Evaluation of a web-based app to assist home-hazard modification in falls prevention

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Original citation:
Ward, G; Walker-Clarke, A. and Holliday, N. (2017) Evaluation of a web-based app to assist home-hazard modification in falls prevention *British Journal of Occupational Therapy* (in press). DOI: 10.1177/0308022617726243

https://doi.org/10.1177/0308022617726243

Title: Evaluation of a web-based app to assist home-hazard modification in falls prevention

Short title: Evaluation of an app to assist with falls prevention

Abstract

Introduction - Given the impact falls can have on older people and their families, many health and social care services are focused on preventing falls and implementing interventions to reduce future falls. FallCheck is a web-app that supports identification of home-hazards and directs users towards self-management strategies to reduce risk of falling.

Method - A survey of clinical experts of a beta version of FallCheck, collecting quantitative and qualitative data including issues and attributes identified by respondents.

Findings - Testing by health and social care professionals found there is scope for using the app as a digital self-assessment tool by people at risk of falls. It has further potential as an effective tool to support environmental/behavioural change to reduce risk of falls.

Conclusion – FallCheck was developed from a sound evidence-base to support home-hazard modification as an effective intervention component within a multifactorial intervention to prevent falls. Health and social care professionals found it had good acceptability for use in practice, justifying further testing of usability and effectiveness of the app in supporting behavioural changes and environmental modifications with people at risk of falling and carers.

Key words: falls prevention, home-hazards, health apps

Introduction

Home-hazard modification is identified as an effective fall prevention intervention when carried out in domestic home environments by an occupational therapist as part of a multifactorial intervention (NICE 2013, Pighills 2011, Costello & Edelstein, 2010). However, interventions are often poorly resourced and not implemented in practice. Innovative approaches, including digital technologies must be explored to enable best use of resources within fall prevention. Health and care industries are responding to increasing use of tablets and smartphones with health and wellbeing "apps" estimated to make up approximately 40% of those currently being developed (Smallman, 2012) and are increasingly used by health and social care professionals and service users (Jordan, 2014). This paper discusses the development of the FallCheck app that supports people at risk of falling (or their informal carers) to access information to facilitate home-hazard identification and modification. It is suitable for any internet-enabled device and can be downloaded free at www.coventry.ac.uk/fallcheck/. Hazards relevant to an individual's environment are selected, then the user is presented with simple behavioural and environmental changes to reduce or remove hazards, along with web-links to assistive technologies and products to support falls prevention. Signposting to other associations for help and advice including occupational therapy and telecare services is included.

Literature Review

Globally, falls are the second leading cause of accidental or unintentional injury deaths worldwide, with an estimated 424,000 individuals dying from falls each year.

Adults over 65 suffer the greatest number of fatal falls and 37.3 million falls are severe enough to require medical attention (WHO, 2012).

In the United Kingdom (UK), supporting people at risk of falling remains a challenge, and is estimated to cost the National Health Service £2.3 billion a year (NICE, 2013, p5). There are additional costs for social care and hidden impacts on individuals and families in terms of health, psychological and social well-being. By 2036, predictions suggest there could be up to 140,000 admissions per year due to hip fractures resulting from falls (Age UK and National Osteoporosis Society, 2012, p6).

Fall prevention strategies should emphasize education, training, creating safer environments, prioritizing fall-related research and establishing effective policies to reduce risk (WHO, 2012) and many UK health and social care services are focused on preventing future falls (Gillespie et al., 2012). A systematic review found home safety assessment and modification interventions carried out face to face in the person's home were effective in reducing rate of falls (RR 0.81, 95% CI 0.68 to 0.97; six trials; 4208 participants) and risk of falling (RR 0.88, 95% CI 0.80 to 0.96; seven trials; 4051 participants) (Gillespie et al 2012). The National Institute for Clinical Excellence guidelines (NICE, 2013) continues to support home-hazard assessment and modification as part of a multifactorial intervention and is also supported in other countries (Sadasivam, 2014). The use of home safety checklists, applied as screening instruments to identify home-hazards has been documented in the literature (Mackenzie, Byles & Higginbotham 2002). The NICE guidance (2013) emphasises that home-hazard assessment is effective in conjunction with follow-up and intervention at home, and evidence suggests that home safety interventions appear to be more effective when delivered by an occupational therapist (Pighills, 2011; Costello & Edelstein, 2010). The evidence based "Occupational therapy in the

