

# "Watch, Smell, Ask, Touch": Practices, Challenges, and Technological Support in Ability Assessment of Older Adults from Practitioners' Perspectives in China

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## Abstract

As the global population ages, comprehensively assessing older adults' physical, cognitive, and social capacities is increasingly crucial for guiding care decisions and resource allocation. While technology shows promise in enhancing these assessments, there is limited understanding of how practitioners conduct such assessments and how they perceive and experience assessment technologies in real-world settings. This paper presents an exploratory study of the practices and experiences of practitioners in China's Ability Assessment of Older Adults (AAOA), based on 28 on-site observations and in-depth interviews with eight assessors in a large southeastern city. Our findings reveal the adaptive workflows, strategies, and diverse challenges faced by assessors, highlighting the complexity, context-specificity, and collaborative nature of these processes. While grounded in China's evolving healthcare system, these findings also resonate with broader global challenges in aging care, particularly in resource-constrained settings. Based on these insights, we propose implications for designing practical assessment technologies and considerations for better supporting assessors and older adults across care contexts.

## CCS Concepts

- Human-centered computing → Empirical studies in HCI

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Ability Assessment of Older Adults, Needs Assessment, Older Adults, Technology, Practitioners, Geriatric Care

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## 1 Introduction

The global increase in the number and proportion of older adults presents significant challenges to health and social systems worldwide [93]. As populations age, a substantial percentage of older adults face complex health issues. Research indicates that approximately 60% of individuals over 65 experience disabilities that impede their daily activities, over 50% suffer from impairments, and over 90% have at least one chronic disease [42], often involving co-occurring conditions [31, 59]. These statistics underscore the urgent need for comprehensive assessments of older adults' health and abilities, which are essential for improving care, enabling early detection, and ensuring the appropriate allocation of social services and subsidies [5, 53, 55, 58].

Needs assessments are systematic evaluations designed to measure various aspects of an older adult's physical, cognitive, and social functioning [17, 19]. These assessments typically encompass a range of domains, including activities of daily living (ADLs), mobility, cognitive abilities, and social participation. The goal is to provide a holistic understanding of an individual's capabilities and needs, which can then inform care plans, resource allocation, and eligibility for social services. In China, this process is referred to as the **Ability Assessment of Older Adults (AAOAs)**. Similar to

needs assessments in other countries, AAOA plays a critical role in determining the appropriate level of care, support, and social welfare benefits that older adults require and are eligible to receive, particularly in the context of aging in place and community-based care [4, 55, 62, 90].

Within the field of HCI, much attention has been devoted to developing technologies that support older adults in post-assessment phases [16, 22], such as monitoring health, facilitating training and rehabilitation, and enhancing daily living activities (e.g. [16, 21, 25, 26, 89]). However, the critical task of assessing older adults' abilities has not received the same level of focus. This underdeveloped area is particularly concerning, as precise and thorough assessments are essential for guiding effective care strategies and interventions. Despite this gap, technology holds significant potential in improving the accuracy and efficiency of ability assessments. Various tools, from cognitive function tests to mobility assessments, have shown promise in preliminary studies [2, 48, 51, 70]. Yet, many of these innovations remain in prototype stages, with limited application in real-world settings. A deeper understanding of how to implement these technologies effectively is crucial for increasing their acceptance and impact in everyday practice [6, 11].

Moreover, the literature increasingly acknowledges the significant role of assessment practitioners—such as clinicians, social workers, or specialized assessors—in the successful integration of these technologies into practical assessment practices [65, 70, 80]. Yet, compared to the extensive focus on older adult-oriented analysis and examination [3, 20, 46, 73, 77, 85, 86, 99], the experiences and perceptions of practitioners remain underexplored. This oversight is particularly concerning given the dynamic and complex nature of ability assessments [4, 23], which require not only technical accuracy but also the flexibility to adapt to the individual needs and contexts of older adults.

In China, where the aging population is growing rapidly, the need for effective ability assessments is especially pressing. These assessments are typically conducted in person by trained assessors with backgrounds in healthcare or social work, who evaluate older adults across multiple domains, including physical health, cognitive function, and social participation. The process requires assessors to visit older adults in their homes or care facilities, conducting evaluations face-to-face. The country faces unique challenges, including large aging population and regional disparities in healthcare access. Despite the introduction of standardized assessment protocols and the recognition of AAOA assessor as a formal profession [34, 61], there remains a significant gap in understanding how these assessments are conducted in practice and how technology can best support these efforts.

This paper seeks to address these gaps by providing an in-depth, empirical examination of AAOA in China, focusing particularly on the practical experiences and perceptions of AAOA assessors in China. Through a multi-phase qualitative study, including 28 field observations and in-depth interviews with eight assessors, we explored the complexities and challenges they face, the strategies they employ to navigate these challenges, and their expectations for future technological support. While rooted in the context of China's evolving healthcare system, our findings underscore shared global challenges in aging care, particularly in resource-constrained

settings. We hope these insights will inform the design and implementation of assessment technologies and support assessors and older adults in similar contexts worldwide.

Our study contributes to the HCI community by providing (1) the first empirical investigation of ability assessments for older adults within the HCI field, specifically examining how these comprehensive assessments are conducted in real-world, in-person scenarios in China; (2) an empirical understanding of assessors' experiences and perceptions of current assessment practices and technologies, as well as their expectations for future technological support. According to the results, we (3) propose a set of design implications for the development of future technologies to better support ability assessments, and (4) highlight considerations for addressing systemic, cultural, and other factors to enhance support for both assessors and older adults.

## 2 Related Work

### 2.1 Ability Assessment of Older Adults

Needs assessments, also referred to as care assessments, are a cornerstone of geriatric care, aimed at evaluating the physical, cognitive, and social functioning of older adults [17, 55]. These assessments determine individuals' capacities to perform activities of daily living (ADLs), such as eating, bathing, dressing, and mobility [49], as well as instrumental activities of daily living (IADLs), which include more complex tasks such as managing finances, transportation, and medication [54, 67]. The primary objective is to gain a comprehensive understanding of older adults' abilities and limitations, which subsequently informs the development of personalized care plans [69]. These assessments also serve as a basis for determining the need for support services, such as in-home care, assisted living, or nursing home placement [4, 55, 76], and are crucial for allocating resources, including government subsidies and healthcare interventions tailored to the specific needs of older adults [35, 62, 96].

Traditionally, standardized tools like the Barthel Index for ADLs [91] and the Lawton IADL scale [54] have been widely adopted in clinical and community settings to assess functional status [30]. While these tools provide consistency and comparability, they may not fully capture the complexity and heterogeneity of older adults' conditions, especially in varied cultural and socio-economic contexts [62, 64]. Increasing recognition of the limitations of such standardized assessments has led to the adoption of more holistic and context-sensitive approaches, which consider a broader range of factors, including physical health, cognitive function, social support networks, and environmental conditions [4]. In China, this form of needs assessment is known as Ability Assessment of Older Adults (AAOAs), which utilizes a multidimensional framework to evaluate self-care, cognition, perception, and social support through in-person assessments, determining eligibility for social services and subsidies for older adults. We provide further details on AAOA within the context of China in Section 3.

### 2.2 Assessment Technologies of Older Adults

The development of technologies to assess the abilities of older adults has emerged as a significant area of research, offering the potential to enhance both the accuracy and efficiency of these assessments. These technologies range from cognitive assessment

tools to devices that monitor daily activities and physical functions. The integration of such digital assessment technologies aims to facilitate earlier detection of health issues, support more personalized care planning, and ultimately improve the quality of life for older adults [27, 28].

A variety of technological approaches have been explored to support different aspects of ability assessments (e.g. [2, 20, 32, 51, 79]). Cognitive assessments, for instance, have been increasingly facilitated by digital tools that range from mobile applications measuring or predicting cognitive decline [36, 77] to serious games and VR-based remote evaluations [86, 99]. These tools often focus on engaging older adults [20, 43] while providing clinicians with additional behavioral data that traditional assessments may not capture, such as response times and explainable AI results [22, 70, 71].

Physical ability assessments have similarly seen advancements, with researchers developing technologies that utilize sensors [2, 48], specialized devices [84], interactive systems [32] to evaluate mobility, balance, and functional capabilities [2, 48]. These tools often employ real-time data collection and analysis, providing more objective and granular insights into an older adult's physical condition compared to conventional assessment methods. For example, sensors embedded in homes can track movement patterns, while wearable devices can monitor gait and stability, offering valuable data that can help in early identification of functional decline [1, 2, 18, 48].

Despite these advancements, many of these technologies remain in experimental stages, with limited implementation in real-world settings. The focus of much existing research has been on validating the usability and effectiveness of these tools in controlled environments, often neglecting the complexities of practical application. The transition from prototype to practical use involves significant challenges, including integration into existing workflows, ensuring accessibility and feelings for older adults with varying conditions [24, 44], and addressing privacy concerns associated with continuous monitoring [87]. Moreover, while technology-supported assessments offer many benefits, they also present new challenges. For instance, the accuracy of these assessments can be influenced by environmental factors, such as lighting and noise, which can affect the performance of digital and sensor-based tools [41]. Additionally, the reliance on technology may inadvertently exclude older adults who are less familiar or comfortable with digital devices, thereby reinforcing existing disparities in healthcare access. Given the complexity of assessing older adults' abilities, which involves accounting for varying levels of physical decline, cognitive changes, and the influence of social and environmental factors, it is crucial to gain an in-depth, empirical understanding of technology-supported ability assessments. Our study addresses this gap by examining the practical experiences and perceptions of AAOA practitioners when integrating technologies into their practical assessments.

### 2.3 The Importance of Assessment Practitioners and The Challenges They Face

Practitioners such as clinicians, occupational therapists, social workers, and specialized assessors play a pivotal role in ability assessments, applying their expertise to navigate the complexities of evaluating older adults' abilities. Their work extends beyond administering standardized tests, requiring them to make nuanced

judgments that consider each individual's context, health status, and social environment through thoughtful communication [44]. Despite technological advancements in assessment tools, the role of these practitioners—who conduct, interpret, and act upon assessments—remains underexplored [41].

