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A Within-Subjects Usability Comparison of Check-in Interaction Methods for Older Adults

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Abstract. As China's population ages, more older adults live alone, leaving families uncertain whether they are safe each day. A check-in app, through which an older person sends a short "I'm fine" message, offers a simple answer, but most such apps rely on only a large button, and whether speaking or taking a photo would suit older users better remains unclear, since these actions differ in hand-control demands and context. This review synthesizes seven usability studies and scoping reviews of older adults' health, voice, and photo applications, addressing app design, daily check-in feasibility, usability measurement, and differing needs of older users and caregivers. The evidence shows tapping is more reliable than dragging, a coach-supported app package including a daily check-in proved feasible over one week, standard and simplified usability scales apply to this group, and voice and photo interactions show preliminary usability but remain untested for daily check-in. Three gaps remain: interaction methods are rarely compared head-to-head, photo-based check-in has not been tested, and few studies are set in China. This review outlines a within-subjects study comparing button, voice, and photo check-ins to identify the most usable method.

Keywords: older adults, check-in, usability, mobile health, interaction design

1. Introduction

China's population is aging rapidly. At the end of 2025, 323.38 million people, or 23.0% of the population, were aged 60 or older [1]. A growing share of them live alone or with only a spouse, and as adult children move away for work, a single question arises almost every day: are the parents safe?

Smartphones offer a low-cost answer. With a check-in app, an older person can send a short "I'm fine" message at a fixed time each day, relieving the family's worry without repeated phone calls. Without such a signal, a fall or a sudden illness could go unnoticed for hours, especially when an older adult has little contact with neighbors during the day. Remote check-in services have therefore become a common part of community elderly care in Chinese cities.

Most such apps are built around one large button. This is simple, but it may not fit everyone. Voice input needs no precise tapping and may suit people with poor eyesight or weak grip; a photo carries more context but takes more steps, such as opening the camera, framing the scene, and confirming the shot. These three actions place different demands on vision, hearing, memory, and

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hand control, so a method that is easy for one person may be hard for another. Which of the three is easiest for an older adult remains unclear.

This review synthesizes seven usability studies and several scoping reviews on health, voice, and photo applications for older adults, identifying design principles and evidence gaps in daily check-in interaction. It shows tapping is more reliable than dragging, a coach-supported app package including a daily check-in proved feasible for one week, and usability scales apply to this age group, yet no study has directly compared button, voice, and photo check-ins among Chinese older adults. This review therefore proposes a within-subjects experiment comparing completion rate, time, and usability across the three methods to identify the most usable check-in interaction.

2. Designing apps for older adults

2.1. Tapping over dragging

Among touchscreen actions, tapping appears to be easier for older adults than more complex gestures such as dragging, swiping, and pinching, which require finer control and more attention.

The average rating across prototype versions was 91 (Standard Deviation (SD) 5.18; range 85-97.5) on the simplified System Usability Scale, and after testing, most participants felt able to complete the cognitive screening test alone [2].

2.2. Common design patterns

The Gomez-Hernandez review organized 27 recommendations into five categories: help and training, navigation, visual design, cognitive load, and interaction. Two golden rules ran through them: simplify the design, and increase the size and spacing of interactive controls. The detailed guidelines also recommended high-contrast colors, a back button on every screen, only a few options per page, and clear feedback after each action. Several guidelines specifically advised replacing dragging with tapping, because older adults find precise dragging difficult, and avoiding crowded screens and small text. These points apply directly to a check-in app, whose main action must be completed quickly and without help [3].

A scoping review of inclusive design heuristics for digital health interventions aimed at the aging population reached a similar conclusion, describing inclusive design as a multidimensional process that combines usability and accessibility with social engagement, motivational features, and affordability [4].

Participants asked for a larger font and clearer colors, as yellow text was hard to see, and for shorter, clearer instructions, because lengthy definitions were confusing. The authors also noted that one design for everyone was less sensible than adjusting for age and health [5].

A scoping review of Chinese older adults, which included 23 studies and 8,203 participants, reached a similar conclusion. Perceived ease of use was the most commonly reported facilitator, while small text, unclear icons, and unstable networks were common barriers. The review also recommended larger text, simplified navigation, and reminders, and it stressed that family guidance and training are central to first-time use [6]. This matters in a Chinese setting where many older adults are introduced to apps by their children.

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2.3. Feasibility of daily check-in

The ENHANCE app was tested for one week at home with ten adults aged 60 to 77, including several from ethnic minorities and low-income households. All met the minimum-use targets, which covered a check-in, short videos, and cognitive games. After the week, 9 of the 10 participants said they wanted to keep using the app and would recommend it to peers [7].

It is important to note that the 90% retention figure reflects adherence to the overall app package, which included a daily check-in, short videos, and cognitive games, rather than adherence to the check-in task alone. The check-in was only one component, so this result supports the feasibility of regular app use by older adults but does not by itself prove that a standalone daily check-in would be sustained. Still, a week of daily app use proved realistic for this age group, and a light task such as a check-in was not too demanding within that package.

