

Project Proposal

26 July 2026 7:06 PM

UNIVERSITY OF WALES TRINITY SAINT DAVID

ACCA5033

Changemakers: Creativity and Value Creation

Assignment 1: Innovation and Research

PROJECT PROPOSAL

Design and Evaluation of an Accessible Smart Home Support System for Older Adults and Family Carers

Responsive Web Application Prototype

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BSc (Hons) Applied Computing

E-portfolio URL: Site Under Construction

Note on Word Count:

The total word count may appear higher because of the separate Reference List for each task, additional Mind Map text, Appendix B elaboration and supporting explanations. The main written proposal has been kept as close as possible to the required word limit.

Task 1: Ideation and Mind Map

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Task 1: Ideation and Mind Map

Project Proposal: Design and Evaluation of an Accessible Smart Home Support System for Older Adults and Family Carers



Reference list

- 1 Majumder, S., Aghayi, E., Noferesti, M., Memarzadeh-Tehran, H., Mondal, T., Pang, Z. and Deen, M.J. (2017) 'Smart Homes for Elderly Healthcare: Recent Advances and Research Challenges', *Sensors*, 17(11), 2496.
- 2 Nardi, P.M. (2017) *Critical Thinking: Tools for Evaluating Research*. Oakland: University of California Press.
- 3 Office for National Statistics (2023) *Unpaid care, England and Wales: Census 2021*. Newport: Office for National Statistics.
- 4 Peek, S.T.M., Wouters, E.J.M., van Hoof, J., Luijkx, K.G., Boeije, H.R. and Vrijhoef, H.J.M. (2014) 'Factors influencing acceptance of technology for ageing in place: a systematic review', *International Journal of Medical Informatics*, 83(4), pp. 235–248.
- 5 W3C (2024) *Web Content Accessibility Guidelines (WCAG) 2.2*. W3C Recommendation.
- 6 W3C WAI (2025) *Older Users and Web Accessibility: Meeting the Needs of Ageing Web Users*. World Wide Web Consortium.

Ideation and Mind Map

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TASK 1: IDEATION AND MIND MAP

Central idea: Creativity, innovation and value creation

Innovation can be understood as the practical application of a new or improved idea that creates value for individuals, organisations or society. In Applied Computing, innovation does not always require inventing completely new technology. It may involve combining existing technologies in a more accessible, affordable or user-centred way. Digital innovation can improve communication, automate routine tasks and widen access to services. However, technology creates meaningful value only when it responds to genuine human needs. Critical thinking is therefore needed to consider both benefits and unintended consequences (Nardi, 2017).

Branch 1: Social problem and opportunity

The proposed area is the use of smart home and web technologies to support older adults who wish to remain safe and independent at home, while also assisting family carers. This is a socially significant area because approximately five million people in England and Wales reported providing unpaid care in the 2021 Census (Office for National Statistics, 2023). Smart home systems can use sensors, reminders, alerts and connected devices to support safety, health monitoring and everyday activities. Research suggests that such technologies may help with ageing in place, but their success depends on usability, affordability, privacy and acceptance by users (Majumder et al., 2017; Peek et al., 2014).

Branch 2: Applied Computing interests

The project connects several areas of Applied Computing. These include responsive web development, human-computer interaction, user experience design, accessibility, databases, Internet of Things concepts, cybersecurity and data privacy. My interest is not simply in connecting devices, but in designing an interface that presents information clearly to people with different levels of digital confidence. Older users may experience reduced vision, hearing, dexterity, concentration or short-term memory. The World Wide Web Consortium explains that these needs overlap strongly with established digital accessibility requirements (W3C WAI, 2025). This creates an opportunity to apply computing knowledge in a socially responsible way.

Branch 3: Initial project ideas

Several related ideas were considered. The first was a medication reminder application that would notify an older person and a family carer when a dose was due. The second was a home safety dashboard showing doors, temperature, movement and smoke alarm status. The third was a family care coordination system containing appointments, routine tasks and notes. The fourth was an emergency alert interface that would display simple instructions and contact options. Each idea has value, but a single-purpose system may not reflect the connected nature of daily care. A combined support dashboard would allow these functions to be explored within one coherent prototype.