Practitioners face significant challenges in balancing standardized tools with the need to tailor assessments to each older adult's unique circumstances [68, 90]. This adaptability is especially important when standardized assessments fail to capture complex conditions such as cognitive impairments or physical disabilities that defy easy quantification [4, 74]. The integration of new technologies, while improving accuracy and efficiency, adds complexity, as practitioners must acquire new skills and adapt their assessment practices accordingly [14]. Decision-making in ability assessments goes beyond numerical scores, requiring consideration of qualitative factors like emotional state, social support, and living conditions [9]. Practitioners must balance these elements to ensure assessments lead to appropriate and effective care outcomes. Ethical challenges also arise, particularly when navigating sensitive issues such as diminishing independence, requiring practitioners to balance empathy with professional responsibility [67].

There is growing recognition of the need to focus on the experiences and challenges faced by assessors and other stakeholders in the geriatric care process, emphasizing the importance of a comprehensive understanding of current practices [23, 41, 78, 80]. While much of the existing research is rooted in a Western context, Chen et al. conducted a preliminary quantitative study examining assessors' workloads in the context of AAOA in China [47]. While this study highlighted the overload and time demands placed on assessors—often extending beyond normal working hours, as evidenced by a survey of 93 assessors in Shanghai—it did not thoroughly examine the specific tasks involved in assessments or the role of technology in this process. Building on this foundation, our work is the first to deeply investigate both the practical challenges and opportunities of AAOA practices, as well as technology-supported assessments, from the perspective of assessors. These insights provide a crucial understanding of how comprehensive needs assessments are conducted within China's context, offering valuable guidance for integrating technologies into real-world assessment and improving the effectiveness of these tools in practical assessments. This work underscores the importance of supporting practitioners as they navigate the evolving landscape of geriatric care.

## 3 Background and Research Context

China's ability assessment system has been nationally standardized since the introduction of the 2020 *"Specification for Ability Assessment of Older Adults."* In this study, 'older adults' are defined as individuals aged 60 and above, consistent with the eligibility criteria for this assessment system. This system classifies older adults' abilities into five levels based on physical, cognitive, and social functioning [34, 82]. The formalization of this process was further reinforced by the recognition of the *"Senior Ability Assessor"* as a licensed profession in 2020 [61].

This study was conducted in a large southeastern city in China, which includes urban, suburban, and rural areas, and has a population of over 1 million residents aged 60 and above—approximately

20% of the total population. The city has actively adopted national guidelines for ability assessments, and its provincial guideline currently consists of seven components (79 specific criteria, see Appendix A): activities of daily living (10), cognitive ability (4), perception and communication (3), health condition (12), medical condition (30), special care needs (10), and social support (10). The city has also enlisted qualified organizations to carry out these assessments, employing assessors with medical or social work backgrounds and at least two years of experience in elderly care.

The characteristics of China's AAOA practice, shaped by its demographic trends, policy frameworks, and healthcare system, are particularly relevant to the context of our research:

- **Growing Demand and Limited Assessors:** China's aging population has strained its ability assessment system, with assessors unable to meet rising demand. In our research area, over 1 million older adults are served by seven organizations, each with around ten assessors. These assessors complete over ten in-person AAOAs daily, with some handling up to 30 cases. The requirement that each assessment be conducted by two assessors working in pairs adds further pressure, alongside the need for periodic reassessments (every 1-2 years for each older adult), often resulting in time-constrained evaluations.
- **Brief Interactions with Older Adults:** Unlike healthcare providers, assessors in China's system do not form long-term relationships with those they evaluate. Assigned cases through a centralized provincial system, assessors must complete each evaluation within ten days. For many older adults, this brief interaction is their first and only contact with an assessor, limiting engagement depth.
- **Significance of Assessments in Determining Social Care:** In our research area, government-appointed private social work organizations provide essential in-home services, such as meal delivery and housekeeping, to support aging in place. Public care homes, managed by private entities under government contracts, rely on AAOA to determine eligibility for government subsidies. These assessments play a critical role in (1) determining the range of home services an older adult qualifies for, (2) setting admission priorities for public care homes, (3) calculating annual care home subsidies based on resident assessments, and (4) determining long-term care insurance subsidies for older adults.
- **Challenges Faced by Vulnerable Older Adults:** Older adults in China, particularly those who are advanced in age, living alone, or experiencing functional decline, face numerous difficulties, including health concerns, social isolation, and financial insecurity. Access to and awareness of healthcare services remain limited, with only 37% of rural older adults participating in government-sponsored health examinations [33]. The demand for elderly care frequently exceeds the available resources, especially in rural areas, exacerbating disparities in care accessibility [95]. In light of these challenges, the primary recipients of AAOA are vulnerable individuals requiring support. AAOA serves a crucial role in assessing and addressing their needs, facilitating access to home care or welfare services.

## 4 Methodology

This paper seeks to provide an in-depth, empirical understanding of the Ability Assessment of Older Adults (AAOA) in real-world contexts. Specifically, we focus on: (1) the current practices and processes of AAOA, (2) the challenges encountered by specialized ability assessors, and (3) assessors' attitudes, perceptions, and expectations regarding technological support for AAOA. To investigate these aspects, we conducted a multi-phase qualitative study, including 28 field observations of real-world AAOA practices and in-depth semi-structured interviews with eight AAOA assessors. In the following sections, we provide detailed information on the types of data collected, participant recruitment, and the data analysis process.

### 4.1 Data Collection: Observations

We initiated the study with on-site observations of in-person ability assessments to gain firsthand insights into assessment practices for older adults in real-world scenarios. Table 1 details the observation settings at three different sites. Each site was observed for one day, lasting 4-5 hours, involving three pairs of assessors.

**4.1.1 Recruitment and Criteria.** We contacted all seven government-recognized organizations in the city via their public contact numbers. Of these, six did not respond or expressed no intention to cooperate, while one organization provided a positive response. We coordinated our activities through this organization, with the manager assisting in scheduling the upcoming assessments. To ensure a diverse and comprehensive dataset, we selected three locations across different district regions, encompassing urban, suburban, and rural areas, as well as a variety of settings including homes, elderly placement centers, and public welfare homes (Fig. 1).

**4.1.2 Data Collection.** Each day, we accompanied the assessors during their assessments, taking notes on the process. We recorded assessment content, procedures, participant interactions, challenges, and the techniques and materials used by assessors. With permission, we recorded conversations during travel. Each day ended with note-sharing and discussions. After three days and 28 assessments, we documented general AAOA procedures, key challenges, and the technologies and materials used, providing crucial data for our qualitative findings and informing the subsequent interview study.

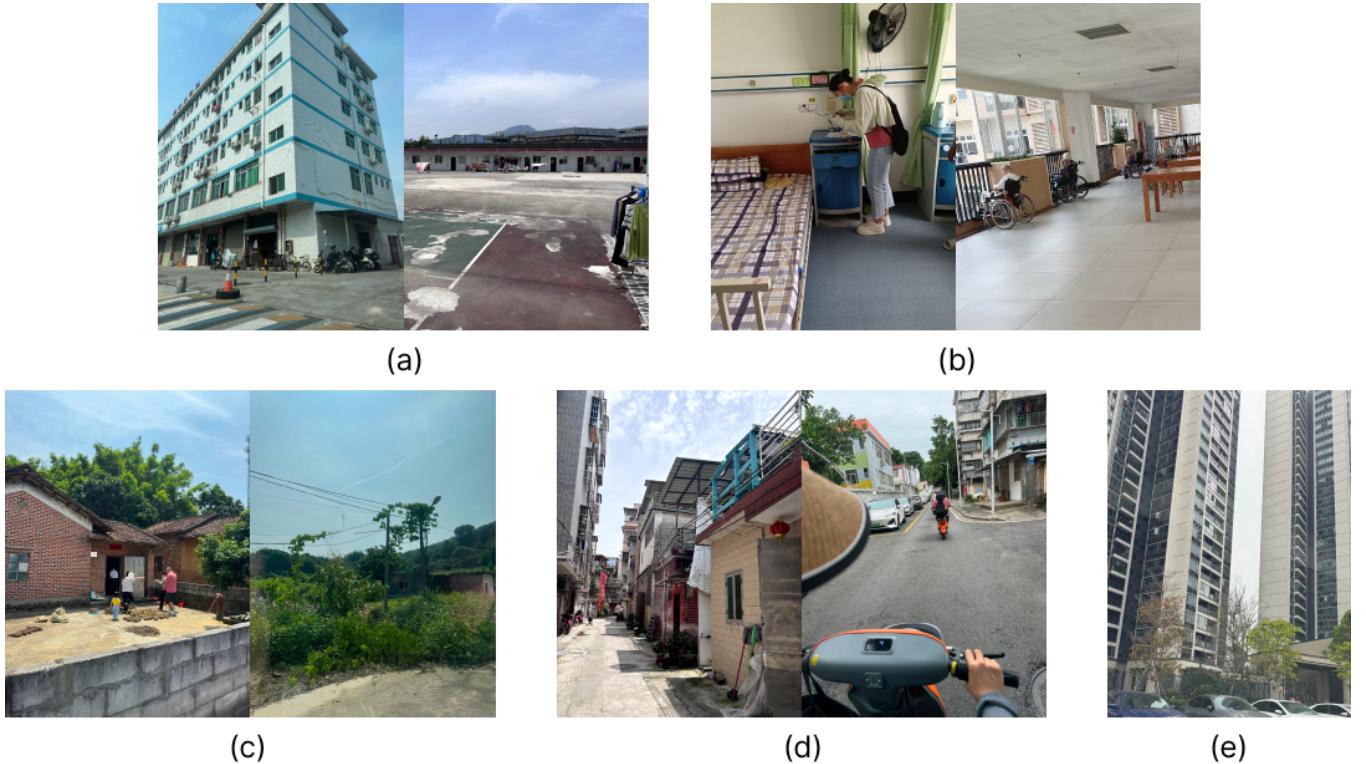
**4.1.3 Ethical Considerations.** We received ethical approval from our institution's Ethics Committee for all procedures involving human subjects and took careful steps to protect participant rights and privacy throughout the research. Each day, we introduced our research goals to new assessors. However, informing each older adult and obtaining consent during assessments was impractical and would have disrupted the assessors' activities. To avoid this, we acted solely as observers, taking necessary notes without collecting personal data or interacting with the older adults.