prevention and management of falls in adults - Practice Guidelines" (College of Occupational Therapists, 2015, p2) include recommendations that service users who have fallen or are at risk of falls should be offered an occupational therapist-led home-hazard assessment, pre/post-discharge home assessments to reduce risk of falls following discharge; and those living in the community should be offered advice, instruction and information on assistive devices as part of a home-hazard assessment.

However, there is a gap in access to home-hazard assessment and intervention. Only 65% of hip fracture patients and 19% of non-hip fracture patients receive home-hazard assessment by an occupational therapist with less than half taking place in the patient's home (Royal College of Physicians 2011, p7). The scale and significance of fall-related intervention costs is exacerbated by pressure on available resources with budget restrictions and staff shortages, resulting in skills and knowledge being condensed into leaflets without follow-up in the patient's home.

Implementing preventative and self-management measures is now considered imperative in all areas of health. Assistive Technology (AT) is well embedded within fall management intervention, but largely as a reactive measure to a fall having occurred (i.e. equipment to assist with mobility and balance, personal alarms, fall detection devices). Only recently has practice moved into falls prevention via intelligent lifestyle and video monitoring systems, which may be used to proactively forewarn at-risk individuals prior to accidents occurring (Awang & Ward, 2011). There is a gap whereby digital technology could provide preventative assistance,

without need for monitoring, using a public health education approach to information provision to reach a wider public audience.

Smartphones have become an indispensable part of our daily lives. Adults aged 35-64 account for 53% of smartphone users, indicating that those who are most likely to be supporting older relatives, or approaching older age themselves are already familiar with these devices and will expect that health & wellbeing information is available via this technology (IPSOS MediaCT, 2013). The fastest growing group of smartphone users across the developed market are those aged over fifty-five years (Deloitte, 2015) and older age groups in the UK are catching up in the adoption of technology (OFCOM, 2015a, b) indicating older people are engaging with digital technologies, therefore this opens new possibilities for app-based health interventions.

Evaluating health apps aimed at encouraging behavioural change and awareness of health is a new issue facing researchers. Randomised controlled trials are often too costly and slow to be a feasible means of app evaluation given the rapid pace of development, updates, and often commercial interest (Kumar et al., 2013). Recent guidelines from the British Standards Institution (2015) were published to offer a framework for health and wellness app development , but offers developers limited direction in terms of evaluating interventions, other than to say evaluation should occur.

Usability of a product refers to a person being able to do what he/she wants to do with it, the way he/she expects to do it, without hindrance, hesitation or questions. To be useable, a product or service should be useful, efficient, effective, satisfying, learnable and accessible (Rubin & Chisnell, 2008 p4). These are key to adoption of

apps and must be considered at the development phase. However, evaluation must also explore “beyond usability” and include aspects such as ‘acceptability;’ that is, how acceptable the app is to users as a means of achieving their goal (Jordan, 1998) and design of the product (Green & Jordan, 2002).

Ease of use and intuitiveness are important for users who may have limited digital skills; e.g. older users and some of the health and care workforce (Boulos et al., 2011). Additionally, it is recommended that health professionals are included in iterative co-design processes to ensure the app is not only theoretically sound, but works practically within a real-world environment and meets intended users’ needs (Broderick, 2014; Kratzke & Cox, 2012). This is where usability and feasibility studies, which utilise co-design with health professionals and potential end-users, become essential to app development (Kratzke & Cox, 2012; Aitken & Gauntlett, 2013). User star ratings (e.g. ratings ranging from 0 to 5) are generally not focused on accuracy of information or the evidence-base supporting an app, but are helpful in determining usability and functionality. Average rating scores provide a relative measure of popularity and/or longevity of the app (Boudreaux et al., 2014). Following this, the researchers focussed on evaluating acceptability of the app in terms of ease of use, usefulness, ease of learning and satisfaction with the app prior to testing usability and effectiveness of the intervention with the end users.