Branch 4: Selected project idea

The selected idea is "Design and Evaluation of an Accessible Smart Home

Support System for Older Adults and Family Carers". The proposed output will be a responsive web application prototype rather than a fully deployed medical or Internet of Things product. It will display simulated smart home information and allow users to explore features such as daily reminders, simple wellbeing check-ins, home status summaries, unusual activity alerts, emergency contacts and a family carer view. The prototype will use large controls, clear language, strong contrast, consistent navigation and adjustable accessibility options. It will be designed in line with relevant Web Content Accessibility Guidelines, particularly the principles of being perceivable, operable, understandable and robust (W3C, 2024).

Branch 5: Stakeholders and value

The primary stakeholders are older adults and family carers. Secondary stakeholders could include care staff, local authorities and technology-enabled care providers. For an older adult, the potential value is greater confidence and independence. For a family carer, value may come from clearer communication, fewer unnecessary checks and quicker awareness of a possible problem. The design must avoid replacing human care. Instead, it should support relationships and improve access to useful information.

Branch 6: Design thinking and constraints

A design thinking process will guide the project. The empathise stage will investigate the needs and concerns of older adults and carers. The define stage will convert these findings into a clear problem statement. The ideate stage will generate and compare interface solutions. The prototype stage will create a responsive web application, and the test stage will collect usability feedback. Important constraints include privacy, consent, digital exclusion, false alarms, internet reliability and the risk of presenting inaccurate information. These constraints must shape responsible design. The final concept is an accessible, privacy-aware and user-centred prototype that explores how computing can create practical social value.

Task 1 Reference List

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Reference List

Majumder, S., Aghayi, E., Noferesti, M., Memarzadeh-Tehran, H., Mondal, T., Pang, Z. and Deen, M.J. (2017) 'Smart Homes for Elderly Healthcare: Recent Advances and Research Challenges', *Sensors*, 17(11), 2496.

Nardi, P.M. (2017) *Critical Thinking: Tools for Evaluating Research*. Oakland: University of California Press.

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Peek, S.T.M., Wouters, E.J.M., van Hoof, J., Luijkx, K.G., Boeije, H.R. and Vrijhoef, H.J.M. (2014) 'Factors influencing acceptance of technology for aging in place: a systematic review', *International Journal of Medical Informatics*, 83(4), pp. 235–248.

W3C (2024) *Web Content Accessibility Guidelines (WCAG) 2.2*. W3C Recommendation.

W3C WAI (2025) *Older Users and Web Accessibility: Meeting the Needs of Ageing Web Users*. World Wide Web Consortium.

Research Area and Research Question

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TASK 2: AIM, OBJECTIVES AND RESEARCH AREA

Research area and research question

The project sits at the intersection of human-computer interaction, accessible web development, smart home technology and technology-enabled care. Smart home research often concentrates on sensors and automated monitoring, while user-facing information receives less attention. Marikyan, Papagiannidis and Alamanos (2019) argue for greater attention to the user perspective. Acceptance among older adults also depends on usefulness, ease of use, support, privacy and personal circumstances (Peek et al., 2014). The proposed project will therefore focus on the interface through which an older adult and a family carer understand and respond to simulated smart home information.

The main research question is:

How can a responsive and accessible web application be designed to present smart home support information clearly and usefully to older adults and family carers?

Project Aim and Objectives

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Project aim

To design and evaluate a responsive web application prototype that provides accessible smart home support information for older adults and family carers, with particular attention to usability, accessibility, privacy and perceived usefulness.

Project objectives

1. To review academic and professional literature on smart homes, ageing in place, family caregiving, accessibility and user acceptance.
2. To identify the most important user requirements for an older-adult view and a family-carer view through a small mixed-method data collection exercise.
3. To create user personas, user stories and a prioritised requirements list based on the literature and participant feedback.
4. To design and develop a responsive web prototype containing simulated reminders, home status information, alerts, wellbeing check-ins and emergency contact features.
5. To evaluate the prototype against selected WCAG 2.2 Level A and AA criteria and through task-based usability testing.
6. To analyse quantitative and qualitative feedback, identify limitations and recommend improvements for a future working system.