The same study recorded what went wrong. Some cues were hard to see, fast flashing in a game caused discomfort, touch actions were hard for users with stiff hands, and some never found the messaging box. For a check-in app, the lesson is to keep tasks short, drop the animation, and make the controls obvious.

3. Measuring usability

3.1. The standard SUS and the simplified S-SUS

Two related but distinct scales appear in the literature. The standard System Usability Scale has ten items on a five-point scale, converted to a score from 0 to 100. The Peruvian study used the standard version with sixteen people aged 61 to 85 and obtained a mean of 60.78 (SD 13.68), an acceptable score [8].

The Simplified System Usability Scale (S-SUS) was used in the MyCog study, where the average across prototype versions was 91 [2].

3.2. Lab tests versus real use

Neither study treated a good test score as proof of real-world success. The 91 in MyCog came from a controlled setting, and the authors note that home pilot testing and clinical validation were still needed [2]. The Peruvian app faced the same gap [8].

4. Voice and photo as alternative channels

4.1. Voice assistants

A review of voice assistants for older adults found that most studies focused on usability and acceptability, while the one study that directly tested the effect on loneliness with a standardized instrument reported a positive preliminary result, especially for people living alone. The review also noted that voice assistants can support daily reminders, information seeking, and simple companionship [9]. The GRACE study tested an embodied voice assistant for cognitive stimulation and reported that older adults found the tool feasible and acceptable, although response delays, voice quality, and personalization still needed work [10]. These findings support voice as a low-effort channel for older adults, while also showing that speech recognition and delays are not yet solved. Voice input may also be affected by background noise, strong accents, and dialects, which many older adults in China use, so the planned check-in should be tested in a quiet home setting.

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4.2. Photo-based interaction

Photo-based interaction has been studied less. The GoodTimes app used an Artificial Intelligence (AI)-driven photo album to prompt reminiscence, and participants reported that the system was simple and helpful: 92% (12/13) found it user-friendly, 85% (11/13) found it helpful, and 69% (9/13) wanted to use it frequently [11]. Although this is not the same as a daily safety photo, it suggests that older adults can engage with photographs and that visual material can be a workable channel. Whether a photo check-in is practical within a few seconds each day remains untested.

4.3. Different users and tailored views

Three separate views of a health monitoring app, one for the older person, one for a professional caregiver, and one for family, were built and tested with 25 participants. Across all groups, the quality asked for most was the same: make the interface obvious. Touch was the preferred input for 92% of participants (23/25), because it felt simple and familiar, although 45% (5/11) of the older adult subgroup were interested in voice commands, compared with 32% (8/25) of all participants [12]. The three views were not separate apps but one system sharing the same data, so the older person's simple interface and the caregiver's richer interface stayed in sync.

Among the older adult subgroup, 91% (10/11) showed positive acceptance of using the augmented reality view to share health information with caregivers [12].

5. Research gaps and the proposed study

5.1. Three research gaps

Reading across the studies, three gaps stand out. The first is the lack of head-to-head comparison. Each study evaluates one app or fixes one interaction, and none places buttons, voice, and photos within the same experiment with the same people. Previous research showed tapping to be reliable but did not test whether voice or photo is better for the same task [2].

The second is the photo. The results are encouraging, but a photo album is not a daily safety check, and no study has asked older adults to photograph themselves or their surroundings to confirm they are safe [11]. The idea is plausible, but the effort and cognitive load have not been measured.

The third is place. Most evidence comes from Europe, North America, or Latin America, and although a scoping review covers Chinese older adults, it synthesizes existing work rather than testing a check-in app [6]. Chinese older adults use different phones, in different family settings, and may speak dialects, so local evidence is needed.

5.2. The proposed within-subjects study

The planned study will recruit 15 people aged 65 and older from the researcher's family network. This sample size is comparable to the usability studies reviewed above, which ranged from 10 to 25 participants, and is sufficient for a within-subjects comparison in which each participant serves as their own control. Each person will try all three methods in an order balanced by a Latin square, and the study will compare completion rate, time, and usability. Each method will involve five check-ins, for a total of fifteen check-ins per participant, with a one-minute rest between methods. The aim is to determine which of the three methods is easiest for an older adult to use.

Figure 1 illustrates the step-by-step check-in procedure for each of the three interaction methods.