FallCheck App Development

App development and testing was led by Coventry University through the ‘Innovation in supporting people at risk of falling’ study (http://www.coventry.ac.uk/research/research-directories/current-

projects/2015/fallcheck/) funded by West Midlands NHS Regional Innovation Fund. Previous research (Ward, Holliday, Fielden et al., 2012) involving older people, carers and telecare professionals found an appetite for a wider range of resources, (including apps), to support people at risk of falling, and their families (Holliday, Ward, Fielden, et al., 2015). Although the FallCheck app is aimed at the person who is worried about falling (or their informal carer who may be worried about them), it was recognised that health and social care professionals are often the gatekeepers to health information sources, and their role in signposting people and families to information resources is key. For occupational therapists to embed the app within practice and recommend its use, it was considered essential that they have confidence in the app content and its relevance to practice. Therefore, development of the first iteration of the app included professionals involved in falls management/prevention prior to involving the intended end-user, the person at risk of falls and/or their carer.

Identifying the foundational tool

To develop the app content, two expert fall practitioners and an academic occupational therapist reviewed the most widely used home safety assessment tools including The Westmead Home Safety Assessment (Clemson, Fitzgerald & Heard, 1999) and SAFER tool (Letts, Scott, Burnley et al., 1998). The Falls and Accidents Screening Tool (HOMEFAST) (Mackenzie, Byles & Higginbotham, 2000) showed most appropriate content, ease of use and appropriate completion time for use in an app format. To develop the HOMEFAST tool, Mackenzie, Byles & Higginbotham (2000) reviewed and evaluated seven of the main home safety assessment tools used in practice and published evidence of its reliability. Acceptable kappa scores for inter-rater reliability with further testing in 2012 (Vu and Mackenzie) indicated that the

HOMEFAST tool could be used by a range of people from a variety of professional and non-professional backgrounds and was considered to provide the most robust template from which to develop the content of the FallCheck app. To optimise the HOMEFAST tool for user experience, the wording was revised and adapted to fit screen optimisation required for using an app, and additional fields were added that related to assistive technologies. How this affects the previously established reliability for the HOMEFAST tool is not known and still to be tested.

Initial Tool development

With a modest development budget and need to reach a wide end-user group (older people and families), an information based web-app that operates on any web-enabled platform (i.e. Apple, Android, Blackberry) or device (smartphone, tablet, PC) was created. This was contrasted with the option for a 'gaming' format, which was not judged as good a fit with the intended app function of providing information to the end-users. Others (Marston et al., 2015, Ejupi et al., 2016) have focused on gaming for older people in relation to reducing all risk through improving physical activity as opposed to risk assessment. Whilst serious games demonstrate an effective medium for behavioural change with specific users (Kato, 2010), there has been no evidence thus far to suggest it is an effective medium for older people and/or home-hazard identification and modification, with some authors finding that older people view digital games as childish (Sayago, Rosales & Righi, 2016). In addition, game programming/development is costly and time consuming (Kato, 2012) and therefore a pragmatic approach was taken in construction of FallCheck.

One of the unique features of an occupational therapist-led home environmental assessment when compared with an information leaflet is the personalisation of the

person, environment and occupation that occurs through the therapist selecting the features of the person's home, the occupations that they wish to carry out and the provision of tailored fall prevention advice. These personalisation features were crucial to deliver in a technological substitution to improve on the effectiveness of a non-personalised leaflet. Therefore, a menu structure was created that offered selection of only those hazards that are relevant to an individual's environment, identified through a simple 'yes/no' answer. Within FallCheck if the answer is 'yes', the user taps the screen to add this hazard to their individual checklist which is saved to act as a reminder of the potential hazards and actions to be taken. The content is based on simple behavioural and environmental change solutions to reduce/remove the hazard along with web-links to low-tech AT solutions, and signposting.