### 4.2 Data Collection: Semi-structured Interviews

To gain a comprehensive understanding of AAOA assessors' experiences with technology in supporting AAOA, as well as their attitudes, perceptions, and expectations of technology-supported

Location ID	Number of Assessments	Geographical Areas	Settings
L1	8	Suburban (mostly), urban	Homes
L2	11	Rural, suburban, urban	Homes, elderly placement center
L3	9	Suburban (mostly), rural	Public welfare house, homes

Table 1: Information about observed assessments (N=28)



**Figure 1: Different settings of 28 AAOAs from observations:** a) Elderly placement centers (from L2): Typically situated in rural or suburban areas, these centers provide temporary housing for older adults, as their children often live and work in urban areas. After their original homes are demolished for redevelopment, the older adults are relocated to these facilities. b) Public welfare homes (from L3): Government-subsidized private organizations that accept older adults, with a waiting period for admission. AAOAs determine the priority for admission and the annual subsidies the care home receives based on the residents' disability levels. c) Rural homes (from L2): Typically scattered across large areas, making addresses difficult to locate. d) Suburban homes (from L1): These homes are densely packed, often with narrow roads and steep inclines. e) Urban homes (from L2): Tall buildings with multiple levels.

AAOA, we conducted in-depth semi-structured interviews with eight AAOA assessors.

**4.2.1 Recruitment and Criteria.** We recruited our participants through referrals facilitated by the manager of the organization where we conducted observations. The manager introduced us to six assessors from their organization (P1–P6), one assessor who had recently

joined from another organization (P7), and one assessor who was employed at a different organization (P8).

The eight assessors we interviewed came from three organizations that collectively serve over half of the city's older adult population (see Table 2). All had experience conducting AAOAs in urban, suburban, and rural areas, as well as in both home and public

ID	Gender	Age Range	Work Experience (Year / Number of Assessments)	Professional Background
P1	M	41-45	6 years / > 3600	Social Work
P2	F	41-45	6 years / > 10000	Nursing
P3	F	41-45	6 years / > 10000	Nursing
P4	F	25-30	3 years / 200-300	Nursing
P5	F	41-45	4 years / > 10000	Nursing
P6	M	36-40	5 years / > 1000	Engineering
P7	F	21-25	2 years / > 2000	Nursing
P8	M	31-35	2 years / > 7000	Social Work

Table 2: Participants' demographic information (N=8)

welfare settings. No notable differences were observed between the three organizations during the interviews. P7, who had worked at two organizations, also reported no significant variation in assessment practices. This consistency is likely due to the assessors' training under national and provincial standards and their use of standardized tools, such as the official app-based assessment form.

**4.2.2 Data Collection.** The interview questions primarily consisted of two parts. The first part was about participants' daily AAOA activities, including: 1) their daily AAOA practices, procedures, and targeted groups; 2) follow-up questions on their practical ability assessment strategies based on our observations, such as the intention behind some practices; 3) materials and technologies used, if any; and 4) challenges encountered.

The second part focused on participants' experiences, attitudes, perceptions, and expectations of technology-supported AAOAs. To prompt interviewees' reflections on technology-supported AAOAs beyond the mobile applications they currently use, we introduced several research-based technologies: 1) explainable dementia screening via machine learning [70], 2) social robots for cognitive and fall assessments [38], and 3) smart home sensors for daily activity assessment [2]. Drawing on the manager's reference to innovative products showcased at the City Elderly Health Expo, we also discussed smartwatches, care home robots, and physical ability assessment machines. While these technologies and products can assess specific abilities, we found no existing technology capable of supporting a comprehensive assessment process like AAOA.

**4.2.3 Ethical Considerations.** Before commencing the interviews, we informed participants of our intentions and provided background information about the study. We assured them that the collected data would be used solely for this research and obtained their consent. All data collected during our study was anonymized, ensuring there was no link between the collected data and any individual participant.

### 4.3 Data Analysis

We conducted a thematic analysis [12, 13, 63], guided by an iterative and systematic approach. This method enabled the development of themes through collaborative coding and consensus-building, ensuring both trustworthiness and rigor throughout the analysis process. The analysis process was supported by FigJam board software, which facilitated efficient data organization, coding, and theme development. Three authors participated in the analysis,

with coding beginning alongside data collection to allow for iterative development of codes and themes as new data emerged. During the open coding phase, each author independently reviewed the data, generating codes aligned with the research objectives. Weekly meetings facilitated team alignment and refinement of ideas. An initial code list was created to capture participants' practices, procedures, challenges in AAOA activities, interactions with technology, and their perceptions and expectations of technology-supported assessments. We then synthesized the codes into broader themes. After several rounds of analysis and discussion, the team reached consensus and developed a final thematic map identifying five core themes (see Appendix B). The following section presents a detailed discussion of these themes, illustrated with representative quotes from participants, translated from Chinese to English.

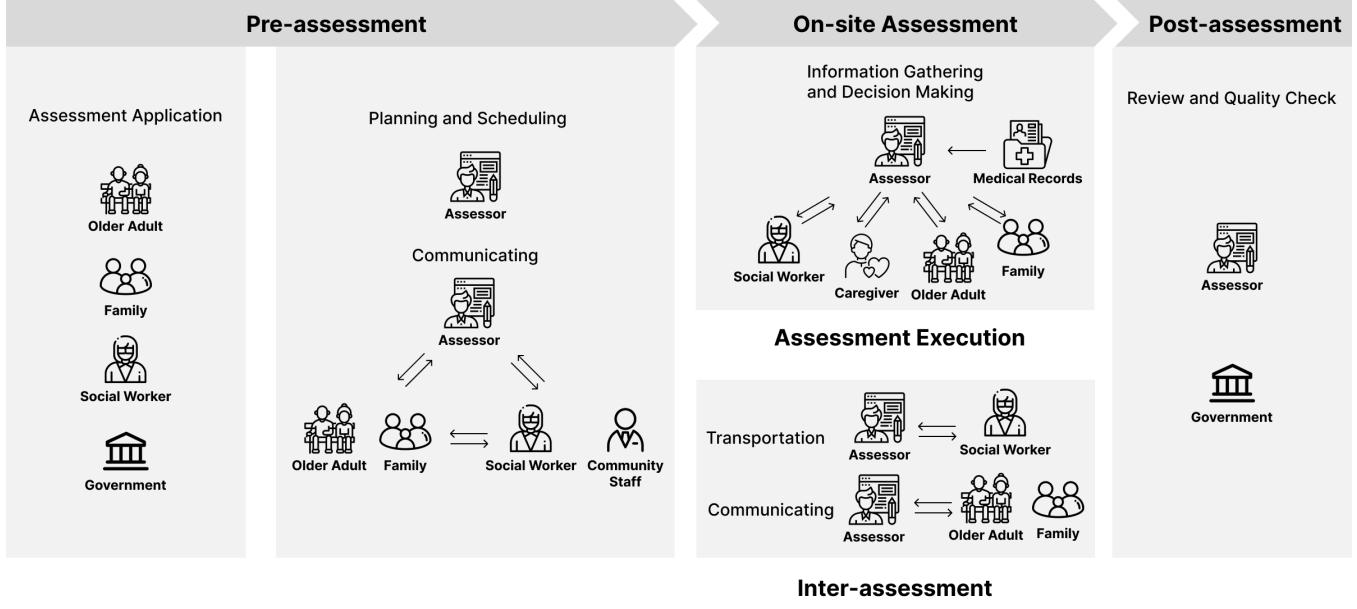
## 5 Results

In addressing our research questions, we present key findings across five main dimensions: (1) activities and technology use in practical Ability Assessment of Older Adults (AAOAs), (2) on-site challenges faced by assessors during AAOAs, (3) strategies employed by assessors in conducting assessments, (4) less visible, unresolved challenges encountered during AAOAs, and (5) assessors' expectations for technology-supported AAOAs.

### 5.1 Activities and Use of Technologies in Practical AAOAs

**5.1.1 Overview of Practical AAOAs.** Given the number of older adults requiring assessment and the limited number of full-time assessors, each assessor is typically responsible for assessing 10-30 older adults per day. Assessments are required to be conducted in pairs. Based on our observations and discussions with assessors, the AAOA workflow comprises three main stages (see Fig. 2): *Pre-assessment, On-site Assessment, and Post-assessment*. To be specific:

**Pre-assessment.** This phase begins with the initiation of the assessment application. The application can be submitted by the older adult, their family, or sometimes by a social worker on behalf of the older adult through the government system. Once the request is received, the assessor handles planning and scheduling the assessments, prioritizing cases based on urgency and proximity. The assessor communicates with the older adult, their family, social workers, or community staff to ensure they are informed of the schedule and to remind them to prepare necessary documents, such as medications and medical records, for the assessment.



**Figure 2: Overview of the Ability Assessment of Older Adults (AAOA) process, structured into three phases: Pre-assessment, On-site Assessment, and Post-assessment. The process involves multiple stakeholders—Older Adults, Families, Social Workers, Assessors, and the Government—and encompasses critical steps such as Application, Planning and Scheduling, On-site Information Gathering and Decision Making, Inter-assessment Coordination, and Review and Quality Control.**

**On-site Assessment.** The on-site assessment consists of two key stages: assessment execution and inter-assessment. During the assessment execution stage, assessors collect essential information and make decisions based on direct interactions with the older adult. Upon arriving at the older adult's place, assessors first conduct facial recognition verification for both themselves and the older adult, followed by a request for the older adult to sign an honesty agreement (Fig. 4 (e)). Data is then gathered through interactions with the older adult, their family, and, when applicable, a caregiver or social worker. This includes reviewing medical records (Fig. 4 (h)), engaging in conversations, and asking the older adult to perform tasks such as raising their hands or recognizing the time (Fig. 4 (c)). Each on-site assessment typically lasts 4 to 10 minutes.

