Language Barriers in Long-term Aged Care Homes: Design Considerations for Translation Technology

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Language barriers pose communication challenges between aged care residents and caregivers from different cultural backgrounds, impairing residents' wellbeing. Yet, relatively little is known about design considerations for translation technology used in aged care. To address this gap, we conducted interviews with 18 caregivers in an Australian aged care home. We found that addressing language barriers was complex due to the varied cultural backgrounds of residents and caregivers, residents' declining language abilities, and diverse forms of everyday conversations. Caregivers desired to mitigate language barriers to provide better care, but current services and tools did not sufficiently meet their translation needs. This tension highlights a significant need for translation technologies tailored to aged care settings. We suggest that translation technology designed for aged care should establish personalized models tailored to residents' spoken languages, incorporate features of communication technologies to adapt to residents' abilities, and align devices with the context of daily care.

CCS Concepts: • **Human-centered computing** → **Human computer interaction (HCI)**; • **Human computer interaction (HCI)** → *Empirical studies in HCI*.

Additional Key Words and Phrases: Translation technology, Aged care, Language barrier, Culturally and linguistically diverse

1 Introduction

In countries with substantial immigration, many older adults living in aged care homes may have culturally and linguistically diverse (CALD) backgrounds with limited English proficiency. In Australia, for example, it has been found that 72.4% of care homes in the state of Victoria accommodated at least one resident who preferred speaking a language other than English [43]. While ethnospecific care homes provide more tailored services for residents sharing common languages and cultures, many older adults from CALD backgrounds cannot access these homes due to insufficient facilities and long waiting lists [46]. CALD residents in mainstream care homes, however, may face language barriers.

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Although many care homes hire caregivers from CALD backgrounds, the languages spoken by caregivers and those spoken by residents do not always match [46].

Language barriers can negatively impact aged care residents and caregivers. The absence of common languages may lead to residents' needs being overlooked and misunderstood [7, 18]. Residents from CALD backgrounds are prone to social isolation and disengagement from social activities when they cannot communicate with caregivers and fellow residents [34, 44]. Meanwhile, caregivers' job stress may be intensified when they cannot properly understand residents' needs and cultural traditions [12, 18]. While caregivers are expected to have the communication skills to address residents' negative moods and agitated behaviors, language barriers can hinder effective communication with residents [12, 18]. Despite these negative impacts, overcoming language barriers remains a challenge. Professional translation services are difficult to access and have long waiting times [3]. Over-reliance on ad-hoc bilingual caregivers or family members for translation may place additional responsibilities on them [8, 10].

Technologies used for language translation could be useful in addressing these issues. Today, numerous translation apps are readily accessible on smartphones and tablets. Prior research has examined how existing translation apps, such as Google Translate, may address the translation needs of care workers and older adults in healthcare settings [8, 23, 42]. This research has found that while caregivers and older adults are willing to use Google Translate, usability issues—such as frequently producing inaccurate translations and being unable to capture messages from older people with cognitive and sensory impairments—hinder its effectiveness in care settings [23, 42]. Moreover, current research has largely overlooked the specific needs that translation technologies should support in aged care contexts. Aged care homes are complex settings that are in some ways unique. They provide long-term care to residents who are often frail and have limited mobility and cognitive impairments such as dementia [17]. Besides providing physical care to residents, aged care homes also run a range of social programs to enhance residents' social enrichment and creativity [54]. Meanwhile, caregivers working in care homes often come from CALD backgrounds and may have low levels of education and training [50]. It is likely, therefore, that the communication needs in care home settings differ from other settings in which effective communication also is vital, such as in healthcare.

This paper reports findings from an interview study with 18 caregivers from an aged care home in Australia. We seek to identify design considerations for translation technology in aged care homes by examining how language barriers affect caregivers in everyday communication, and to better understand the contextual factors contributing to these barriers. Although we primarily focus on the perspective of caregivers, the fact that language barriers affect both caregivers and residents means that the results of our study shed light on how translation technology could also support residents.

This study makes three contributions to the HCI literature. First, we provide a holistic understanding of the context of language barriers in aged care. We show that addressing language barriers is a particularly complex issue due to the multicultural backgrounds of both caregivers and residents, CALD residents' declining English abilities, and the diverse forms of conversations present in everyday care.

Second, we identify a tension between caregivers' desires and expectations of providing better care to CALD residents and the limitations of existing services and tools, including Google Translate, in effectively addressing caregivers' translation needs. This tension suggests that translation technology specifically tailored to aged care homes has high potential value for caregivers and residents.

Third, we provide three considerations for the design of translation technology to mitigate language and communication barriers in aged care. Future research on translation technology design should: (1) establish personalized

models tailored to residents' spoken languages, (2) integrate features of communication technologies and providing cultural-related information, and (3) provide specific devices for translation.

2 Literature review

2.1 Designing translation technologies to mitigate language barriers

HCI researchers have designed various forms of technologies for people from CALD backgrounds with limited English proficiency, showing multiple benefits of technology for this user group. For example, Brown et al. [6] developed a translation app to support non-English-speaking refugees in communicating with their mentors. Kim et al. [27] and Smith et al. [49] created apps to enable migrant communities to access healthcare information. These studies show that bridging language barriers strengthens social relationships and increases feelings of independence for people from CALD backgrounds.

Prior research has also investigated how to improve the usability of translation tools [29]. For example, Läubli and Green reviewed studies on interactive machine translation systems designed for professional translators from an HCI perspective. They found that while machine translation increases translation speed, user experience is highly influenced by the interactive features of technology design. They suggested that the design of translation technologies should improve information visualization and increase adaptation by learning from users' input [29].

