestyle. The second app (photographic food diary theme) was also liked by participants who endorsed the number of symbols used in the interface, the large size of the interface buttons and the small amount of text used on it. The app was declared to be graphically well-designed and useful for people with a requirement for symbol access to information.

Conclusions

Prototype health apps have been developed for people with MCI and ID including health promotion messages which can be understood and used by people who need symbols to aid understanding. The prototype apps were designed to reduce the complexity of messages and made use of symbols which participants were able to understand. The apps also used simplified navigation processes to reduce cognitive load on the users and provided them with interfaces which had accessible on-screen keys of appropriate size. Feedback from participants indicated that the apps had good potential for encouraging better engagement with health-related issues for people with MCI and ID. Future developments would aim to refine the user interfaces and include further health promotion messages in the apps. Development of ways of involving participants more extensively in the design process could also be beneficial in making the apps more effective with this group of participants.

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