Assessors use a specialized app to conduct and document the assessment, with each assessor responsible for specific sections. All questions are multiple choice, allowing assessors to evaluate abilities one by one (Fig. 4 (g)). At the conclusion, assessors can add comments or upload additional evidence, such as videos or photos of the older adult performing tasks or displaying medications (Fig. 4 (f)).

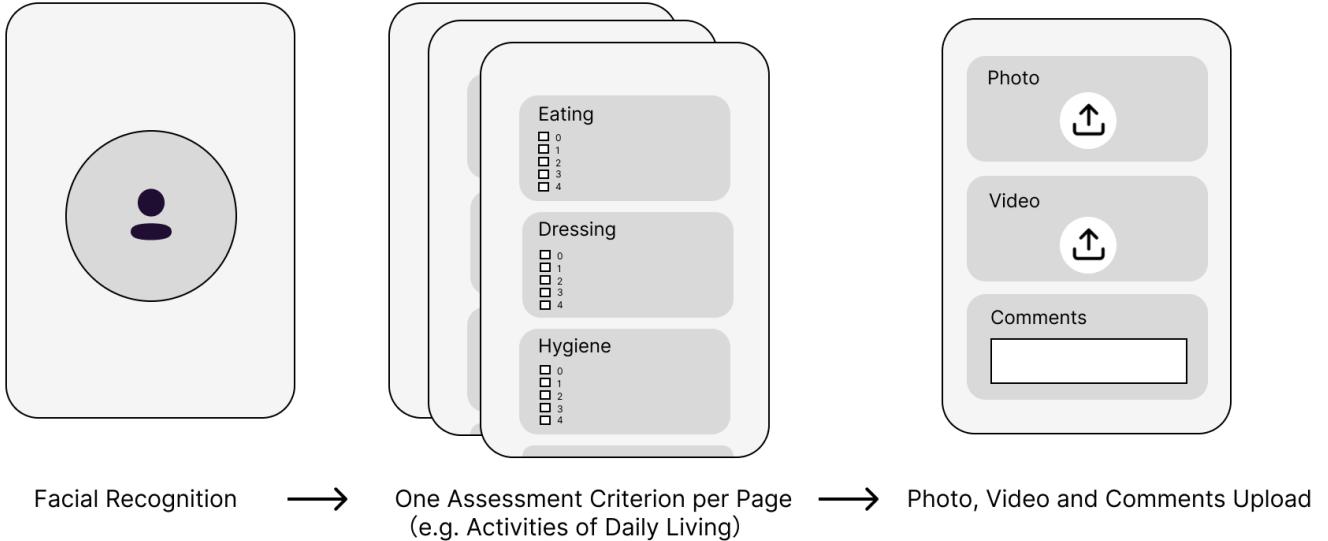
The inter-assessment stage takes place between assessments conducted on the same day. During this period, assessors spend considerable time traveling between locations and locating the exact addresses of older adults (Fig. 4 (d)), often adjusting their transportation methods to suit the environment. Assessors frequently collaborate with social workers and community staff to find addresses and coordinate logistics throughout the assessment process (Fig. 4 (a)).

**Post-assessment.** After each assessment, an in-house assessor reviews all collected materials (assessment forms, videos, and photos) in the app to verify the accuracy before officially submitting the results to the government. Additionally, the government periodically selects certain older adults for a follow-up visit and reassessment as a quality control measure.

**5.1.2 Existing Usage of Technologies.** Our findings indicated that the assessment process relied heavily on smartphones. Instead of traditional paper-and-pen methods, assessors used a government-provided app to record assessment data (fig. 3). They also utilized their phone cameras to take videos and photographs of the older adults during assessments. For navigation, they employed the phone's map application. Additionally, assessors used private messaging apps to contact local community social workers for assistance with location finding. The detailed challenges and technological needs within the practical AAOA are presented in Sections 5.4 and 5.5.

## 5.2 Challenges of Conducting On-Site AAOAs

**5.2.1 “There’s Always Something Unexpected”.** Assessors often face significant challenges due to limited prior knowledge about the older adults and the environments where assessments will be conducted. This leads to many unexpected situations for assessors to handle. For instance, it is common for older adults to refuse assessments or not cooperate for several reasons: depression after moving to a care home, anxiety due to misconceptions about the visit’s purpose (such as mistaking it for an inspection), conflicts with the care home, or fear of being deceived. Additionally, those



**Figure 3:** The flow of the application used during assessments starts with facial recognition, followed by one assessment criterion per page (e.g. Activities of Daily Living), and then proceeds to photo, video, and comment uploads.



**Figure 4:** Photos from onsite assessment observations. a) A local community worker responsible for delivering food to older adults guides the assessors through rural roads to reach residents in remote areas; b) An assessment conducted at a rural elderly care center, where older adults are resting outdoors; c) In a care home, an assessor asks an older adult to read the time from their watch for a cognitive assessment and prepares a newspaper to test their vision; d) Assessors inquire an older adult about how to access the building of an elderly placement center; e) An assessor performs facial recognition while an older adult signs an honesty agreement; f) Assessors select photos depicting older adults' physical conditions (left) and add detailed notes on specific issues in the comment section (right); g) Assessors fill in the multiple-choice social support scale; h) Assessors examine medications (left) and medical records (right) to complete the health condition assessment.

with mental impairments and dementia may exhibit aggression or have significant communication barriers. P5 noted, “if they are unwilling to speak, then it is really hard to determine it is cognitive ability issue or they are unwilling to cooperate.” Dialect differences

and hearing loss further complicate effective communication and information gathering. Furthermore, older adults might not be at home at the scheduled time or may forget about the assessment

altogether. These situations can cause delays, require multiple assessment attempts, or complicate the assessment process. As P2 noted: “*We have to quickly adapt to different situations, considering the older adults’ cooperation, mental state, family support, and understanding of our work—all of which can be very unpredictable.*”

Currently, assessors often have access only to basic demographic details about older adults, which hampers the assessment process. Detailed prior information, such as medical records, is crucial for validating health conditions but is not pre-uploaded or included in any forms in the preceding workflow. On the day of the assessment, older adults may be “*unable to locate their medical information, may not remember its location, or it may be held by absent family members*” (P1). This makes it challenging for assessors to reliably determine their medical conditions based solely on questioning or reviewing medications.

The problem is further compounded by the limited involvement of family members and caregivers in the information-gathering phase preceding assessments. This phase is crucial for collecting personalized details, yet the current government-provided process lacks a formal mechanism for their participation. Consequently, assessors often struggle to obtain comprehensive information prior to conducting assessments. This gap can lead to incidents that negatively impact older adults’ emotional well-being, given the inherently communicative nature of the assessment process. For instance, P1 recounted a case involving an older adult with cancer—a diagnosis the family had intentionally withheld: “*While reviewing an older adult’s medication, one of our colleagues almost mentioned ‘this is for cancer’ before the family quickly intervened. They later explained that they had been hiding this information from the older adult. Incidents like this could be avoided if we had more accurate and detailed information before the assessment.*” Assessors also noted that privacy and confidentiality concerns further contribute to this lack of involvement. Family members and caregivers are often reluctant to disclose sensitive health information without the explicit consent of the older adult (P8), creating additional barriers to effective preparation.

**5.2.2 “What We See is Not Always the Truth”.** Accurately assessing the abilities of older adults can be influenced by both unintentional factors and deliberate misrepresentations. Assessors often encounter older adults in circumstances that do not accurately reflect their typical condition, such as immediately after returning home or upon waking, which may impact their performance. Environmental factors, like temperature, also affect assessments; for example, “*Warmer weather significantly improves the mental state and abilities of older adults*” (P3). In warmer weather, older adults tend to be more alert and engaged, improving their performance in tasks like recalling the date. In contrast, cold weather can cause stiffness and fatigue, making physical tasks and cognitive performance more difficult. Tasks like recalling the date may also suffer from lack of interest rather than cognitive limitations. As P3 observed, “*In care homes, you’ll see older adults playing mahjong with great skill—how could they not know the date? They might simply not be paying attention.*”

Beyond these objective factors, assessors must also contend with intentional misrepresentations. Some older adults may downplay symptoms, presenting themselves more favorably. For example, P5

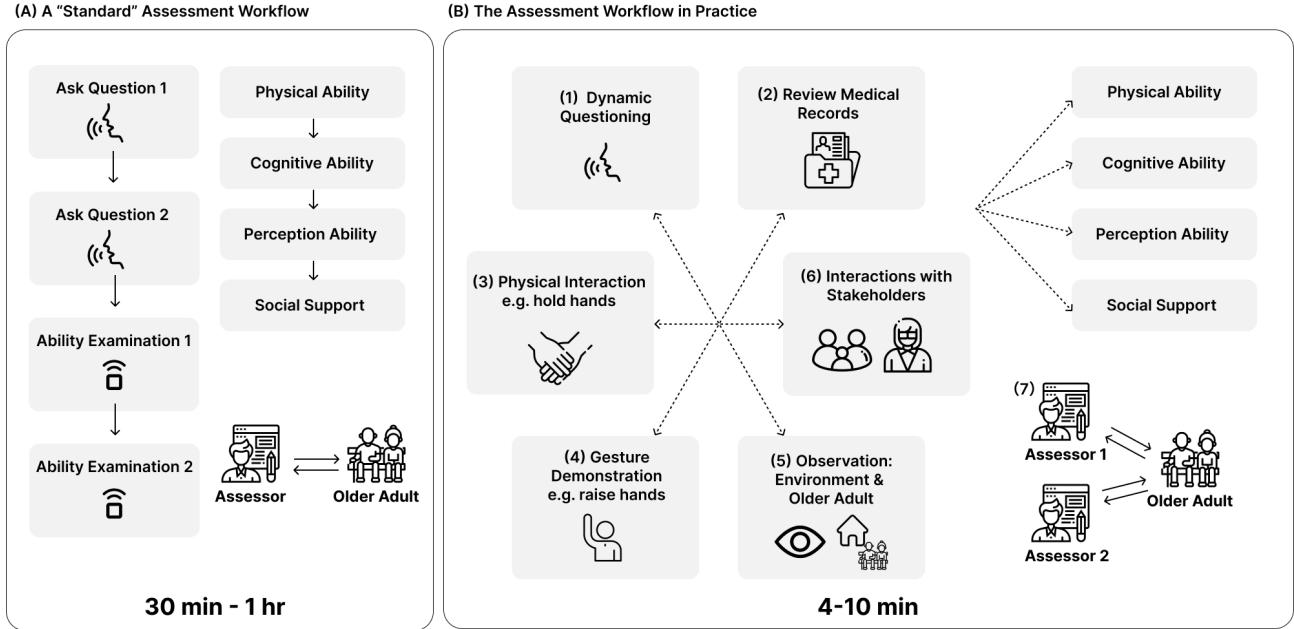
noted, “*Older adults may hide their true condition, claiming to feel fine despite experiencing pain or sleep issues, often because they want to believe they are still in good health.*” Similarly, some may attempt to demonstrate abilities that exceed their actual capacity by “*insisting on performing actions to prove their capability*” (P2). Caregivers may exaggerate dependency, claiming older adults require more assistance than is accurate, as P1 noted: “*They’ll insist the person cannot eat independently and must be fed*.”