Aims of the study

Investigation of how technology could support change in professional practice approaches provided the underpinning research question. The study aimed to develop a contemporary approach to falls prevention intervention by testing an app with health and social care professionals that assists individuals at risk of falling in identifying home-hazard fall risks relevant to their own home environment.

The objectives were to;

- Evaluate acceptability of the app in terms of ease of use, usefulness, ease of learning, and satisfaction with the app with health and social care professionals
- Assess the content of the FallCheck app

Method

Ethical approval was given by Coventry University's Ethics Committee. Informed consent was obtained from all participants who were assured of their rights of anonymity, confidentiality and that they were free to withdraw from the study at any time without giving a reason.

The study used an online survey to collect quantitative and qualitative data from clinical experts that downloaded and trialled the app. Further issues and attributes related to content features were identified using open questions.

Participant recruitment

Participants were recruited via gatekeepers of a regional falls network mailing list of tele-healthcare professionals that included occupational therapists and falls prevention experts. No personal details were shared with researchers – interested participants were asked to contact the researchers directly for further information. Recruitment used a snowballing approach as those initially contacted passed on details of the study to other relevant contacts. Participants who returned their survey entered prize-draw in recognition of their contribution to the study. All participants were required to have access to their own internet-enabled device throughout the trial period.

Procedure and data collection

Once participants had provided consent to take part they were sent instructions on how to download the app to their device, and were asked to use it over a two-week period as part of their normal work. Participants were sent a link to the survey hosted

via Bristol Online Surveys (University of Bristol, 2016) to evaluate the app (from their own perspective rather than a service user/family member). The survey was based on the 30-point USE Questionnaire, which was developed to assess Usefulness, Satisfaction and Ease of Use of consumer interfaces – metrics of user experience that may be closely associated with purchase and use decisions (Lund, 2001). Using a Likert rating scale, 20 questions in 4 sections explored; ease of use (5 questions), usefulness (6 questions), ease of learning (3 questions) and satisfaction (6 questions) with using the app. The USE Questionnaire was adapted from a 7-point Likert scale to a 5-point Likert scale to provide ratings in keeping with consumer app-store evaluations (Boudreaux et al., 2014), which provide 5-point 'star ratings'. Six further targeted open questions considered the content features of the app and offered an opportunity for participants to expand their views (see Figure 1).

(Insert Figure 1 here)

A total of 126 responses were received from the open questions, spread across all 6 questions, the lowest response being 13/27 responses and the highest 27/27 responses.

Data Analysis

The quantitative survey data were analysed using descriptive statistics. Percentages for participants strongly agreeing or agreeing with the statement were combined to give an overall figure of positive agreement of acceptability for that item. More than 60% overall agreement (i.e. the majority of participants agreed) was considered acceptable for each item by the research team. Star-ratings were based on modal responses from the participants. The mode is the most appropriate measure of central tendency for nominal/categorical data where we wish to know the most

common category (Cambliss and Schutt, 2016). Where the total response for each rating differed by only one or fewer responses, a ‘half star’ rating between the two stars was used as is commonly seen in app stores. Data from open questions were analysed using thematic analysis (Green and Thorogood, 2014). The qualitative data were read, re-read then coded and collated under the items related to acceptability; ease of use, usefulness, ease of learning, and satisfaction. A second researcher confirmed the coding. Additional data arose that related to appearance, checklist function, use of the app by professionals, and areas for development.

Results

Response rate

It is unclear as to how many individuals the call for participants reached using the snowball technique, however thirty-six individuals signed up to take part in the study, and twenty-seven respondents took part in the final evaluation survey. The reasons 9 people dropped out and did not take part in the survey are unknown.

Participants

Healthcare professionals, including occupational therapists, were the largest group of participants (N=10), followed by those in a social care role (N=9). Job roles included health and social care professionals (e.g. Occupational Therapists and Social Workers), Local Authority employees (e.g. service commissioners/community alarm providers), Assistive Technologists and Fire Safety Officers.