Research Philosophy

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Research philosophy

Pragmatism is the most appropriate research philosophy for this project. Pragmatism begins with the research problem and selects methods according to their usefulness in answering the question. It does not require the researcher to treat quantitative and qualitative approaches as competing positions. This is suitable because the project needs numerical evidence, such as task completion rates and usability scores, as well as qualitative explanations of what participants find confusing, reassuring or useful. Creswell and Creswell (2018) describe mixed-method research as a way of combining the strengths of quantitative and qualitative evidence. A pragmatic position also fits the practical purpose of producing and improving a prototype.

The project will use an iterative, user-centred approach. Literature will inform initial requirements, questionnaires and interviews will explore priorities, and usability tasks, the System Usability Scale and open questions will assess the prototype. The intention is not to prove that the prototype improves health or prevents emergencies. Instead, it is to investigate whether the proposed interface is understandable, accessible and potentially useful.

Search Tools, Databases and Search Strategy

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Search tools, databases and search strategy

Research will be located through a combination of academic databases and authoritative professional sources. Google Scholar will be used for broad discovery and citation tracking. IEEE Xplore and the ACM Digital Library will support searches related to software, Internet of Things, human-computer interaction and interface design. Scopus and ScienceDirect will be used to identify multidisciplinary and peer-reviewed studies. PubMed will be searched for research concerning older adults, ageing in place, assistive technology and carers. Authoritative standards and guidance will be obtained from the World Wide Web Consortium, the Information Commissioner's Office, the Office for National Statistics and GOV.UK.

Searches will use Boolean operators, phrase searching and truncation. A typical search string will be:

("older adult*" OR elderly OR ageing) AND ("smart home" OR "Internet of Things" OR "assistive technolog*") AND (accessib* OR usability OR "user-centred design") AND (caregiver* OR "family carer*")

Additional searches will combine terms such as "responsive web application", "technology acceptance", "ageing in place", "privacy", "telecare", "WCAG" and "usability testing". Inclusion criteria will prioritise English-language peer-reviewed research, relevant systematic reviews, studies involving older adults or carers, and authoritative standards. Recent research from approximately 2014 onwards will be prioritised, while older influential sources may be included for established methods such as the System Usability Scale. Studies focused only on hospital systems, robotics or complex clinical diagnosis will be excluded unless they provide directly relevant design or ethical insights.

A search record will document the database, search string, date, filters and reasons for selecting sources. Backward and forward citation searching will identify earlier and newer relevant work. Sources will be assessed for relevance, methodological quality, sample characteristics and possible bias. This structured strategy will improve transparency and help ensure that the design is based on credible evidence.

Task 2 Reference List

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Task 2 Reference List

Creswell, J.W. and Creswell, J.D. (2018) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 5th edn. Los Angeles: SAGE.

Marikyan, D., Papagiannidis, S. and Alamanos, E. (2019) 'A systematic review of the smart home literature: a user perspective', *Technological Forecasting and Social Change*, 138, pp. 139–154.

Nardi, P.M. (2017) *Critical Thinking: Tools for Evaluating Research*. Oakland: University of California Press.

Peek, S.T.M., Wouters, E.J.M., van Hoof, J., Luijkx, K.G., Boeije, H.R. and Vrijhoef, H.J.M. (2014) 'Factors influencing acceptance of technology for aging in place: a systematic review', *International Journal of Medical Informatics*, 83(4), pp. 235–248.

W3C (2024) *Web Content Accessibility Guidelines (WCAG) 2.2*. W3C Recommendation.