Conversely, some older adults may exaggerate their impairments to secure more financial support or faster access to care services, particularly because they are part of an especially vulnerable group with limited resources as elaborated in Section 3. Family members or caregivers sometimes encourage these misrepresentations, coaching the older adults on how to act during the assessment. P2 recounted, “*Family members or staff coached the older adults on what to say and how to behave before our arrival... it became apparent because they were too familiar with the assessment criteria.*” Distrust of assessors also plays a significant role. Older adults and their family members may feel uncertain or uneasy about the motives behind the assessment, leading them to “*provide inaccurate information*” or “*refuse the assessments to protect themselves*” (P2).

### 5.3 Workflow and Strategies of Assessors in Practical AAOAs

Despite these challenges, assessors must adapt their approach to complete assessments effectively. Typically, the process and structure of the assessment metrics follow a **standard, structured workflow** (Fig. 5 (A)), in which assessors ask sequential questions to gather information on various abilities—physical, cognitive, perceptual, and social support. This approach is linear, with each question and task addressed in turn, usually taking 30 minutes to an hour. While systematic, this approach may miss the complexity of older adults’ abilities and limit efficiency. In practice, however, assessors often adopt a more **flexible, adaptive workflow** (Fig. 5 (B)). This approach allows them to efficiently gather comprehensive information by using parallel methods, such as combining observation, stakeholder input, and real-time adjustments. As a result, assessors can obtain a more holistic view of an older adult’s abilities within just 4 to 10 minutes.

Central to this adaptive workflow is **(1) dynamic questioning**, where assessors adjust inquiries based on the older adult’s emotional and cognitive state. For example, asking about daily activities like grocery shopping can reveal insights into multiple abilities. As P5 explained, “*If their cognitive abilities are good, I’ll ask if they know today’s date. If not, I’ll start with the month or greetings to gauge their sense of time.*” This flexibility also helps assessors handle **sensitive topics** with care. Personal or emotionally charged issues, like incontinence or cognitive decline, are approached gradually, starting with casual questions to build rapport before moving to more intimate topics. Assessors may lower their voice when discussing private matters, especially in public settings. P4 noted, “*We ask about spouses in the basic information section, but assessing their comfort level first is key. These questions are better approached after building trust.*” This strategy encourages more accurate and honest responses from older adults.



**Figure 5: An overview of the assessment workflow.** On the left (A), the “standard” workflow is shown, where assessors follow a segmented, step-by-step process—asking each question and receiving definitive answers before moving to the next, and addressing each ability category sequentially. This structured approach typically takes around 30 minutes. On the right (B), the actual workflow used in practice is depicted, illustrating how assessors adapt to high assessment volumes by paralleling tasks and flexibly gathering information from multiple sources to complete evaluations more efficiently.

In addition to questioning, assessors often **(2) review medical records** to gain a comprehensive understanding of the older adult’s health background. These records provide critical context, enabling assessors to tailor their observations and inquiries based on pre-existing conditions that might affect physical or cognitive performance.

**(3) Physical interaction** plays an equally important role in the assessment process. For example, holding an older adult’s hand allows assessors to gauge grip strength. As P8 explained, such hands-on approaches provide immediate insight into whether the older adult can manage daily tasks, such as using utensils or dressing independently.

Assessors also use **(4) gesture demonstrations**, such as asking an older adult to raise their hands, to assess mobility in a simple, non-invasive manner. As P3 noted, a single gesture can reveal multiple physical abilities, making it an efficient tool for assessing functional health—one that older adults are generally willing to perform. When appropriate, assessors opportunistically incorporate tools the older adults are already using, such as asking them to simulate eating during a casual meal. This flexible, unobtrusive approach minimizes disruption while gathering useful data.

Equally critical to the practical assessment is **(5) observing the older adult and their environment**. This involves closely monitoring “*unintentional behaviors*” (P2)—subtle, often subconscious actions that provide valuable insights into the individual’s abilities.

For instance, assessors may observe whether the older adults can open doors independently, navigate their home without assistance, or whether there are signs of incontinence, such as the presence of unused adult diapers or noticeable odors. These **unintentional behaviors** frequently reveal cognitive or physical impairments that might not surface during formal questioning. As P1 highlighted, assessors adopt a holistic approach, engaging all their senses—“*watch, hear, smell, ask, touch, like a Chinese medicine doctor*.” Assessors also observe the home environment and the people present to gain an understanding of living conditions, family dynamics, and relationships. These observations allow assessors to maintain the dignity of the older adult by avoiding questions that may cause embarrassment, appear too simplistic, or make the individual uncomfortable, while preserving a professional and respectful approach.

Finally, **(6) collaboration with stakeholders**, including family members, caregivers, and social workers, is vital in ensuring a comprehensive assessment. Stakeholders provide valuable contextual information, especially when communication barriers exist. As P1 noted, social workers often have a “*70-80% grasp on family relationships*,” which assists assessors in navigating sensitive topics and building trust. P2 further highlighted the importance of having a familiar presence to gain the older adult’s trust: “*Even though we wear uniforms, older adults may not trust us and withhold information. That’s why having a familiar staff member present is crucial*.” This

multi-stakeholder collaboration ensures that the assessment captures the older adult's abilities within the context of their broader social support network.

A key advantage of the practical workflow is the way in which **(7) two assessors work seamlessly together**. Instead of strictly dividing tasks, they alternate naturally between asking questions and recording, ensuring that any gaps or follow-up questions are addressed in real time. This fluid collaboration allows for smooth transitions between roles, where each assessor contributes to gathering essential details without disrupting the flow of the assessment. Their coordinated efforts enhance efficiency and ensure a more thorough and accurate evaluation, all while adapting to the older adult's responses and needs.

In conclusion, while the **(A) "standard" assessment workflow** offers a structured and systematic approach, the **(B) practical assessment workflow** is far more dynamic, incorporating real-time adjustments, sensory observations, and collaboration between both assessors and stakeholders. This flexible, parallelized approach enables assessors to efficiently manage high volumes of evaluations while still capturing the complex, nuanced realities of older adults' lives, ultimately allowing for more informed and empathetic decision-making.

## 5.4 Invisible and Unresolved Challenges of Practical AAOAs

Despite the effective strategies assessors employ, which have allowed them to complete a vast number of assessments over the past few years, their work remains fraught with invisible and unresolved challenges. This section explores these difficulties in detail, highlighting the complexities and obstacles that assessors face in their efforts to accurately evaluate the capabilities of older adults.

**5.4.1 The Unreliable: Current Technical Limitations.** The assessment process heavily relies on smartphones and internet connectivity, which introduces several challenges. A key issue is the misalignment between the assessors' dynamic, parallel workflow and the rigid, sequential structure of the current application. As shown in Figures 3 and 4, the app requires assessors to fill in questions one by one and click "next page" for each criterion. Assessors noted that this rigid format increases cognitive demands, as they must remember previously evaluated abilities while progressing through the assessment, which conflicts with their more fluid, multitask-oriented approach. Additionally, while videos and pictures need to be captured during the assessment, the app mandates uploading them only after completing the entire evaluation. This process forces assessors to use personal device cameras to record these files, storing them locally before uploading, raising security and privacy concerns. Moreover, the requirement to simultaneously fill out forms, conduct facial recognition, and capture media can distract assessors from engaging attentively with older adults. As one assessor shared, "*An older adult once remarked, 'Why do you always hold your phone while talking to me?'*" (P7). Technical issues such as app crashes or device malfunctions can lead to data loss or a return to paper-based methods, further increasing the assessors' workload. In rural areas with poor internet coverage, assessors face challenges in uploading data in real time, which impacts assessment

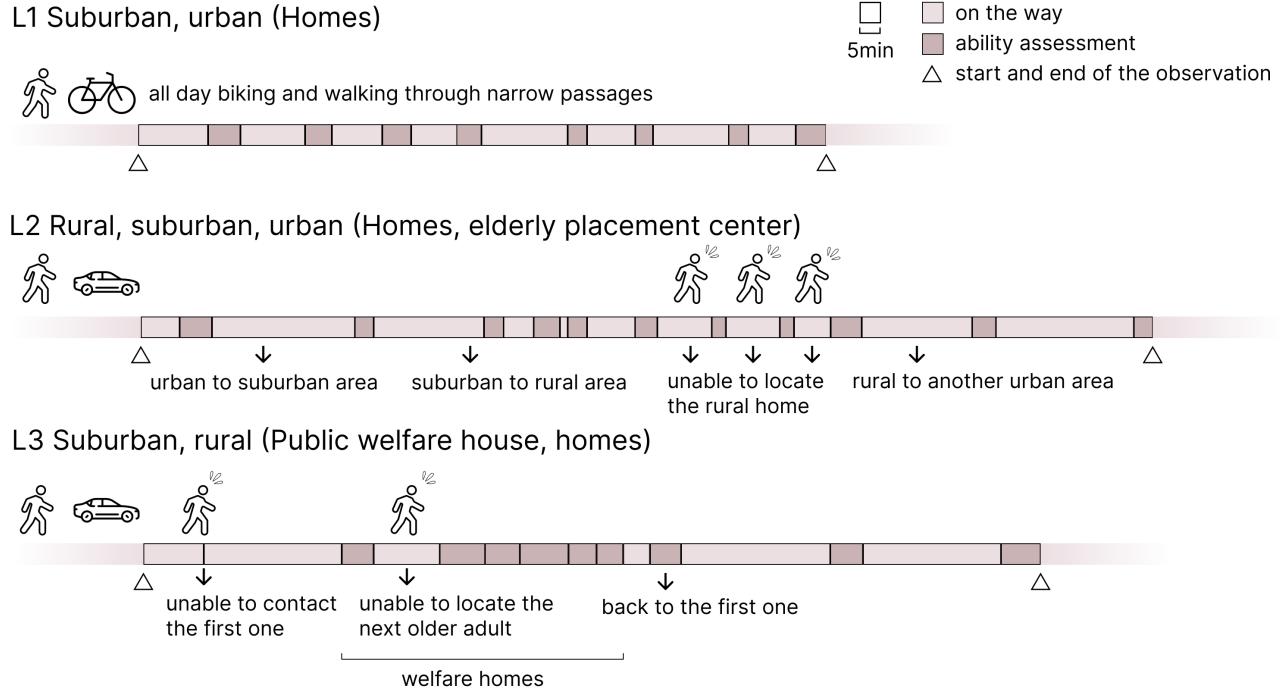
efficiency. Overall, the app's lack of workflow optimization limit its ability to streamline the assessment process effectively.