Devices Used in the study

Most users used the app on a smartphone (N=22) rather than a tablet (N=10), although it should be noted that some used the app on more than one device. Apple (N=22) devices were the most commonly used, followed by Samsung (N=4), Sony and HTC (N=2), Nokia and Blackberry (N=1).

Acceptability: Ease of use, ease of learning, usefulness, and satisfaction with the app

Table 1 presents the responses to the items on ease of use, ease of learning, usefulness, and satisfaction with the app for all respondents, together with the user star ratings. As discussed earlier, user ratings are generally not focused on the accuracy of the information, but can be helpful in determining usability and functionality. All but one of the items received a modal star rating of 4 stars.

Table 1: Ratings for Ease of use, ease of learning, Usefulness and Satisfaction, and resultant modal star ratings

(Insert Table 1 here)

Ease of use

Ninety-two percent positively agreed that the app is user friendly and 85% positively agreed that they could use it successfully every time. In terms of what they would expect the app to do, 67% positively agreed that it did everything they expected the app to do. None of the items were below the 60% acceptability level.

This was corroborated by qualitative data provided by participants as to what aspects of the app they particularly liked;

"Its simplicity is a key feature, ease of use." [SC02]

Several participants stated that the layout contributed to making the app easy to use;

"[I liked] the easy to use sections … the app was well set out." [NX02]

Participants confirmed that they liked the way the app was split into different rooms in the home making it easy to identify risks;

"I liked the way you can travel through the different rooms in the house, including access to the property, therefore identifying risks throughout the home." [HP03]

Ease of learning

Ninety-eight percent positively agreed that they learned to use it quickly and 93% positively agreed that the instructions were easy to follow. In addition, all participants found it easy to remember how to use the app. None of the items were below the 60% acceptability level. Again, participants' qualitative comments supported this data;

"*The app was self-explanatory." [NX02]*

Usefulness

Participants were asked to rate how useful they found the app; 96% positively agreed that the app was useful. However, three of the items fell below the 60% acceptability level for overall agreement; "It meets my needs" (55%), "It saves time" (52%) and "I could use this in my job" (45%). In contrast 100% positively agreed that it would help someone identify falls risks in the home with a further 71% positively agreed that the app would meet the needs of those at risk of falling.

Satisfaction

Participants were asked to rate to their satisfaction with the app. None of the items were below the 60% acceptability level, with 85% positively agreeing they were satisfied with the app and 70% positively agreeing that it worked the way they expected it to. This was supported by qualitative data from participants;

"Very easy app; pleasant, loads quick." [NX01]

"It did exactly what it needs to do." [SC02]

A total of 85% positively agreed that they would recommend the app to colleagues but more importantly, 93% positively agreed they would recommend the app to service users/carers;

"I would definitely give it to informal carers to look at themselves and reduce their own falls risks." [HP10]

Content of the FallCheck app

Qualitative data were analysed and responses indicated participants liked the concept and the content was comprehensive;

"Grouping of hazards is good and all major risks are included." [HP04]

"The topic areas were comprehensive." [HP09]

"I can see its value in supporting staff who are not familiar with falls causation and prevention, or citizens for self-assessment." [SC02]

The links to external sites for further information on hazard reduction were another popular content feature;

> *"It's good that includes links to suggested equipment to manage the hazards identified." [AT01]*

A few participants suggested that they would like to see additional content;

> *"Some information about falls and the damage they can do and why we should all be mindful." [HP02]*

> *"There could have been more mention of hazards of standing … if you have balance issues […] little mention of trolleys/walking frames/stair lifts as a solution" [LA01]*

Several other issues and attributes arose from the analysis of the qualitative data:

Strengths of the app

Participants generally found the app attractive and liked the use of photographs depicting areas throughout the home;

> *"I like the fact that it has pictures to visualise risks in the home environment." [HP05]*

It was clear that participants liked the checklist function; specifically, that a user could determine which risks were relevant to them;

"The fact you can choose which category you want to complete and that you don't have to complete them all. Also, you can revisit as you choose and your options are saved. I also like that it tells you which items are added to the checklist so you know you don't need to add again." [LA01]