Validity, Reliability, Generalisability and Ethics

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TASK 3: RESEARCH STRATEGIES

Validity, reliability, generalisability and ethics

Validity concerns whether the research methods measure what they are intended to measure. Construct validity will be improved by linking questionnaire items, interview questions and usability tasks directly to the project objectives. Accessibility will not be judged only by appearance. The prototype will be checked against selected WCAG 2.2 criteria and tested through realistic tasks such as reading an alert, confirming a reminder and changing text size. Perceived usability will be measured with the established System Usability Scale, while open questions will explore the reasons behind participants' ratings (Brooke, 1996).

Content validity will be supported by deriving requirements from both literature and stakeholder feedback. A traceability table will connect each major requirement to a source, participant need or accessibility criterion. Triangulation will compare evidence from questionnaires, interviews, observed task performance and usability scores. Conflicting findings will be reported. The study will avoid claims about medical effectiveness because the prototype will not use clinical data or operate as a medical device.

Reliability concerns the consistency of the research process. All participants will receive the same information sheet, task instructions and core interview questions. The prototype version, test device and task order will be recorded. A pilot will identify ambiguous wording and technical problems. Calculations and qualitative coding will follow documented procedures and an audit trail.

The findings will have limited statistical generalisability because the sample will be small and purposively selected. The project will therefore aim for analytical transferability rather than claiming that all older adults or carers have the same needs. Participant age group, role, digital confidence and accessibility needs will be described anonymously so readers can judge whether findings may apply to similar contexts.

Ethics are particularly important because the topic may involve older or potentially vulnerable participants and information connected with health and home routines. Participation will be voluntary and based on informed consent. Information will be provided in plain language, with a large-print version where needed. Participants will be told that the prototype is not a medical system, does not provide emergency monitoring and should not be relied upon for personal safety. They may decline any question or withdraw before anonymised analysis. No participant will be asked to reveal passwords, detailed diagnoses, addresses or real smart home records.

Data protection will follow the principles of lawfulness, fairness, transparency, purpose limitation, data minimisation, storage limitation and security (Information Commissioner's Office, 2026). Participants will be assigned codes rather than identified by name. Consent forms will be stored separately from responses. Digital files will be password protected and retained only for the period required by university policy. The prototype will use simulated data. Privacy by design will also be discussed within the interface, because smart home systems can create risks involving surveillance, unauthorised access and the exposure of household behaviour (Buil-Gil et al., 2023).

Research Strategy and Data Collection Methods

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Research strategy and data collection methods

A small sequential mixed-method strategy will be used. Stage one will be a focused literature review. Stage two will collect user requirements through a short questionnaire and optional semi-structured interview. Stage three will create the prototype. Stage four will conduct task-based usability testing followed by the System Usability Scale and brief interview questions.

A purposive sample of approximately eight to twelve participants will be sought, ideally including older adults and current or recent family carers. This is realistic for a student prototype project and should provide varied feedback, although it will not represent the entire population. Reasonable adjustments will include printed questions, larger text, extra time and the option to have a trusted person present. Participants will not be recruited where informed consent cannot be established.

The initial questionnaire will collect non-sensitive background information, current use of digital devices, confidence with technology, preferred features and main concerns. Semi-structured interviews will allow follow-up questions about alerts, privacy, information sharing and the balance between independence and carer oversight. The prototype evaluation will use a think-aloud approach where participants explain what they expect to happen as they complete tasks. The researcher will record task completion, errors, help requests and comments. A post-test questionnaire will contain the ten System Usability Scale items and brief open questions.

A pilot version of the questionnaire and usability script is included in Appendix A. It should be tested with one older adult and one family carer before the main study. Genuine pilot feedback must be recorded in Appendix B.

Quantitative and Qualitative Analysis

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Quantitative and qualitative analysis

Quantitative analysis converts numerical data into summaries or tests. Descriptive analysis will be most appropriate for this small project. It will include frequencies and percentages for preferred features, median or mean ratings, task completion rates, number of errors, requests for assistance and time taken. System Usability Scale responses will be scored using the established calculation and presented as an overall usability indicator. Charts may show feature priorities or task success. Inferential techniques include t-tests, chi-square tests, correlation and regression, but they are unlikely to be appropriate because the proposed sample is too small for reliable population-level conclusions.