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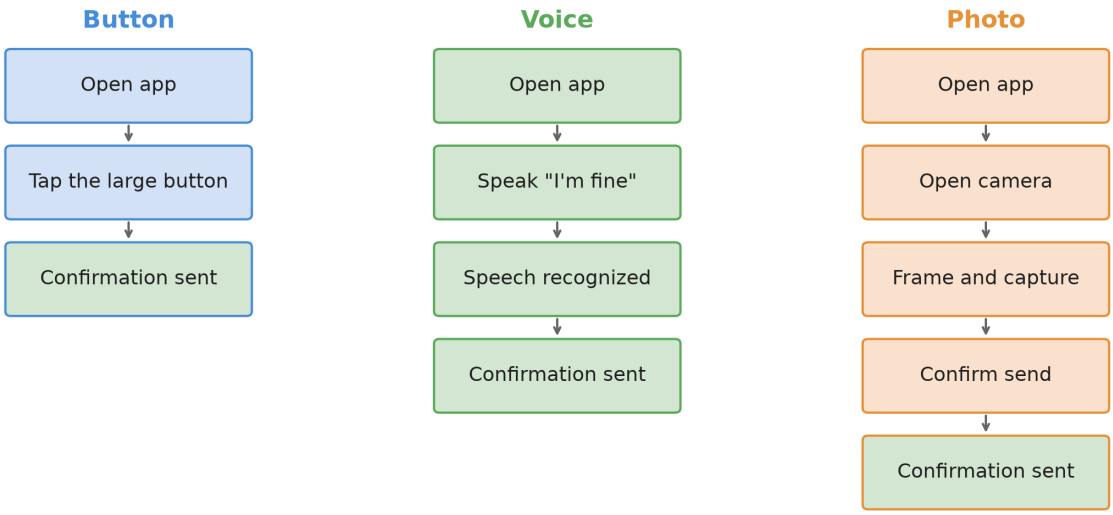


Figure 1. Check-in steps for the three interaction methods (photo credit: original)

The button method requires only two actions: opening the app and tapping the large button. The voice method adds a speech step, in which the user says "I'm fine" and the system must recognize the phrase. The photo method is the longest, requiring the user to open the camera, frame and capture an image, and confirm sending. These differences in step count and sensory demand are the core reason for comparing the three methods directly.

The independent and dependent variables, together with the instruments used to measure them, are summarized in Table 1.

Table 1. Variables and measures in the proposed study

Type	Variable	Description or instrument
Independent	Interaction method	Button, voice, or photo (within-subjects)
Independent	Trial order	Counterbalanced with a Latin square
Dependent	Completion rate	Check-in completed without assistance (yes/no)
Dependent	Task time	Seconds from opening the app to confirmation
Dependent	Perceived usability	Standard System Usability Scale (0-100)

Interaction method is the within-subjects independent variable, and trial order is counterbalanced to avoid learning effects. The three dependent variables capture different aspects of usability: whether the task can be finished without help, how long it takes, and how usable the participant perceives the method to be on the standard System Usability Scale.

To control for order and fatigue effects, the sequence of methods is counterbalanced across participants using a Latin square, as shown in Table 2.

Table 2. Counterbalanced trial order (Latin square)

Group	First method	Second method	Third method
A	Button	Voice	Photo

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Table 2. (continued)

B	Voice	Photo	Button
C	Photo	Button	Voice

Each participant is assigned to one of three groups (A, B, or C), and every method appears equally often in the first, second, and third positions. This design ensures that any difference in completion rate or time cannot be attributed simply to practice or fatigue across the session.

A caveat is needed. The apps reviewed here support cognitive screening, health surveys, or cognitive training, which are more complex, less frequent, and more cognitively demanding than a daily check-in. The three methods also impose different cognitive loads: a button requires one action, a voice command requires remembering a phrase and speaking clearly, and a photo requires framing the camera. These differences may matter more for older adults with mild cognitive or sensory impairment. In addition, a single usability session may not predict daily use, because a check-in is a repeated, low-interest task that may feel tedious over time. These differences may limit how far the findings transfer, so the comparison should be tested directly rather than assumed.

6. Conclusion

Across the studies, one theme runs through the whole body of work: older adults are not restricted to a single way of using an app, and the field is moving toward offering several simple options rather than one.

Tapping appears to be a reliable touch action, and large fonts, large buttons, and little typing come up repeatedly. A coach-supported app package including a daily check-in proved realistic over one week, and the standard System Usability Scale works with users well into their eighties, with 60.78 a fair benchmark. Voice assistants have shown generally positive usability and acceptability and can ease loneliness, although recognition delays and personalization remain unfinished, and photo-based reminiscence suggests that visual material can engage older adults. Caregivers and older adults want different things, but a multi-view app is workable, and most older adults were open to a new way of sharing.

These findings set up the planned experiment on three fronts: the button is a sound control because tapping is known to work; regular app use including a check-in is realistic because a week of such use has already been completed; and the standard SUS is the appropriate measure. The study then compares the three methods directly, offering local evidence for designing age-friendly check-in apps in China. The results will also help community care services decide whether voice or image features are worth adding beyond a simple button, and where limited design resources should be focused. In the long term, a method that older adults can complete without assistance is more likely to be used every day, which is the condition on which the safety value of the system ultimately depends.

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