Although the app is intended for people at risk of falls or their carers to use, some participants suggested that the app could also be a useful tool for professionals;

"[The app is] useful as a reminder or prompt for existing staff." [SC03]

Areas of concern

Some participants raised concerns about the potential end-users of the app (i.e. older adults and carers) having an increased likelihood of visual and dexterity difficulties, and that changes to optimise the app for this user group were required;

"It may be beneficial to add an easy accessibility mode for those with a visual impairment (possibly fewer images and larger print option?)" [HP08]

Participants felt the app was easier to use on a tablet than on a smartphone, because of the larger screen;

"*It is easier to use on the iPad rather than the iPhone. Not very clear on the smaller screen […] not very user friendly on a phone due mainly to screen size […] more successful on iPad." [HP01]*

In recognition that at present, the app was aimed at non-professionals within a single individual's home, participants felt that functionality would need to be extended if it

were to be used by professionals by being able to create multiple checklists for different clients or patients;

> *"I would add the facility to store multiple checklists for when more than one visit is being conducted so that these can be reviewed again later." [SC09]*

Required improvements to the app

Some participants wanted to see the checklist adapted to make it clearer to the user to when they had completed the entire assessment,

> *"When you go through the different rooms, at the end you should be able to press 'Finish' or 'Complete' etc. and go straight to the checklist…, it makes you think that you haven't completed the assessment." [SC06]*

It was also suggested that having the ability to attach photographs or email or print the results of different assessments might be useful as evidence of the hazards observed;

> *"Ability to add a photograph - may need to call in a specialist service." [NX01]*
>
> *"Would it be possible to provide option to send checklist to an email address in order to print it out?" [LA02]*

Some improvements were suggested to improve navigability of the app. Participants felt that the start/home page needed modification and similarly, some participants found navigation back to other parts of the app from the checklist and the additional resource links somewhat difficult.

Others stated they would like to see these links improved by directing users to specific websites or more localised information.

Based on this data, several changes (Figure 2) were made to the next iteration of the app (within the feasibility of the web-app technology environment) prior to usability testing by people at risk of falling and their carers.

(Insert Figure 2 here)

Discussion

This study demonstrates that there is scope for a digital self-assessment tool to assess home-hazard risks. Results suggest that health and social care professionals feel the FallCheck app may be appropriate for end-users to self-assess their home for fall hazards. It was clear they found it easy to use, easy to learn and were satisfied with the way it worked. Three items that related to usefulness of the app fell below the 60% acceptability level for overall agreement; “It meets my needs”, “It saves time” and “I could use this in my job.” However, as the app is intended for use by people at risk of falling and their carers rather than health or social care professionals directly, these questions may have had less relevance to health and social care participants. Nonetheless, some did see an application for use of the app as a tool for staff to use in practice, albeit that additional functionality would be required (i.e. the ability to save and store multiple checklists for different clients).

Implementing evidence-based occupational therapy practice often depends on successful behaviour change interventions to support people to make changes to their daily living habits and routines. This requires an appropriate method for characterising interventions and linking them to an analysis of the targeted behaviour, in this case the end-user making changes to their home environment or adopting safer methods of carrying out activities of daily living to reduce risk of falls. Behavioural change models may provide indications of how and why FallCheck may result in behavioural change. For example, the COM-B Model of Health Behaviour (Michie, van Stralen, & West 2011) suggests that behavioural change is most likely to occur when one or more components of behaviour are altered. These are: capability (the psychological or physical ability to enact the behaviour); opportunity (the reflective and automatic mechanisms that activate or inhibit behaviour) and motivation (the physical and social environment that enables the behaviour). Given that falls prevention requires a multi-factorial intervention for a multi-factorial problem, the FallCheck app could be integrated into existing interventions and enhance the effectiveness of home-hazard modification strategies that are currently delivered in the person's own home via information leaflets. Similarly, as the focus of public health shifts from rehabilitation to prevention and self-management, FallCheck provides a method by which those at risk may self-educate about their falls risk within their own home, and increase their sense of autonomy and self-efficacy, and therefore overall wellbeing. By reducing reliance on statutory care there is also the potential for reduced falls-related costs to health and social care services.