Qualitative analysis will be used for interview notes, think-aloud comments and open-ended responses. Thematic analysis will follow the general stages described by Braun and Clarke (2006): becoming familiar with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the account. Possible themes might relate to clarity, trust, privacy, independence, reassurance, alert fatigue or digital confidence, but themes will be generated from the actual data rather than decided in advance. A coding table will include anonymised extracts, codes and theme names.

The final interpretation will integrate both forms of evidence. A low task completion rate may be explained by comments showing that a button label was unclear, while a high usability score may still be accompanied by privacy concerns. Combining numerical patterns with explanations will produce a more useful evaluation. The research will conclude with prioritised recommendations for improving the prototype and for conducting a larger future study.

Conclusion

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CONCLUSION

This proposal presents an Applied Computing project that combines accessible web development, human-computer interaction and smart home concepts to address a practical social need. Its main contribution will be a responsive prototype that translates simulated home information into a simple interface for older adults and family carers. A pragmatic mixed-method approach will connect literature, user requirements, prototype development and usability evaluation. Technical functionality alone is insufficient. Accessibility, trust, privacy, consent and clear communication determine whether the system creates value. Although the small study cannot demonstrate medical effectiveness or broad generalisability, it can produce evidence-based design recommendations.

Task 3 Reference List

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Task 3 Reference List

Braun, V. and Clarke, V. (2006) 'Using thematic analysis in psychology', *Qualitative Research in Psychology*, 3(2), pp. 77–101.

Brooke, J. (1996) 'SUS: a quick and dirty usability scale', in Jordan, P.W., Thomas, B., Weerdmeester, B.A. and McClelland, I.L. (eds.) *Usability Evaluation in Industry*. London: Taylor and Francis, pp. 189–194.

Buil-Gil, D., Kemp, S., Kuenzel, S., Coventry, L., Zakhary, S., Tilley, D. and Nicholson, J. (2023) 'The digital harms of smart home devices: a systematic literature review', *Computers in Human Behavior*, 145, 107770.

Creswell, J.W. and Creswell, J.D. (2018) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 5th edn. Los Angeles: SAGE.

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Appendix A: Pilot Data Collection Instrument

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APPENDIX A: PILOT DATA COLLECTION INSTRUMENT

Part 1: Background and requirements questionnaire

1. Which best describes you?
 - Older adult / Family carer / Both / Other
2. How confident are you when using websites or mobile applications?
 - Very unconfident / Unconfident / Neutral / Confident / Very confident
3. Which features would be most useful? Select up to three.
 - Daily reminders
 - Home safety status
 - Unusual activity alert
 - Wellbeing check-in
 - Emergency contacts
 - Family notes and appointments
 - Accessibility settings
4. What would concern you most about a smart home support application?
 - Privacy / False alerts / Difficulty using it / Cost / Internet failure / Too much carer monitoring / Other
5. What information should an older adult see on the home page?
6. What information should a family carer see?

Part 2: Semi-structured interview prompts

- What daily situation could this type of system make easier?
- How should the system explain an alert without causing unnecessary worry?
- What information should remain private?
- Who should be allowed to see or change information?
- What would make the interface easier to trust and use?

Part 3: Prototype usability tasks

1. Find today's reminder and mark it as completed.
 2. Check whether the front door is shown as open or closed.
 3. Read an unusual activity alert and identify the suggested next action.
 4. Increase the text size.
 5. Find the emergency contact button.
 6. Switch between the older-adult view and family-carer view.
- After completing the tasks, participants will complete the ten-item System Usability Scale and answer:
- What was easiest?
 - What was most confusing?
 - Which feature was most useful?
 - What should be changed first?

Appendix B: Pilot Feedback Record

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APPENDIX B: PILOT FEEDBACK RECORD

Pilot participant code: P01

Role: Family carer

Date: 20 July 2026

Completion time: 16 minutes

Method used:

The participant completed the background questionnaire, answered the semi-structured interview questions and attempted the six prototype usability tasks. I observed the participant and recorded brief notes during the session. The participant was informed that the activity was for a university project proposal and that no identifying personal or medical information would be recorded.