Läubli and Green's review primarily focused on translation technologies that display texts [29]. With the development of automated speech recognition and text-to-speech technologies, translation technologies are increasingly used to support verbal communication. Prior studies have examined how translation technology can facilitate conversations and teamwork among multilingual speakers [11, 19]. Earlier work by Hara et al. [19] found that spoken language translation always made errors. They suggested that translation technologies should provide feedback mechanism and allow text-based input when it could not recognise users' speech. In a more recent work, Liebling et al. [30] investigated the effectiveness of commercially available translation apps, such as Google Translate, in supporting the translation needs of migrant communities. Like Hara et al. [19], Liebling et al. [30] reported limitations of translation apps in facilitating speech translation in natural settings. Liebling et al. [30] proposed that in addition to reducing translation errors, translation technologies should also support dialect and accent recognition, as well as offer touch-free experience to facilitate smooth conversations.

2.2 The design and use of translation technologies in healthcare

Prior research has rarely examined the design requirements for translation technology in aged care homes. Here we review prior studies on the design and use of translation technology in healthcare settings with older people, seeking to draw insights to inform the design of such technology in aged care homes.

The unmet translation needs in healthcare have been reported by many studies (e.g. [3, 8, 41, 42]). For example, in a recent HCI study, Calambur et al. [8] explored nurses' experiences of collecting information from older adults with limited English proficiency in a telehealth program. They found that nurses struggled to find reliable translators. Ad-hoc translators often lacked the necessary professional skills. Professional translators and family members could provide effective translation but were constrained by availability. Google Translate did not provide effective assistance to nurses, but the reasons for its ineffectiveness were not detailed by Calambur et al. [8]. Two other studies in the field of nursing by Panayiotou et al. [42] and Hwang et al. [23] examined the limitations and advantages of Google Translate in more depth.

Panayiotou et al. [42] investigated the perceptions of CALD older adults and healthcare workers on the use of mobile translation apps to aid everyday communication. Participants evaluated three apps in short-term trials, including Google Translate that provides real-time translation and two other fixed-phrase translation apps that translate predefined phrases. Panayiotou et al. [42] found that participants were open to adopting translation apps, but expressed concerns about risks associated with mistranslation. Participants preferred fixed-phrase translation apps over using Google Translate, given that Google Translate was more likely to make errors. Following this study, Hwang et al. [23] deployed the same translation apps across four aged care hospital wards for two months. These hospital wards provide specialized healthcare services for older people. Hwang et al. [23] found that inaccuracy remained a concern for the use of Google Translate, but it had the advantage of facilitating two-way communication compared to fixed-phrase translation apps. The features of synchronized voice-to-voice translation and showing both audio and text in Google Translate were considered useful [23, 42].

While the use of translation apps improved rapport between healthcare staff and older people, Hwang et al. [23] reported that the translation apps they deployed were difficult to use for older people with visual, cognitive, and hearing impairments. Ji et al. [25] highlighted that translation technology designed for healthcare should be made accessible for patients who face communication challenges. One way to address this issue could be integrating multi-modal interaction, such as including audio, text, and images, into translation technology design [8, 25].

These studies provide valuable information on the considerations for designing translation technology for older people. However, the communication needs in healthcare settings can differ from those in aged care homes. In healthcare, ensuring accuracy in translation is a priority, since inaccurately translated medical information may pose serious risks to patients' health [25, 41, 42]. While addressing health needs is still important for aged care residents, caregivers in aged care also need to cater to residents' psychosocial needs, since residents' abilities to engage in meaningful activities and maintain social networks are often deteriorating [17, 19, 54]. Additionally, many aged care residents have cognitive decline, such as dementia, making communication complex and challenging [17, 45]. Considering these situations, it is important to investigate how translation technology might address the unique communication needs in aged care.

2.3 Technology supporting social connection and communication in aged care

Residents living in aged care homes often experience social isolation and loneliness. Due to their mobility constraints and monotonous routines in care homes, residents often have limited opportunities to engage with the outside world [4]. Technological innovations provide opportunities to enrich social experiences and foster social connections for aged care residents [59, 60]. For example, video conferencing enables remote communications between residents and their families [26] and virtual reality opens opportunities for residents to interact with the outside world [55]. Social robots, such as robot pets, offer companionship to residents who cannot own pets in care homes [1, 59]. Various studies have shown the benefits of these technologies on residents' social and emotional wellbeing [1, 26, 55, 59].

In exploring technology design for aged care residents, HCI researchers have especially focused on designing technologies to reduce communication barriers for people with dementia, who occupy a large proportion of aged care residents [39]. Dementia can hamper people's abilities to engage in social interactions, undermine their self-esteem, and weaken their social relationships with other people [2, 45]. The potential of technologies in improving social connection for people with dementia has been identified in prior studies. For example, game apps designed by Muñoz et al. [37, 38] promoted positive interactions between people with dementia and their visitors. Digital media used by Welsh et al. [56] supported intergeneration engagements between young people and people with dementia. An everyday sound player designed by Houben et al. [20] initiated conversations between residents living with advanced dementia and caregivers.

A few HCI researchers have also examined how technology may aid caregivers [21, 28, 32, 48, 52]. For example, Vidas et al. [52] implemented an app to train family caregivers in using music therapy for older people with dementia and Shen et al. [48] designed augmented reality to provide training to healthcare professionals. Other research [21, 28, 28, 32] examined design considerations for relieving burden on caregivers and enhancing their wellbeing.

However, HCI studies have not yet sufficiently explored how technology can support the communication needs of aged care residents from CALD backgrounds in English-speaking care homes. This is important given the fact that CALD residents commonly disengage from social activities [7, 34]. McGrath et al. [34] reviewed the barriers CALD residents with dementia face in engaging in social activities in aged care. They found that language barriers posed barriers for CALD residents to effectively communicate with caregivers and to properly understand what was going on in social activities.