Occupational therapists have an interest in recommending apps as part of their intervention and, health promotion organisations may want to provide

recommendations regarding health apps as part of their services (West, 2012). However, decisions over which app and where to embed apps within care pathways is one that requires further exploration within clinical teams and service users. Guidance on how to judge the validity/worth of apps is lacking (Powell, Landman and Bates, 2014) and the decision to recommend an app may have serious consequences if content is inaccurate, ineffective or harmful. Boudreaux et al (2014) provides a useful summary of strategies to assist health and care professionals evaluate and select publicly available apps targeting health behaviour or health maintenance. This includes reviewing app descriptions, user ratings, and reviews, piloting of the apps, and eliciting feedback from end-users.

Future development of the FallCheck app

As these findings are based on data from health and social care professionals; the next stage of this iterative development process is to test usability and acceptability of the app with end-users (people worried about falling and their family/carers). Implementing evidence-based occupational therapy often depends on successful behaviour change interventions to support people to alter their daily living habits and routines, therefore the potential of the FallCheck app to affect behaviour change in those at risk of falls must also be explored. A usability study including a “Think-aloud” evaluation (Olmsted-Hawala et al 2010) and guided by the COM-B model to reflect on whether the FallCheck app influences all three components of behaviour change is currently underway and results will be reported in the near future.

Limitations of the study

One of the limitations of the study is that it is not known how many times each participant used the app over the 2-week evaluation period, some may have used it several times giving a more thorough evaluation than those who used it once and whilst it was clear that some participants used the app in a practice context, not all did. The USE evaluation tool although appropriate for assessing usability, (Lund, 2001) lacks evidence of psychometric properties. It was adapted for use within this study, and testing was not carried out prior to use which may therefore affect reliability of the survey. As previously discussed, the app is designed to be used by non-professionals as opposed to the targeted professional group in this study. However, utilising professional viewpoints to evaluate the app is not unfounded in terms of their ability to address any content issues, or usability issues for their client group. This limitation will be addressed in the next evaluation of the app by end-users.

Conclusion

FallCheck is a web-app that supports the identification of home-hazards and directs the user towards self-management strategies to make their home safer to reduce falls risk. Testing of the FallCheck app with health and social care professionals has shown that there is scope for its use as a digital self-assessment tool to identify home-hazards, and indicated that the FallCheck app may be appropriate for self-assessment of home-hazards. It has been developed from a sound evidence base that supports home-hazard modification as an effective component within a multifactorial intervention to prevent falls. This paper has introduced the app as an effective tool for behavioural change using the COM-B Model of Health Behaviour

(Michie, van Stralen, & West, 2011) and this will be further explored during end-user testing and evaluation of the app.

With increased interest in using apps to support intervention there is a need to consider strategies to assist health and care professionals to evaluate and select publicly available apps that target health behaviour or health maintenance to ensure they are of high quality and meet the needs of the target user group. Decisions regarding which app and where to embed apps appropriately within care pathways is one that requires further exploration within clinical teams and end-users.

Key Findings:

- FallCheck has good acceptability and ease of use as assessed by health/social care professionals and is relevant to occupational therapy
- It has potential as an effective tool to support environmental/behavioural change

What the study has added:

This is the first European study to evaluate a web-based app to support home-hazard modification and self-management intervention to prevent falls at home.

Acknowledgements: The authors would like to thank the West Midlands Regional Falls Network and the participants for their contributions to the development of the app.

Research ethics: Ethical approval was obtained from Coventry University Ethics Committee (Reference number P3210, February 2012). All participants provided written informed consent

Declaration of conflicting interests: The authors confirm that there is no conflict of interest.

Funding: This research was funded by the West Midlands NHS Regional Development Fund and Coventry University.