**5.4.2 The Exhausting: Planning, Traveling, and Contacting.** Assessors spend significantly more time on pre- and between-assessment activities, such as planning, traveling, and contacting older adults, than on the assessments themselves. These are the areas where they feel in need of significant support. Daily, they carefully plan their routes to ensure all requests are completed on time, a task that is both time-consuming and energy-draining. Navigating rural areas presents additional challenges, as addresses may be inaccurate or not clearly marked on maps. The physical demands of transportation are considerable, often involving all-day walking, biking, driving, and climbing stairs to reach each assessment location. During our observations, assessors completed all assessments before noon to avoid missing older adults who take afternoon naps. This tight scheduling often means assessors cannot take regular meal breaks, adding to the physical demands of the job. Moreover, any delay in an assessment necessitates immediate communication with all subsequent appointments to prevent a "cascading effect," which further exacerbates the assessors' stress. Despite these challenges, assessors feel a profound sense of responsibility; P3 noted, "*If I cannot complete the assessment, the food delivery service that the older adult relies on might be discontinued. Where would they get their food?*" We have included a graph (Fig. 6) illustrating the distribution of their time across the three days during observations.

**5.4.3 The Ambiguous: Assessment Criteria.** The assessment tools currently utilized are insufficiently quantifiable, leading to outcomes that may lack full objectivity. The reliance on multiple-choice questions introduces ambiguity and subjectivity into the decision-making process, even for experienced assessors. For example, questions designed to evaluate the cognitive abilities of older adults may offer options such as "knows a few people," "knows some people around," and "knows a large number of people around." These descriptors are inherently vague, making it difficult to establish clear criteria for what constitutes "few," "some," or "large." This issue is exemplified by P1, who questioned, "*How should one accurately gauge this measure if the older adult only interacts with one caregiver?*" However, assessors noted that the official training provided is insufficient to give them a clear understanding of how to accurately perform the ratings.

Similarly, in assessing physical abilities, assessors are tasked with assigning a score on a scale from 0 to 4. However, they indicated that the actual abilities of older adults may not fit neatly within these predefined categories. As P5 noted, "*It's not just a simple 'yes' or 'no.' Sometimes it's difficult to assess because they often exist in that in-between state.*" Additionally, assessors often hold the hand of older adults to evaluate grip strength as an indicator of functional capacity in daily activities, but this approach is recognized by assessors as highly subjective.

Moreover, despite efforts to observe the living environments of older adults and gather relevant clues, achieving a comprehensive understanding of their social support systems remains challenging without deep insight into their life circumstances. P7 articulated this difficulty, "*It's difficult to assess the social support scale. In emergencies, the family might offer financial support, but it may not be sufficient, making it challenging to determine.*"



**Figure 6: Distribution of time spent on traveling and conducting assessments.** The graphic illustrates the time allocation of assessors across three observation days in different settings. The majority of time is spent on traveling between locations, with additional challenges such as navigating narrow passages (L1), difficulty locating rural homes (L2), and the inability to contact or locate older adults (L3). Each block represents 5-minute intervals, highlighting the significant time demands associated with traveling and contacting compared to the actual assessment time.

**5.4.4 The Hidden: Regional Inequities and Differences.** Assessments require both on-site observations and access to older adults' medical records, which reveal health conditions not apparent through observation alone. Assessors have noted significant disparities in rural areas, where older adults often lack both awareness and access to healthcare services. Consequently, these individuals seldom possess medical records or are unaware of any long-term illnesses they might have. This absence of documentation unfairly disadvantages them during assessments, as unrecorded health issues may lead to inaccurately high assessment scores. These inflated scores mistakenly suggest better health than is accurate, thereby reducing their priority for receiving necessary social services. As P3 noted, "*This highlights the flaws in this assessment—it's not truly fair.*" Despite being cognizant of these inequities, assessors are compelled to evaluate and score based on the available evidence, perpetuating this systemic disadvantage.

Beyond disparities in healthcare access, assessors also observed notable differences in how urban and rural older adults engage during assessments. Urban older adults, especially those with higher education levels, tend to be more "*proactive and assertive*" (P6), frequently questioning the assessors' authority, training, and the purpose of the evaluation. Conversely, rural older adults are generally more "*reserved and compliant*" (P6), rarely challenging the

process and generally "*following what their children tell them to do*" (P1). These differing engagement patterns necessitate careful preparation by assessors, including the use of well-crafted language and supporting documentation to address potential doubts or inquiries. The underlying reasons for the differences in engagement styles are explored in detail in Section 6.3.

**5.4.5 The Validity: Review Mechanisms.** As previously mentioned, the review mechanism consists of two parts: an in-house assessment review and government-selected reassessments. Each has its own limitations. In-house reviews are limited to the same information that was initially collected as "*(assessors) cannot record the entire time*" (P1), enabling assessors to identify only significant discrepancies, such as between degree 0 and degree 4. However, they struggle to determine the accuracy of subtler differences, such as between degree 1 and degree 2, as well as aspects that are not recorded or easily to be observed from the video clips, such as vision as P7 elaborated "*even if the older adult is entirely blind, you might not able to identify it from photos or videos*". Additionally, since assessors typically conduct assessments on the same adults every one to two years, they observe that older adults' abilities can significantly change during these intervals. Consequently, government reassessments sometimes show different results, which do

not necessarily reflect inaccuracies in the original assessments but rather the natural progression of aging.

## 5.5 Assessors' Needs and Concerns for Technological Support in Assessing Older Adults' Abilities

**5.5.1 Support Measuring.** Assessors emphasized the need for technological tools to efficiently and accurately measure physical capabilities in older adults. For instance, a device like a smart cane with a grip strength sensor would provide a convenient alternative to manual methods. As P6 noted, such a device would allow assessors to “*measure hand strength conveniently*,” replacing practices like holding an older adult’s hand or observing arm strength.

P1 stressed that these tools should replicate the intuitive methods used by human assessors. For example, by simply holding an older adult’s hand, assessors can make informed judgments about multiple activities of daily living, such as using utensils, dressing, or brushing teeth. P1 suggested that an ideal tool should “*be capable of providing answers to multiple questions through a single test, and obviating the need for video recordings as evidence*.”

Assessors also noted the importance of portability and inclusivity. P7 highlighted tools like “*special chopsticks that do not restrict their gesture*,” accounting for different usage habits and eyesight conditions. Additionally, P1 envisioned tools such as a VR device that could standardize vision testing conditions, ensuring that older adults accurately perceive visual acuity charts during assessments.

**5.5.2 Support Daily Data Collection.** Assessors favored the collection of daily activity data from older adults, such as information on “*walking patterns, nighttime awakenings, or time spent on meals*” (P6). This data can validate self-reported responses and highlight areas difficult to observe during standard assessments. As P6 noted, “*This data is definitely helpful, offering a review based on actual daily life. If an older adult says they can complete a task, but the data suggests otherwise—how many times they completed it, or how thoroughly—then I have evidence to support my judgment*.” Data from motion sensors or cameras could provide clips or reports aligned with assessment criteria, offering a solid basis for targeted questioning. However, assessors acknowledged that family members might hesitate to share this information.

Additionally, robots in care homes engaging older adults in cognitive games can generate supplementary material for cognitive assessments. Assessors emphasized that cognitive games are more useful for tracking changes over time rather than diagnosing impairments, as variations in performance may occur even among those with similar cognitive abilities. As P6 explained, “*A prerequisite is understanding an older adult's baseline cognitive level... it can be used to track cognitive changes rather than to diagnose cognitive problems*.”

**5.5.3 Support Planning, Locating, Contacting.** Assessors currently allocate considerable time to manual scheduling and route planning for their assessments. They advocate for a system that can automatically plan routes and estimate arrival times at each location. Such a system should also include functionality for automatically contacting older adults, thereby eliminating the need for manual planning and communication on the preceding day. Ideally, this planning

system would be dynamic and adaptive, capable of automatically adjusting schedules in the event of delays and informing subsequent older adults of any changes. Moreover, the system should support a multi-stakeholder mode, enabling relevant parties—such as family members, social workers, community and care home staffs and caregivers—to input and update locations directly within the system. As P7 noted, “*It will save us significant time locating older adults, especially in rural areas, if social workers or rural community staff could directly send us the exact location of older adults*”.

**5.5.4 Support Remote and Online Assessments.** The necessity for online assessments has become increasingly evident, particularly during the COVID-19 pandemic, when lockdowns in China prevented assessors from conducting in-person visits. This disruption led to delays in assessments, jeopardizing the continuity of essential services for older adults. Assessors believed that online assessments could significantly enhance efficiency by reducing the time and effort required for transportation and route planning.