The lack of shared language also hampers caregivers' understanding of residents' underlying needs. In a study by Rosendahl et al. [44], a talkative CALD resident was misunderstood as introverted by caregivers unable to communicate with this resident. Language barriers increase the risks of CALD residents' needs being neglected, exacerbating negative moods and behavioural symptoms [7, 18]. Many caregivers acknowledge that language barriers are a major challenge when caring for residents from CALD backgrounds [12].

To improve the care provided by CALD residents, further research is needed to explore how translation technology can reduce language barriers for CALD residents and caregivers in aged care homes. We aim to bridge this gap by understanding caregivers' perceptions of and design requirements for translation technology in an aged care home.

3 Method

We conducted an interview study with 18 caregivers working in Sunshine Care (pseudonym), a residential aged care home in Australia. This study was approved by the human research ethics committee at our university.

3.1 Participant recruitment

Sunshine Care is a community-based aged care home located in a suburb in a capital city of Australia. Before the interview study, the first author worked as a volunteer in Sunshine Care for six months, supporting the social activity programs. Participants were primarily recruited from the network that the first author built with staff and volunteers while working as a volunteer. We also asked a lifestyle manager and a volunteer coordinator to recommend staff and volunteers who would be interested in this study. Overall, we recruited 18 participants, including 15 care staff and three volunteers. Staff members included seven lifestyle coordinators, six personal care staff, a volunteer coordinator, and a physiotherapist. Lifestyle coordinators oversaw social activities, while personal care staff managed residents' fundamental daily living activities, such as dressing, eating, bathing, and toileting. Volunteer coordinators handled the recruitment and work associated with volunteers, and physiotherapists were responsible for residents' physical wellbeing. The three volunteer participants assisted lifestyle coordinators with organising social programs.

Before each interview, participants were asked to complete a questionnaire to collect their demographic information. They also assessed their own confidence in using technology by choosing from four options: very confident, somewhat confident, unconfident, and very unconfident. We did not specify the types of technologies involved in this assessment. Based on the first authors' observation in the care home, staff used computers and tablets in their daily work and all participants had their mobile phones. Only one participant described herself as "unconfident" in using technology. Participants had a large age range, from 20s to 80s. All participants identified as women, reflecting a gender distribution typical in aged care homes [16]. Table 1 shows the details of participants' information.

Pseudonym	Age	Role	Years working in aged care	Confidence in using technology
Bobbie	30-39	Personal care staff	3	Somewhat
Keshia	20-29	Personal care staff	2	Very
Linda	40-49	Personal care staff	3	Very
Emma	20-29	Personal care staff	1	Very
Murphy	40-49	Personal care staff	28	Very
Chloe	20-29	Personal care staff	Less than one year	Somewhat
Michelle	20-29	Physiotherapist	2	Very
Wendy	60-69	Volunteer coordinator	30	Very
Charlotte	60-69	Lifestyle coordinator	20	Somewhat
Bella	70-79	Lifestyle coordinator	10	Very
Angelina	30-39	Lifestyle coordinator	1	Very
Ellie	50-59	Lifestyle coordinator	16	Somewhat
Lily	40-49	Lifestyle coordinator	25	Very
Harper	60-69	Lifestyle coordinator	20	Unconfident
Vida	30-39	Lifestyle coordinator	2	Very
Sherry	60-69	Volunteer	7	Somewhat
Marline	80-89	Volunteer	8	Somewhat
Amelia	60-69	Volunteer	3	Somewhat

Table 1. Participants' demographics

3.2 Data collection

We conducted semi-structured interviews with participants at Sunshine Care from November 2022 to January 2023. Informed consent was obtained from participants before proceeding with the interviews. Each interview involved individual participants engaging with the first author in person for around 20 minutes. Seventeen interviews were conducted in English and one in Mandarin. The interview in Mandarin was conducted with Sherry, a volunteer who could only understand simple English words and could not have conversations in English. She felt comfortable talking in Mandarin, which was her native language. Each participant was reimbursed with an AUD $30 voucher.

We asked about participants' experiences of working with CALD residents who spoke different languages, perceived challenges and workarounds to address these challenges, and their perspectives on having a translation technology to support their work. Using a semi-structured approach, We adjusted the predefined set of questions according to the participants' answers and asked follow-up questions for clarification.

3.3 Data analysis

All interviews were audio recorded after getting participants' approval. The interviews were then transcribed into written form. The first author translated the interview conducted in Mandarin into English. The data analysis followed a reflexive thematic analysis approach [51]. After becoming familiar with the transcriptions, the first author carried out inductive line-by-line coding and clustered codes into initial themes. Subsequently, the research team discussed and reviewed the initial themes, examining whether the interpretation of data could delve deeper. Following multiple rounds of discussion and reflection, the themes were recursively refined and finally determined during writing.

3.4 Positionality statement

According to the requirement for transparency in reflexive thematic analysis [51], we provide a brief positionality statement that outlines the authors' backgrounds relevant to this study. The first author moved to Australia from China a few years ago. Her family members faced language barriers during the initial years of this transition. This experience helped her empathise with caregivers and residents who encountered language barriers. The other three authors were born in Australia and have experienced family members living in aged care. The authors' academic backgrounds span philosophy, information systems, and human-computer interaction. All authors were involved in analysing data and writing this paper.