Questions or terms found unclear

The participant understood most questions but was initially unsure what the term “**unusual activity alert**” meant. They asked whether it referred to a possible emergency, a change in normal routine or suspicious activity in the home.

The phrase “**wellbeing check-in**” also required a short explanation. The participant suggested changing it to simpler wording such as:

“Confirm that the person is safe and well.”

The participant also felt that “**too much carer monitoring**” might sound judgemental. They suggested replacing it with:

“Concerns about privacy or being monitored too closely.”

Tasks that required help

The participant completed four of the six usability tasks without assistance.

They required some help with:

1. Increasing the text size

The accessibility icon was recognised, but the participant did not immediately understand that it contained the text-size control.

2. Switching between the older-adult view and family-carer view

The participant initially thought the view-switching button was a logout button because it only contained a user icon.

The participant successfully:

- Found today's reminder and marked it as completed
- Checked whether the front door was open or closed
- Read the unusual activity alert
- Found the emergency contact button

Accessibility or formatting problems

The participant identified the following issues:

- Some secondary text was too small
- The light-grey text had insufficient contrast against the white background
- The icons were not always understandable without text labels
- The buttons on the alert screen were positioned too closely together
- The difference between an information message and an urgent alert was not sufficiently clear
- The text-size option returned to the default setting when moving to another page

The participant said that the large main buttons and simple navigation were helpful but recommended using text labels alongside every important icon.

Participant suggestions

The participant suggested:

- Changing “Unusual activity detected” to a clearer message such as “No movement has been detected in the living room for three hours”
- Showing the time and location connected to each alert

- Adding a short explanation of what the family carer should do next
- Using green for normal status, amber for something requiring attention and red only for urgent situations
- Adding a clear confirmation message after a reminder has been completed
- Showing who can view the information
- Including a privacy settings page
- Keeping emergency contact information visible on every screen
- Allowing users to choose which alerts are sent to family carers
- Adding text labels to the older-adult and family-carer view buttons

Changes made to the questionnaire

Following the pilot feedback, the following changes were made:

1. "Wellbeing check-in" was changed to:
"Safe and well check-in."
2. "Unusual activity alert" was clarified as:
"An alert showing an unexpected change in normal activity, such as no movement being detected for several hours."
3. "Too much carer monitoring" was changed to:
"Concerns about privacy or being monitored too closely."
4. A **"Not sure"** response option was added where appropriate.
5. The following open question was added:
"Is there any feature or information you would not want the system to collect or display?"

These changes made the questionnaire clearer and more relevant to privacy and user control.

Changes made to the prototype or task script

The following prototype changes were planned following the pilot:

- Add the labels **"Older-adult view"** and **"Family-carer view"** beside the relevant icons
- Increase the minimum size of secondary text
- Improve the contrast of grey text and background elements
- Add text labels beside accessibility icons
- Make the text-size setting remain active across all pages
- Increase spacing between alert-response buttons
- Add clear alert categories such as information, attention required and urgent
- Include the alert time, location and recommended next action
- Add a confirmation message after a reminder is completed
- Add a short privacy explanation showing who can access the information

The usability task script was also changed from:

"Read an unusual activity alert and identify the suggested next action."

to:

"Open the activity alert, explain what has happened and identify what the system recommends doing next."

This revised task is more specific and allows the researcher to evaluate whether the alert message is understandable.

Pilot outcome summary

The pilot showed that the proposed data collection method was generally suitable, but several terms needed clearer wording. The participant could complete most tasks independently, suggesting that the basic navigation was understandable. However, difficulties with the accessibility controls, view switching and alert terminology showed that icons should not be used without labels.

The pilot feedback resulted in practical changes to the questionnaire, interface and usability task script. This demonstrates how pilot testing can improve the clarity, accessibility and reliability of the final research process.