However, the implementation of remote assessments presents several challenges. A primary concern is the technical literacy of older adults, especially in rural areas where both older adults and their children may lack the necessary skills to use mobile devices. Moreover, assessors expressed doubts about the reliability of data collected through remote methods, fearing that important details may be overlooked due to the absence of in-person, multisensory interactions. As P6 noted, “*I always emphasize that our job involves all kinds of multisensory observations and interactions. It requires touch, smell, and direct engagement, so you'll miss a lot of details simply with video conferencing*.”

**5.5.5 Support the Safety of Female Practitioners.** Although the current assessment procedure requires only the uploading of images and several video clips of older adults, some assessors considered the use of continuous video recording devices throughout the entire assessment process. This consideration arises from concerns about the safety of female assessors. P1 recounted, “*Two of our female colleagues once visited the home of a 70-year-old bedridden older adult. His son, who was about 40 years old and responsible for his care, made them feel uncomfortable by constantly staring at them and intentionally getting too close. This created a sense of insecurity for the assessors. The risk of sending two female assessors to rural towns or into private homes for assessments is a significant concern for us*.”

However, P1 acknowledged that implementing continuous video recording poses substantial challenges, including the high costs associated with storage and the human resources required to manage and maintain these recordings. As a result, the organization is currently unable to adopt this approach.

## 6 Discussion

Our study, based on 28 on-site ability assessment observations and interviews with eight assessors, reveals the complexities of AAOA that extend beyond simple question administration. Assessors are tasked with managing substantial demands in information gathering, decision-making, logistics, and quality control. This section explores the key challenges and opportunities identified in our

research, focusing on how technology can enhance assessment accuracy, improve data shareability, and foster collaboration among stakeholders. We also examine the invisible labor and logistical hurdles assessors encounter, as well as the cultural and emotional dynamics that influence assessments. Finally, we reflect on the broader implications of our findings, considering their relevance to global aging populations and healthcare systems.

## 6.1 Leveraging Technology to Enhance Ability Assessment of Older Adult

**6.1.1 Towards Comprehensive Understanding: Leveraging Long-Term Data for Reliable Assessments.** Our findings reveal that brief, short-term interactions during assessments make it difficult for assessors to fully understand an older adult's daily functional abilities and health status. This aligns with prior research on the challenges of reliability and accuracy in assessments, especially when interactions with older adults are limited [4].

To address this issue, assessors in our study emphasized the need for technologies that enable long-term data collection to provide a more comprehensive view of older adults' lives. Passive methods, such as sensors tracking behavioral patterns or short video clips capturing natural, unintentional behaviors, could enhance the reliability of assessments. Active approaches, like gamified cognitive assessments via social robots, also show promise. For instance, social robots already used in some care facilities not only collect cognitive data through interactive games but also potentially enhance cognitive function with regular engagement [25, 88]. However, these technologies present challenges, including data overload, privacy concerns [87], and questions about the reliability and quality of collected data [40, 56]. The large data volumes generated can increase assessors' workload in cleaning, interpreting, and integrating information into decision-making. To address this, we recommend systems that produce concise, actionable summaries of functional capacities, supported by user-friendly interfaces and predictive analytics to streamline the evaluation process [50]. Additionally, breakdowns in data infrastructure may shift the burden of data management to family members or caregivers [83], underscoring the importance of collaboration among assessors, caregivers, and families to ensure the equitable and effective implementation of these technologies.

**6.1.2 Enhancing Data Shareability and Reusability: Balancing Context, Quality, and Ethics.** Another key challenge identified in our study is the limited shareability and reusability of assessment data. Consistent with prior research in other care contexts [10], we found that data collected during assessments—such as multiple-choice questionnaires and short video clips—often lacks sufficient context for quality control and review, resulting in gaps in contextual understanding and data utility.

To address this, we recommend technologies that enhance both the quantity and quality of data collected during onsite assessments. For instance, continuous video recordings could provide a more comprehensive view of older adults' behaviors but raise privacy concerns, particularly in personal homes, as well as increased demands for data storage and management. Assessors also suggest incorporating tools that capture objective measures, such as grip strength or vision tests, which can provide tangible evidence

for reviews and records. We emphasize the need for assessment technologies to produce data that is not only actionable but also shareable and reusable across stakeholders. Further research should explore how to balance these advancements with ethical considerations, such as privacy and data security, to ensure practical and effective implementation.

**6.1.3 Fostering Collaboration in AAOA: Enhancing Stakeholder Communication and Integration.** The AAOA process is inherently collaborative, involving multiple stakeholders beyond assessors. Family members and caregivers offer insights into older adults' daily living conditions, while social workers and community staff provide expertise on personal, financial, and family dynamics. Governments play a key role in coordinating efforts and ensuring assessment quality. Despite this, current technologies largely focus on improving assessment accuracy, often neglecting the need for collaboration among stakeholders. This leads to fragmented communication, with limited interaction between assessors, family members, and caregivers. Additionally, inadequate technical support for coordinating with social workers or community staff increases logistical burdens on assessors.

To address these issues, we recommend developing tools that enhance communication and information-sharing among all stakeholders. Such tools could reduce logistical challenges and enable a more comprehensive understanding of older adults' needs. Integrating these tools into official workflows, with government support, would promote a more cohesive and efficient process.

**6.1.4 Directions for Remote Assessments.** The demand for remote assessments has risen, especially in response to the COVID-19 pandemic. Research in telemedicine demonstrates that remote clinical assessments and occupational therapy visits not only increase convenience for older adults but also enable more personalized care outcomes [72, 94]. In the context of AAOAs, remote methods reduce logistical burdens on assessors, who often spend more time on planning and travel than on the assessments themselves. However, remote assessments face challenges in capturing non-verbal, multisensory elements like environmental cues, smells, and touch.

Incorporating devices like sensors and specialized equipment can help bridge these gaps by replicating physical and sensory aspects of in-person assessments. Additionally, delegating certain tasks to family members, caregivers, or community workers—who are already familiar with the older adults—can support remote assessments by assisting with physical measurements and monitoring. Technologies that enhance communication about living environments can also provide critical contextual information for remote assessments [29]. As remote data collection evolves, redefining the roles of stakeholders and embracing innovative information-gathering methods will be key to fostering effective collaboration and improving care outcomes.

**6.1.5 Directions for Automated Assessments.** Traditionally, assessments have relied on human practitioners, but emerging technologies are increasingly reducing human involvement to improve efficiency. AI-powered voice assistants, for example, show promise in facilitating flexible conversations to assess cognitive abilities in older adults [24, 92]. Our findings emphasize that assessments are

dynamic and require real-time adaptation to older adults' cognitive capacities, cooperation, and emotional sensitivity, presenting an opportunity for adaptive technologies to enhance comfort and accuracy.

Advancements in Large Language Models (LLMs) further offer potential for healthcare by processing multimodal data and engaging in sophisticated dialogue [15, 37, 97, 98]. Deployed as voice assistants or robotic platforms, LLMs could enable personalized, flexible assessments, improving both responsiveness and accuracy. They could also streamline workflows through asynchronous communication, such as collecting critical data like medical histories, which are often overlooked [52]. Furthermore, LLMs could automate documentation, generating summaries and outcomes from conversation histories, thus saving time and enhancing quality control [37, 39]. In AAOA assessments, LLMs could process multimodal data (e.g., video, audio) to offer targeted recommendations aligned with assessors' workflows, making the process more efficient and personalized.

However, when integrating AI into assessments, it is crucial to view AI as a tool to empower, not replace, human judgment [66]. AAOA assessments benefit from a holistic approach that incorporates multiple metrics and supports assessors in transitioning smoothly between evaluation aspects. To achieve this, we recommend designing AI tools as complements to assessors' expertise. For instance, physical interactions, such as holding an older adult's hand, provide nuanced insights that can be validated through follow-up tasks, while grip strength tests offer preliminary data to inform further investigation. Technology should be tailored to augment these practices, empowering assessors to make informed, context-aware decisions and preserving the human-centered nature of the assessment process.

## 6.2 Invisible Labor and Systemic Barriers in AAOA Assessments

A key theme identified in our research is the significant invisible labor assessors perform, which goes well beyond simple data collection. This aligns with broader calls to recognize the undervalued and often unsupported work of healthcare practitioners [66, 83]. In this section, we discuss the multifaceted challenges assessors face and suggest areas for improvement to better support their critical work.

One critical issue is the logistical burden inherent in conducting at-home assessments across geographically dispersed locations. Managing multiple districts within a city demands significant time, physical effort, and adaptability to accommodate older adults' schedules. This intensive workload often limits assessors' opportunities for regular breaks, exacerbating physical and mental fatigue. Exploring strategies to alleviate these logistical pressures and enhance assessors' well-being warrants further attention.

Assessors also struggle with unclear assessment metrics and insufficient training opportunities, which further complicates their work. Many assessors report a lack of clear guidance on how to interpret and apply assessment criteria, forcing them to rely heavily on personal judgment. A survey conducted in China found that 59.3% of assessors had not received any formal training [81]. This highlights the importance of refining and standardizing assessment

metrics and considering the provision of regular professional training to equip assessors with the necessary skills and confidence.

Our findings also align with prior research emphasizing how invisible work arises when technological systems are poorly integrated into workflows [83]. The current assessment application, for example, often misaligns with assessors' actual workflows, resulting in inefficiencies such as data loss and additional effort to navigate complex processes. There is an opportunity to design technological systems that better support assessors by aligning with their dynamic, complex workflows rather than imposing rigid, sequential processes.

Lastly, survey data reveal that a significant majority of assessors are middle-aged women (81.4%) [81], a group that faces increased safety risks during home visits. Daily interactions with unfamiliar households present notable safety concerns, particularly for women. To address this, government agencies and relevant organizations might consider establishing secure and standardized protocols to safeguard assessors and ensure their safety during home visits.

## 6.3 Navigating Older Adults' Challenges in Assessment: Power, Cultural Dynamics, and Empathy

Although our study primarily focuses on the challenges faced by assessors, it also highlights the critical role older adults play in shaping the assessment process. Aligning with prior research in China, one of the most significant challenges in assessment work is the difficulty of effectively cooperating with older adults [47, 81].