4 Findings

Through our data analysis, we identified three key themes: (1) the complexities of language barriers in the care home, (2) caregivers' desire to provide better care to residents by reducing language barriers, and (3) limitations of existing translation approaches. Each theme is divided into two subthemes. Figure 1 presents the themes and subthemes in our findings.
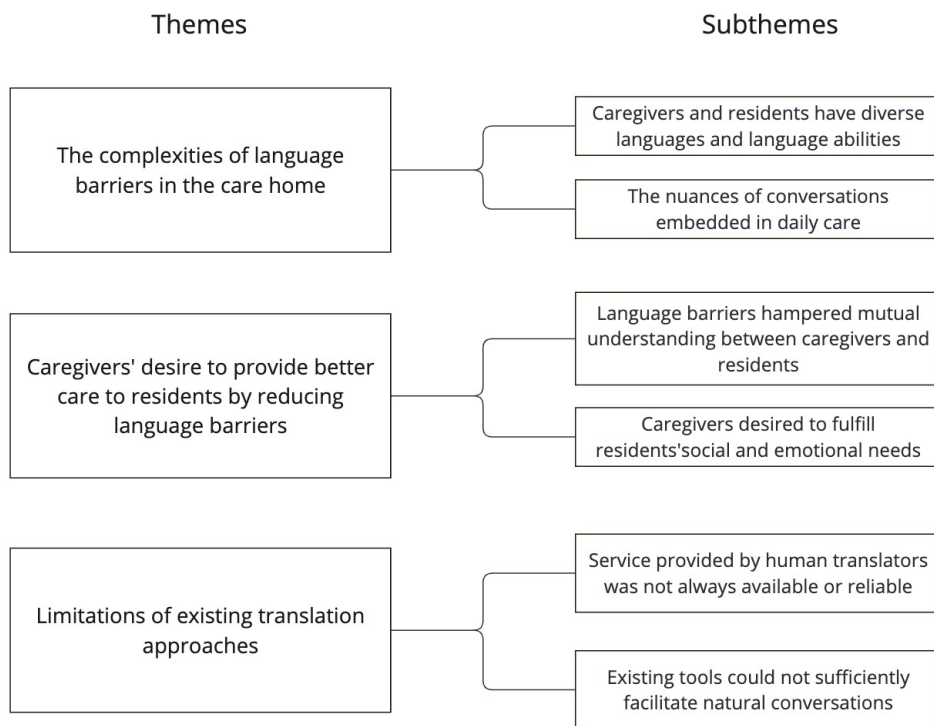

Fig. 1. Themes and subthemes in the findings

4.1 The complexities of addressing language barriers in the care home

Our data shows that language barriers exist broadly in Sunshine Care. Language barriers were created by the multicultural backgrounds of residents and caregivers who have various English proficiencies, residents' dialects, and differing abilities to communicate. Caregivers engaged in both face-to-face conversations with residents and visitors and remote conversations with family members. All these situations add to the complexity of communication in this care home setting.

4.1.1 Caregivers and residents had diverse languages and language abilities. Sunshine Care was a multicultural aged care home with residents from diverse cultural backgrounds. As with migrants in the local community, most CALD residents were from Western non-English-speaking countries such as Greece and Italy. In recent years, an increasing number of Asian residents began to live in this care home. Lily described the diversity of residents' languages:

> "*The catchment of residents is Greek-speaking, Italian-speaking, Spanish-speaking, Arabic-speaking. We have residents from Asian countries as well, Mandarin-speaking and Vietnam-speaking.*"

According to Murphy, these residents were living together in the care home, rather than divided into specific cultural groups: "*In each unit, out of the 31 residents, probably we have 10 residents from different backgrounds. They are all living mixed.*"

Among these residents, only a small number did not speak English. However, even if residents could speak English, participants observed that some residents' English ability deteriorated due to the progress of aging and cognitive decline. Murphy said:

> "*Most residents came to this care home a long time ago. They used to speak English, but as time went on, they forgot English and went back to their mother language. … Sometimes they are just speaking in their languages that we don't understand.*"

The management team in Sunshine Care tried to employ caregivers and recruit volunteers with different backgrounds. However, the number of bilingual caregivers and volunteers and the variety of their languages still fell short of meeting the needs of all CALD residents. In addition, due to caregivers' work shifts, it was not feasible for residents to only receive care from caregivers who shared common languages with them. Therefore, language barriers were common problems for residents and caregivers.

This problem was amplified by the English abilities of caregivers. Many caregivers were immigrants whose first languages were not English. Their accent, grammar, and familiarity with English impacted effective communication with residents. Emma said:

> "*I'm from the Philippines and English is not my first language. My accent is a mix of Filipino and Australian, so it can be confusing. I don't think I have very good grammar. Sometimes I get misunderstood by residents.*"

Similarly, Chloe, who came from an Asian country, said:

> "*Sometimes residents just talk about random stuff. Maybe they're saying something that locals can understand but foreigners like me don't understand. So sometimes I can't communicate with them [these residents].*"

Chloe is highlighting that she felt a disconnection from local residents because she came from a different cultural background. It is possible that understanding the "random stuff" residents talked about required cultural knowledge that Chloe felt she lacked.

All participants were positive about the idea of designing a translation technology to reduce language barriers. For example, Wendy commented on the potential value of translation technology: "*A translation tool would be fabulous if that is possible, because there is a big need for that.*" However, participants also acknowledged the challenges of translation technology to fit into the care home. For example, Lily noted that for some languages, such as Spanish and Italian, the dialects spoken by people from different regions were different. She shared a story of how a resident's family members did not understand the resident's dialect:

> "*We have an Italian resident. Her children couldn't understand her because she reverted to a certain dialect from her childhood. When I asked them what the resident was saying, they said 'We don't know because it is the language of her parents.*"

In this case, the resident's changed dialects increase the complexity of understanding her language. Lily highlighted that a reliable translation technology should correctly understand residents' dialects.