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APPENDICES

Figure 1: Qualitative questions

These questions followed the scaled questions, and were all free text answers:

1. Is there anything you would change about this app?
2. Is there any feature of this app that you particularly like?
3. Is there any feature of this app that you particularly dislike?
4. Where would you expect to find out about this app?
5. How often would you use this app?
6. Do you have any further comments about this app?

Figure 2: Amendments made to FallCheck app

- **Spelling, grammar and wording** checked and reworded for clarity
- **External links improved** where appropriate, external links were changed to more appropriate websites.
- **Marketing via health and social care agencies** promoted
- **Clearer instructions for use,** wording amended to increase clarity.
- **External links losing place within app** – links now open in new browser windows, and instructions given to simply close the new browser window to return to the app.
- **Optimized for visually impaired users**
- **Causes of falls** – new section added to provide some information and signposting to get support where necessary.
- **Addition of a 'No' or 'Not Applicable' check for each item** –existing check button was changed to indicate that an item/hazard had been added to the checklist

Table 1: Ratings for Ease of use, Ease of learning, Usefulness, and Satisfaction, and modal star ratings

Please rate how much you agree or disagree with these statements N=27	**5 Strongly Agree (SA)**	**4Agree (A)**	**3 Neither (N)**	**2 Disagree (D)**	**1 Strongly Disagree (SD)**	**Mode and star rating**
Ease of use						
a. It is user friendly Overall agreement SA/A = 92%	9 33%	**16 59%**	1 4%	1 4%	0	4
b. It requires the fewest steps possible to do what I want to do with it Overall agreement SA/A = 81%	6 22%	**16 59%**	2 7%	3 11%	0	4
c. I did not notice any inconsistencies when I used it	7 26%	**16 59%**	2 7%	2 7%	0	4

Overall agreement SA/A = 85%						
d. It does everything I would expect it to Overall agreement SA/A = 66%	6 22%	**12** **44%**	7 26%	2 7%	0	4
e. I can use it successfully every time Overall agreement SA/A = 85%	11 41%	**12** **44%**	2 7%	2 7%	0	4
Ease of learning						
a. The instructions were easy to follow Overall agreement SA/A = 93%	7 26%	**18** **67%**	1 4%	1 4%	0	4

b. I learned to use it quickly Overall agreement SA/A = 98%	11 41%	**15** **56%**	1 4%	0	0	4
c. It is easy to remember how to use it Overall agreement SA/A = 100%	11 41%	**16** **59%**	0	0	0	4
Usefulness						
a. It is useful Overall agreement SA/A = 96%	7 26%	**19** **70%**	0	1 4%	0	4
b. It meets my needs Overall agreement SA/A = 55%	2 7%	**13** **48%**	9 33%	2 7%	1 4%	4
c. It saves time	3 11%	11 41%	**12** **44%**	1 4%	0	3

Overall agreement SA/A = 52%						
d. I could use this in my job Overall agreement SA/A = 45%	4 15%	8 30%	**13** **48%**	2 7%	0	3
e. It would help someone to identify falls risks in the home Overall agreement SA/A = 100%	11 41%	**16** **59%**	0	0	0	4
f. It meets the needs of those at risk of falling Overall agreement SA/A = 71%	4 15%	**15** **56%**	4 15%	4 15%	0	4
Satisfaction						

a. I am satisfied with it Overall agreement SA/A = 85%	3 11%	**20** **74%**	2 7%	2 7%	0	4
b. It works the way I want it to work Overall agreement SA/A = 70%	3 11%	**16** **59%**	7 26%	1 4%	0	4
c. It did what I expected it to do Overall agreement SA/A = 75%	5 19%	**15** **56%**	6 22%	1 4%	0	4
d. I would keep it on my device Overall agreement SA/A = 74%	3 11%	**17** **63%**	5 19%	2 7%	0	4

e. I would recommend it to a colleague Overall agreement SA/A = 85%	6 22%	**17** **63%**	3 11%	1 4%	0	4
f. I would recommend it to a service user and/or carer Overall agreement SA/A = 93%	10 37%	**15** **56%**	1 4%	1 4%	0	4