These challenges are deeply tied to older adults' lived experiences during needs assessments, often perceived as a period of "discontinuity in life," when individuals may feel their life's countdown has begun [45]. Older adults frequently report feelings of loss, diminished identity and independence, and ambivalence about accepting help [44, 45]. Our findings resonate with these observations, revealing instances where older adults misrepresent their health to maintain dignity, experience depression after transitions to care homes, or feel conflicted about being assessed. These dynamics demand that assessors engage with patience, sensitivity, and empathy—not only to collect accurate data but also to validate older adults' experiences and uphold their dignity.

Power imbalances further complicate assessment interactions. Factors such as frailty, health impairments, and lower social status often limit older adults' ability to fully engage in or influence the process [7, 8, 75]. Building on prior research, our findings highlight how these dynamics vary across contexts. For instance, older adults with physical or cognitive impairments often engage less actively during assessments, compelling assessors to rely more heavily on family input. Additionally, rural older adults, often less educated, tend to demonstrate greater compliance and reservation compared to their urban counterparts, resulting in even less agency in the assessment process. This nuanced understanding points to the need for assessors to adopt strategies that actively empower older adults, ensuring their perspectives remain central. Addressing these inequities can make assessments more supportive of older adults' dignity and autonomy, rather than perpetuating existing inequalities [44].

Cultural attitudes toward aging in China add another layer of complexity to assessments. Compared to Western contexts, aging in China often carries more negative connotations, and societal perceptions can lead older adults to downplay health concerns out of shame or fear of judgment [57]. Such behaviors reflect the influence of cultural stigmas surrounding aging and dependency, further complicating the assessment process.

To improve the assessment process, we suggest that designers and practitioners adopt more sensitive and empathetic approaches that account for sociocultural, emotional, and power-related dynamics. These efforts should aim not only to enhance assessment accuracy but also to provide a more respectful and empowering experience for older adults. Strategies already employed by assessors—such as patiently building trust and rapport, speaking discreetly in public about sensitive topics, and adapting questioning strategies based on environmental and personal observations—offer valuable guidance for future practices.

#### 6.4 Reflection on the Study Context

Our study's findings are embedded within a unique social, cultural, and healthcare context that may differ significantly from global counterparts. In this section, we broaden our perspective to consider the broader applicability of these findings, recognizing that different countries face distinct challenges concerning aging populations, healthcare systems, and available care resources.

In China, where this study was conducted, the healthcare system is still evolving amid the rapid aging of the population and the early stages of long-term care infrastructure development [60]. A critical shortage of assessors creates immense pressure to prioritize efficiency over thoroughness, leading to the widespread use of brief, expedited assessments. By contrast, countries with more robust healthcare resources can afford to adopt more comprehensive, multi-stage assessment processes. For instance, Japan's system includes an initial computer-based evaluation followed by a home visit and physician review, which allows for a more resource-intensive, multi-stakeholder approach [96].

However, even in these well-resourced systems, significant challenges persist. In Belgium, for example, time constraints during at-home assessments often limit meaningful interactions, resulting in incomplete evaluations [90]. Similarly, in Canada and the U.S., practitioners report ongoing difficulties with data accuracy, insufficient feedback loops, and the heavy demands of data collection, which place burdens on both staff and residents [4, 62]. These examples highlight that the complexity of needs assessments is a global issue, transcending specific healthcare settings.

China also faces distinctive challenges, particularly in rural regions where low literacy levels, limited access to medical records, and inadequate infrastructure hinder the feasibility and inclusiveness of assessments. These barriers exacerbate the difficulty in delivering comprehensive and equitable evaluations.

Given the universal relevance of these challenges, our findings offer significant implications for enhancing the efficiency, accuracy, and personalization of assessment processes. As the global aging population continues to rise, particularly in countries with emerging long-term care infrastructures, our study provides critical

insights into advancing the field of comprehensive assessments for older adults, addressing the distinct needs of these contexts.

#### 7 Limitations

This study provides valuable insights into the current practices and challenges of ability assessments of older adults in China, but some limitations must be acknowledged. First, the findings are based on 28 assessments and interviews with eight assessors in a single city, offering in-depth insights that may not be generalizable to other regions in China or beyond. Future research should expand the geographic and demographic scope to explore variations in assessment practices across different regions. Second, while we used examples of existing technologies to discuss technology-supported assessments, current AAOA practices rely heavily on digital apps but lack advanced or tailored solutions for comprehensive assessments. Future research should engage practitioners with hands-on experience using diverse and customized technologies to uncover deeper practical insights and long-term implications.

#### 8 Conclusion

This study reveals critical gaps in the current technology-supported assessment processes for older adults, emphasizing the need for more adaptive, context-sensitive, and ethically responsible tools. The insights from assessors underscore the importance of developing technologies that not only improve accuracy and efficiency but also respect the complexity and humanity inherent in the assessment process. As the global population ages, addressing these challenges is crucial to ensuring older adults receive the care and services they require. Future research should prioritize the design of adaptive, inclusive, and ethical technologies that can be seamlessly integrated into real-world practices to support comprehensive ability assessments for older adults.

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## A Ability Assessment of Older Adults (AAOA) Criteria In Use

- **Activities of Daily Living (10):** Eating, dressing, facial and oral hygiene, bowel control, bladder control, toileting, walking on flat surfaces, transferring between bed and chair, climbing stairs, bathing.
- **Cognitive Abilities (4):** Orientation to time, orientation to people, orientation to place, memory.
- **Perception and Communication Abilities (3):** Vision, hearing, communication abilities.
- **Health Conditions (12):** Geriatric syndromes (sleep disorders, pressure injuries, chronic pain, swallowing difficulties,

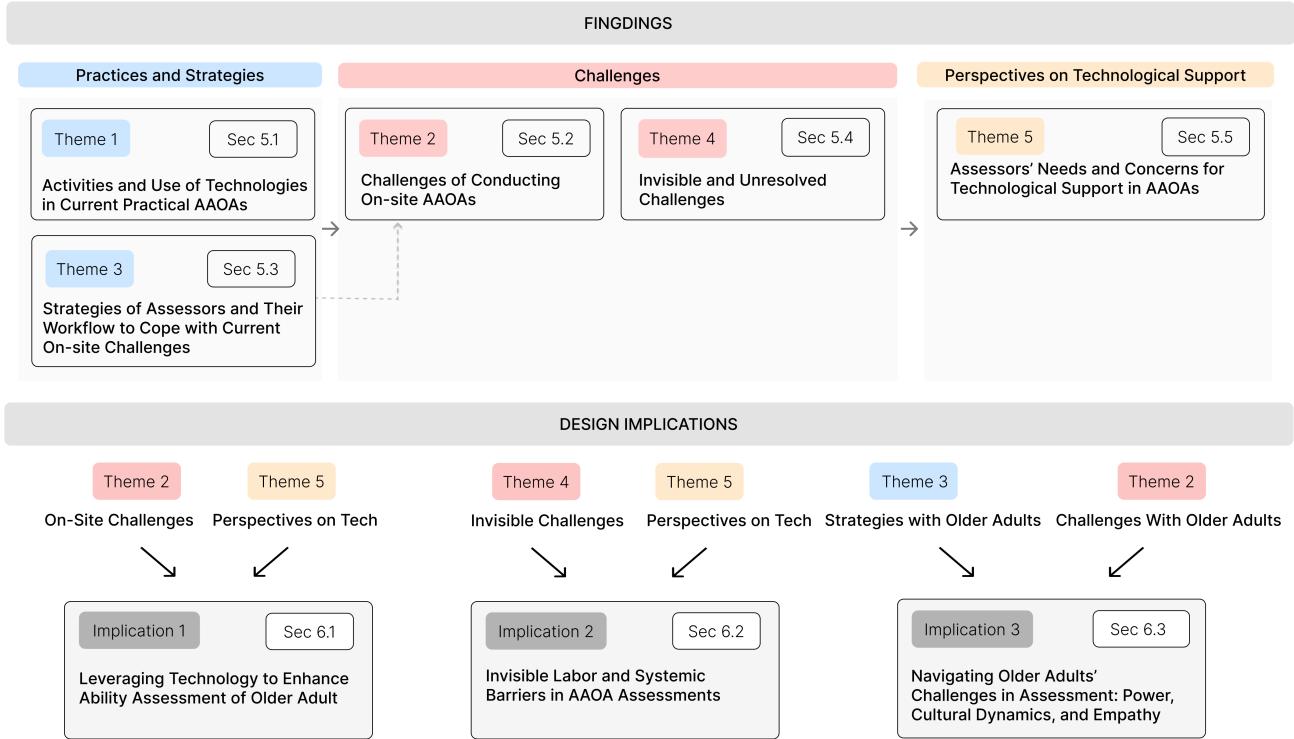


Figure 7: Top: Thematic map of our findings; Bottom: Relationship between findings and design implications discussed.

constipation, polypharmacy (more than 5 medications), delirium (within 30 days), fainting (within 30 days), falls (within 30 days), unstable gait), disease conditions (more than two diseases under treatment), special care needs (one or more types of care required).

- **Disease Conditions (30):** Musculoskeletal diseases (3 types), eye diseases (3 types), neurological diseases (6 types), heart and lung diseases (4 types), endocrine and metabolic conditions (1 type), genitourinary system diseases (1 type), mental illnesses (4 types), digestive system diseases (2 types), infections (3 types), others (2 types or custom-defined).
- **Special Care Needs (10):** Nasogastric tube care, central venous catheter maintenance, oxygen therapy, ventilator or respirator care, tracheostomy care, urinary catheter care, ostomy care (colostomy, bladder, kidney, ureter), wound

drainage care, wound care and dressing changes (excluding pressure ulcer management).

- **Social Support (10):** Number of close friends available for support and assistance; living arrangements in the past year; relationship with neighbors; relationship with current or former colleagues; support and care received from family members (spouse, parents, children, siblings, other members); sources of financial support or practical assistance in emergencies; sources of emotional support and care in emergencies; ways of expressing concerns; sources of help in times of distress; participation in group or community activities.

## B Thematic Mapping and Its Relationship to Design Implications (Figure 7)