4.1.2   The nuances of conversations embedded in daily care. Conversations were deeply integrated into daily care. Caregivers mentioned several scenarios of their daily conversations, including one-to-one conversations, group conversations among multiple people, and remote conversations via phones. One-to-one conversations often involved a caregiver talking with individual residents about their needs and care tasks. For example, Murphy described how she communicated with residents in the morning:

> "*In the morning, we assist residents to get out of bed and ask them if they would like to have a wash or a shower. We don't just jump in and drag them out. We introduce ourselves, say hello to them, and make sure they are well enough to get up or participate in activities.*

Caregivers also had one-to-one conversations to verify residents' preferences and health conditions. For example, Keshia discussed food and clothes choices with residents. Chloe stated that she would confirm residents' health if they experienced pain while dressing : *"I help a resident get dressed up. She [the resident] says, 'Oh, it's pain in my legs.' So I say, 'Oh, which leg is hurt? Which part?'"*

Daily conversations also included handling situations when residents were agitated, which was a challenge for many participants. Murphy expected translation technology could help caregivers identify the reasons for residents' agitation. During our interview, an agitated resident was yelling in her room. Hearing this resident, Murphy asked:

> *"When a resident is a bit agitated or yelling out like this one [a resident] now, can [the translation technology] help to ask, 'What's the matter? What's going on? How can I help?'"*

Group conversations are also a common communication type. These often happen in social activities. For example, in an art activity the lifestyle coordinator Lily observed that a resident was happily talking with a volunteer in the resident's language. Lily felt it was a pity that she could not join their conversations: *"I really want to capture her [the resident's] happiness. I feel sorry that I cannot understand them."*

Lily expected that translation technology could enable three or more people to have conversations together. Wendy, on the other hand, hoped a translation technology could facilitate not only face-to-face conversations but also remote conversations. Wendy mentioned a situation where translation technology could facilitate caregivers' conversations with family members over the phone: *"It would be very helpful if [a technology] could intervene and say: 'The staff member is trying to tell you that your loved one needs more clothes. Can you bring in more clothes?'"*

For non-English-speaking residents, it is possible that some of their family members also come from CALD backgrounds and do not speak English. Wendy highlights that translation technology should also support remote communication between caregivers and family members when they do not share a common language.

4.2 Caregivers' desire to provide better care to residents by reducing language barriers

Caregivers felt frustrated when trying to overcome language barriers, which interfered with their capacity to provide quality care. Language barriers hampered mutual understanding between caregivers and residents. These barriers also made it difficult for caregivers to meet CALD residents' social and emotional needs.

4.2.1 Language barriers hampered mutual understanding between caregivers and residents. Effective communication between caregivers and residents at Sunshine was vital in daily care. However, language barriers often hindered caregivers' understanding of residents' needs. Keshia shared an example of struggling to understand a CALD resident's food choices:

> "Sometimes when we put the food in front of her (a resident), she won't touch it. We try to ask: 'Do you like
> or don't like them? Do you want us to take them out?' She won't say anything. She does not understand me.
> In that case, I feel so bad."

Like Keshia, many participants expressed frustration over their inability to help residents due to language barriers, despite their strong desire to help. Keshia acknowledged that in some situations caregivers simply had to ignore residents' needs because it was not possible to understand what those needs were. However, she, like other caregivers, still hoped residents' needs could be better satisfied. If translation technology could help her understand residents, Keshia was entirely willing to do what residents asked for.

Apart from the importance of caregivers understanding residents' needs, good care also requires that residents understand caregivers. Without properly understanding caregivers' intentions, residents might not cooperate with caregivers. For example, Michelle talked about an unsuccessful exercise session with a resident who did not speak English:

> "I was going to do one-on-one with her [a resident], but that didn't happen because she didn't understand a
> thing that I was saying. I said to her 'exercise', and she said something in Chinese. I did not know what she
> was saying, so I tried to demonstrate a movement and asked, 'Can you do this?' But she did not do it."

The above story illustrates that language barriers may hamper residents' willingness to engage in care activities. Chloe viewed residents' refusal of care as the biggest challenge in her work. Murphy further commented that residents' refusal might be caused by their misunderstanding of caregivers' intentions. She explained this with an example of a resident who always declined caregivers' assistance:

> "Most of the time we take it the wrong way, saying that he [the resident] is aggressive and resistive. I find
> that is not the reason. He is not aggressive or resistive, but because he doesn't understand what we are
> saying and what is going on, it is like we are trying to force him."

Enhancing mutual understanding between caregivers and residents may address the challenges faced by caregivers and reduce residents' negative emotions. Many participants expected that a translation technology could help achieve this. For example, Murphy said: "*If we can have [a technology] that can understand residents or help residents to understand the caregivers, that would be excellent.*"

Michelle further observed that merely facilitating conversations through translation technology was not enough for residents to understand caregivers' intentions. As a physiotherapist, Michelle was responsible for guiding residents to do exercises. She thought for exercise movements, showing a short video might be easier for residents to understand than verbal instructions: "*Visual cues are always the best way for understanding, especially when it comes to exercises.*"

Michelle also discussed a requirement for correctly capturing the speech of residents who have lost the ability to speak clearly. Recalling her experience of communicating with a resident who had Parkinson's disease, Michelle said:

> "*He [the resident] can understand what I'm saying perfectly fine, but his ability to speak has gone down. He speaks very softly. I have to put my ear up against his mouth to hear what he's saying. I feel it will be really challenging if you are to use a technology, because of the way that he speaks.*"

These requirements suggest the importance of having translation technologies that adapt to residents' comprehension and speech abilities.

4.2.2 Caregivers desired to fulfil CALD residents' social and emotional needs. Some participants discussed the social isolation that CALD residents encountered due to language barriers and stressed the importance for residents to be able to access their own languages to feel more socially connected. For example, Wendy thought language was related to residents' cultural and reminiscence needs:

> "*People love to hear their home native language spoken. Their native language brings back happy memories and all the cultural information. You use words that reflect the culture of that country. We want our residents to feel happy and connected with their community and not to feel like no one likes them.*"

Wendy's comment here highlights the significant connections that languages can build for CALD residents. Similarly, Marline empathized with residents' feelings of isolation in a care home with few opportunities to speak their own languages:

> "*You've got somebody who only speaks Mandarin. Suddenly this person [is] transferred from a home where everybody is speaking Mandarin to an aged care centre where nobody is speaking Mandarin. Now, he can't speak or do anything.*"

Marline's quote illustrates how residents' social isolation can be amplified by language barriers. Keshia witnessed such an example when a CALD resident was unable to communicate with caregivers:

> "*She [the resident] used to talk a lot to us in her language. She kept talking but we did not understand. Maybe she wanted to talk about herself or she felt bored. In that case, if something can translate and enable us to at least speak one or two sentences to her, she would feel happy, wouldn't she? At least she would think 'Someone can speak to me.' . . . Now she was so quiet.*"

This resident changed from talking a lot to talking less with caregivers. This change may be because she realized that caregivers could not respond to her. Keshia expected a translation technology could help her to build social connections with this resident, considering that this connection could elevate the resident's mood. Similarly, Isabella noticed that speaking the same language boosted residents' emotions: "*When they [residents] hear their own language, they just feel so [much] more confident. That opens the world for them.*"

Conversely, residents might experience stress due to language barriers. Sherry reflected on her own experience with this problem. When she first arrived in Australia, she could not speak any English. One day she had an emergency in a hospital:

> *"I needed to use the toilet, but I couldn't move. I felt very uncomfortable, but I couldn't articulate it clearly. I was extremely anxious. Then I noticed that people around me were struggling to understand me. Their reaction added more stress to me."*

As Sherry's experience indicates, residents may feel stressed when their messages and words are not understood by caregivers. A translation technology facilitating better communication may reduce this emotional stress.

4.3 Limitations of existing translation approaches

Participants talked about two types of existing approaches that they could access to mitigate language barriers in everyday care. One approach was to rely on the service or assistance provided by professional translators and family members. Caregivers might also learn new languages by themselves. The other approach was to use tools, including cue cards and Google Translate. However, both approaches have limitations in effectively supporting communication in the context of language barriers. People's assistance was not always available or reliable, and existing tools may disrupt the flow of conversations due to limited word choices, inaccurate translation, and the use of personal phones.

4.3.1 Service provided by people was not always available or reliable. Participants shared several current approaches to overcoming language barriers. One approach was using professional human interpreters provided by government services. However, Wendy noted that this service was very expensive. In Australia, government interpreters' service is free only in a small range of scenarios, such as discussing care services, documents, and fees [40].

Caregivers frequently relied on bilingual family members to translate. Yet, this also had limitations. One limitation was family members' availability. Emma shared an example that a resident's wife could not help at night time:

> *"The resident's wife does not stay here all day. She only comes during the daytime, so it can be a bit hard at night time. He [the resident] sometimes shouts but we don't know what he's saying."*

Another limitation was that family members might override the decisions of residents. Comparing professional interpreters and family members, one participant said: *"A professional translator says exactly what you want them to say, but a family member could say anything really. [Family members are] not objective."*

Another participant shared such an example in an exercise session she conducted with a resident, with his family providing translation. This caregiver noticed that the resident looked tired and asked if he wanted to continue the exercise. However, the family members insisted that the resident was fine to continue. Later after trying a few minutes, the caregiver confirmed that the resident was too tired to exercise and stopped the session. This caregiver suspected that the resident told his family that he was tired, but the family believed doing more exercise was more beneficial than taking rest at that time. In such situations, this caregiver hoped to directly communicate with residents through the help of translation technology.

In addition to reaching out to family members, caregivers also tried to overcome language barriers by themselves. Murphy used body language and writing but felt this way was still difficult:

> *"Most of the time we use signs, eye contact, touching or holding and pointing... sometimes we got to write on a piece of paper or on a board. Somehow we get through, but it's very hard."*

Angelina and Vida expressed enthusiasm for learning residents' languages. However, they also recognized the limitations of their capacities in learning different languages. For example, Angelina, who spoke English and Spanish, found learning Mandarin was much more difficult than learning Italian, because *"my letters are like this but those [Chinese] symbols are totally different."*

4.3.2   Existing tools could not sufficiently facilitate natural conversations. Participants talked about using cue cards and Google Translate as tools for translation. Cue cards were printed sheets with images, texts, and pronunciations of commonly used words in another language, such as toilet and water. Bella thought cue cards were handy and useful. However, Wendy pointed out that cue cards had a restricted range of vocabularies. Ellie mentioned that she could not pronounce the words on the cards correctly, so she preferred to use Google Translate, which could provide more accurate pronunciations.

Other participants, however, discussed the limitations of Google Translate. Emma only used Google Translate to translate single words because she found it did not accurately translate long sentences: *"Sometimes the grammar is wrong or the translation of the word is wrong."* Linda found Google Translate did not work for residents who have a speech impairment: *"If they (residents) have speech problems, it [Google Translate] cannot really translate correct meanings."*

Charlotte noted the inconvenience of passing phones between her and residents in conversations:

> *"When I use Google Translate on my iPhone, I have to say to it, and then put it near the residents to let them listen and talk."*

Angelina avoided this problem by using Google Translate to translate her words and repeat the translated words to residents by herself. However, this approach interrupted two-way conversations: *"Residents will reply to me but then I won't understand."*

Vida discussed the constraints of opening Google Translate during spontaneous conversations and hoped a new translation technology could capture or record residents' speech in a more convenient and timely manner:

> *"If residents are speaking and if we don't quite understand, I hope something [translation technology] could speak back to us and say this is what they're saying. I know you can do it with Google Translate, but sometimes you don't have enough time to say, 'Hang on a second. Now, can you say it again?'"*

It is also worth noting that Sunshine Care prohibited caregivers from using personal phones at work. Wendy explained:

> *"Staff would need to have permission because they are not allowed to use their mobile phones when they are on duty. I'm sure permission can be easily passed by in that circumstance [of language translation], but it would still be a potential hurdle for the staff member and the resident."*

Wendy's explanation shows a barrier for caregivers in using Google Translate in daily care. During the preceding volunteer work in the care home, the first author did not see lifestyle coordinators using Google Translate to communicate with a resident who only spoke Mandarin in social activities. Most of the time, lifestyle coordinators used body language or reached out to other caregivers who spoke Mandarin to translate when they were available.

5   Discussion

This study aimed to understand the challenges associated with language barriers in aged care and caregivers' needs for translation technology. Our findings reveal that while caregivers were keen to improve care for CALD residents by reducing language barriers, existing translation approaches could not effectively support their communication needs. This gap highlights an opportunity for well-designed translation technology to augment care in aged care homes. In this section, we first discuss the value of translation technology tailored to aged care homes, and then offer suggestions for the design of translation technology in this complex setting. By exploring the nuanced needs and design considerations

for translation technology, our study adds to the growing body of research concerned with improving care through the design of technology in aged care homes [55, 60].

5.1 A high potential value for translation technology tailored to aged care homes

Our findings reveal a conflict between caregivers' strong desires to mitigate language barriers and the inefficiency of existing approaches in addressing their translation needs. Participants were aware that language barriers hindered their abilities to address residents' care and social needs, expecting a translation technology to mitigate these barriers. Their desire to provide better care to CALD residents echoes a previous study that reported caregivers' dedicated work to manage language barriers in multicultural environments [24]. However, it is evident that participants' communication needs were not fulfilled by existing translation services and tools. These unmet needs suggest an opportunity for well-designed translation technologies to contribute to effective communication in aged care.

The limitations of professional services and Google Translate apps shown in our study are consistent with previous research [8, 23, 30, 42]. However, we further identified some practical barriers for human services and Google Translate to be effective in aged care. For professional interpreter services, our results suggest that they may not be able to support everyday conversations between caregivers and residents, since these conversations are sometimes random and fragmented. For example, our participants talked to residents when residents experienced pain, felt lonely, or became agitated. Considering that professional interpreters need to be pre-booked with possible long processes for booking [3], it is not feasible to rely on them to facilitate incidental and spontaneous communications.

Unlike in the telehealth settings in Calambur's et al. study [8] where translation is only needed when nurses or doctors contact patients over the telephone, translation in aged care homes may be needed at any time, including times when family members are not present. For example, as Emma noted, caregivers need to understand a resident's needs at night time. This poses a practical barrier in terms of family members' availability. Furthermore, we found family members might overlook or diminish resident autonomy in certain circumstances. All these problems highlight a need for an effective translation tool that is available all the time in aged care.

However, existing and common translation tools for participants to use, including Google Translate, had limitations. Besides the need for translation technology to provide accurate care and supporting conversations, as identified by previous research [23, 30, 42], we found a need not only for addressing residents' spontaneous conversations, but also for supporting group conversations among multiple participants. To address the complex communication requirements in aged care, there is a need for new technology specifically tailored to such frequently encountered circumstances in the aged care context.

The language barriers and associated unmet needs found in our research site are likely to occur in other multicultural care homes. In our research site, language barriers were caused not only by the multicultural backgrounds of residents, but also by residents' declining English-speaking abilities and migrant caregivers' English skills. The phenomenon of bilingual older people, especially those living with dementia, reverting to their native languages and losing the ability to speak second languages, has been reported in previous research [35]. The use of migrant caregivers to fill shortages in care forces is prevalent in many countries experiencing the trend of global ageing [50]. Therefore, caregivers in other care homes are likely to face a similar challenge of language barriers as our participants do. Considering that language barriers may hinder caregivers' abilities to address the physical, emotional, and social needs of CALD residents, it is essential to reduce or overcome language barriers in everyday care.

In sum, we see a high potential value for translation technology in aged care homes. This value is evident from a collective perspective considering caregivers' unmet translation needs, the limitations of existing human translators and

technologies, and the prevalence of language barriers in multicultural care homes. The role of translation technology is not only to address caregivers' translation needs but, more importantly, to improve the care provided to CALD residents who are often marginalized [7, 18]. We therefore call for further HCI research into designing translation technology in aged care, which aligns with the goal of upholding ethical care in HCI [55].

5.2 Considerations for designing translation technology in aged care

5.2.1 Establishing personalized models tailored to residents' spoken languages. Participants' expectations show that translation technology in aged care should better support verbal conversations. Liebling et al. [30] suggested that future translation technology should build personalized speech recognition models through model training to support accent and dialect recognition. Our findings confirm that this suggestion is valid in aged care homes. Unlike the wide user groups of Google Translate, aged care homes have a small and relatively fixed group of users who require translation support. It is crucial that technology can accurately recognize their spoken languages, including dialects and accents.

When building tailored language models, it is important to consider the needs of residents who speak less prevalent languages or dialects. Runci et al. [46] found that about 38% of residents living in regional care homes in Victoria, Australia, only spoke their own languages other than English in the care home. Similarly, in our study, Lily noted a resident reverted to a dialect that even her family members did not know. For these residents, a translation technology that can recognize their spoken languages may greatly enhance their social connection.

However, a challenge in building accurate acoustic models for dialects and languages spoken by minorities is the lack of data to train the models [53]. Bridging the language divide may be accelerated by the application of emerging generative large language models in machine translation [58]. Furthermore, the models should adapt to residents' real-time languages, since some residents' spoken languages will change with the progress of their dementia. With the fast-paced development of AI, future research should investigate how that technology may support personalized translation for aged care residents.

5.2.2 Integrating features of communication technologies. Our findings show that translation technology in aged care could be an important communication tool to foster care relationships between residents and caregivers. This role requires translation technology to accommodate the communication abilities of residents, which aligns with the recommendations of Ji et al. [25]. Augmentative and alternative communication (AAC) technology is one of these technologies that aims to address the complex communication needs of people with speech and language impairments [13, 14]. Various AAC devices have been developed to offer multimodal interactions, including touch screen, eye gaze, as well as speech, images, and texts, to enhance users' verbal and non-verbal communication skills [14]. AAC technologies may also be applied to address the communication needs of older adults living with dementia [33, 57]. Drawing on this body of research, we suggest that future design of translation technology might integrate features of AAC technologies to cater to aged care residents' communication abilities. Some AAC strategies have already been included in the design of Google Translate. For example, Google Translate allows users to input text or voice and provides both text and speech as output, which has been found useful when communicating with older adults [23]. Our results suggest that more diverse multimodal interaction features may be needed in the design of translation technologies for aged care contexts. For example, translation technology may use images and videos as visual aids and enable residents to choose from typing, writing, and drawing to express themselves. Translation technology may also incorporate automatic word prediction and abbreviation expansion, features designed for AAC technologies, to reduce the cognitive load for residents with dementia during text input [14, 47].

The design of translation technology may also include contextual information to support effective communication. This could be helpful for caregivers who are not familiar with residents' culture. As shown in the example shared by Chloe, cultural information may hinder caregivers' interpretation of residents' needs. To mitigate this issue, we suggest that translation technology could provide background information when translating terms related to certain cultures. Prior research identified that adding contextual information to translations could reduce cultural barriers for people to understand foreign language posts on social media [31]. Similarly, culture-related contextual information included in the design of translation technology may help caregivers to better understand residents' needs in their daily interactions.

Furthermore, the tone and voices in translation technology output should be tailored to residents' moods and preferences, especially for those with cognitive decline. As Murphy suggested, caregivers expect the technology to help them communicate with residents when they are agitated. Previous research indicates that using a calm and soft voice can help de-escalate agitation [36]. Accordingly, translation technology should adopt soothing and low-pitched voices to avoid escalating residents' agitation and aggression.

5.2.3 Aligning translation devices with the context of conversations in care. For new technology to be successfully implemented in aged care homes, the design of technology should meet the needs of both residents and caregivers and fit into the care home settings [9, 59]. We have discussed how the design of translation technology may respond to the needs of residents in previous sections. For caregivers, our findings show pragmatic barriers related to using their phones at the care home. For example, our research site has strict restrictions on caregivers using personal phones at work. Frequent use of personal phones also raise concerns about privacy issues and data capture [5]. Furthermore, relying on caregivers' personal phones for translation may disrupt the flow of natural conversations. For example, Vida requested translation technology that could capture spontaneous conversations initiated by residents. However, since caregivers use their phones for multiple purposes beyond translation, expecting them to have their phones constantly on standby just for translation is not practical.

These problems speak to a need for specific translation devices tailored to daily care practices. As communication is embedded in care practices, translation devices must align with the specific contexts in which care is provided. For example, considering that caregivers frequently communicated with residents while helping them dress or eat, translation devices should offer hands-free and touch-free interactions to avoid disrupting daily care tasks. For bed-bound residents who often communicate with caregivers near their beds, smart displays [22] that can be placed on bedside tables and respond to voice commands may be useful. In group activities where conversations involve multiple people, mobile social robots [9] that can automatically approach multiple residents and caregivers may be more appropriate.

Due to the varying cognitive and physical abilities of caregivers and residents, future research should investigate whether they need different types of translation devices. For caregivers, who are often busy managing multiple tasks, wearable devices such as earphones and smartwatches [15] may be useful. For residents who have cognitive and sensory decline, translation devices should address their accessibility needs. For example, residents with hearing impairments may benefit from devices that amplify sound, while those with vision impairments may need devices with larger screens [57]. To avoid requiring residents to repeat their speech, as noted by Vida, these devices should be able to capture residents' spontaneous and prompt conversations effectively.

5.3 Limitations

A key limitation of this study is that we focused solely on the perspective of caregivers, without investigating the views of residents and family members. To obtain a holistic understanding of the requirements of translation technology, future research should incorporate the perspectives of all stakeholders. Furthermore, considering the complexity of residents' conditions in aged care, an interview alone may not be sufficient to fully understand how caregivers interact with CALD residents in their everyday activities and conversations. Future research may adopt an ethnographic approach to further examine caregivers' workarounds for coping with language barriers. These workarounds may provide further insights into the design of translation technology in care settings.

6 Conclusion

Our findings highlight the urgent need for well-designed translation technology to address the communication barriers between caregivers and CALD residents in multicultural care homes. Addressing language barriers is complicated due to caregivers' and residents' varied languages abilities as well as the nuances of conversations in everyday care. For translation technologies to fit into complex aged care settings, we provided three design suggestions: developing personalized models to recognize residents' spoken languages and dialects, incorporating helpful features of communication technology and showing cultural-related information, and offering specific and bespoke devices for routine translation. These suggestions illuminate new directions for future design of translation technology in aged care. We hope our work can draw the attention of HCI researchers to this topic and inspire more innovative interaction designs to reduce language barriers for residents and caregivers from CALD backgrounds, thereby upholding the value of care in aged care homes.

Acknowledgments

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