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**TITLE:** A narrative review of the evidence regarding the use of telemedicine to deliver video-interpreting during dementia assessments for older people.

**ABSTRACT:**

**Introduction:** As Australia's ageing population increases and diversifies, there will be a growing need to address the burden of dementia among culturally and linguistically diverse (CALD) communities. Due to a lack of CALD-appropriate services and bilingual health professionals, older people from CALD backgrounds often receive a delayed diagnosis of dementia. The use of telemedicine (TM) to deliver video-interpreting services may overcome the barriers of interpreter availability when diagnosing and assessing dementia in older people from CALD backgrounds.

**Methods:** This paper aims to present a review of the literature on the use of TM to deliver video-interpreting during dementia assessments. Factors affecting the reliability and agreement, feasibility and satisfaction and acceptability when using TM or video-interpreting have been described.

**Results:** The review found evidence that dementia assessments conducted via TM are as reliable as face-to-face (FTF) assessments and that participants are satisfied and find TM acceptable. There was less evidence about the feasibility of TM from the healthcare perspective, particularly regarding the acceptability and potential financial cost-savings. Only five studies investigated the use of video-interpreting during clinical assessments with CALD patients. Although video-interpreting was found to be satisfactory among CALD patients and clinicians, a common finding was the preference for FTF interpreting.

**Discussion**: More research is needed to examine the financial feasibility and the healthcare perspective on the implementation and adoption of TM for dementia assessments. The use of TM to deliver video-interpreting for dementia assessments has never been investigated and represents a significant gap in the literature.

**Keywords:** Dementia, Ethnic, Assessment, Telemedicine, Interpreting



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## Introduction

The Australian population is ageing. In 2016, 3.7 million Australians were over the age of 65. This number is projected to become 8.7 million by 2056, comprising 22% of the population (Australian Institute of Health and Welfare, 2018). Moreover, 30% of Australians over the age of 65 are from non-English speaking backgrounds (Australian Institute of Health and Welfare, 2018).

As the ageing population increases and diversifies, there will be a growing need to address the burden of chronic diseases such as dementia (Haralambous, Mackell, Lin, Fearn, & Dow, 2018; Welfare, 2018). Dementia is the second leading cause of death and the greatest cause of disability in Australians over the age of 65 (Welfare, 2018). It is estimated that 1 in 10 older Australians over the age of 65 and over 50% of residents in residential aged care facilities have dementia (Australian Institute of Health and Welfare, 2018).

Timely diagnosis of dementia is important for management of the condition (Brooker, Fontaine, Evans, Bray, & Saad, 2014; Iliffe et al., 2009; Livingston et al., 2017). Delayed diagnosis of dementia is common among older people from culturally and linguistically diverse (CALD) backgrounds as they present to health services at a later stage of the disease (Lee et al., 2011). A lack of CALD-appropriate services and bilingual health professionals are significant factors that contribute to delayed diagnosis of dementia within the CALD community (Lee et al., 2011). As such, limited English proficiency impedes access to health services, increasing health disparity between people from CALD and non-CALD backgrounds (Jacobs, Chen, Karliner, Agger-Gupta, & Mutha, 2006).

The use of an accredited interpreter has been shown to improve diagnosis, patient satisfaction, outcome, and communication between the health practitioner and individual (Flores, 2005; Jacobs et al., 2006; Karliner, Jacobs, Chen, & Mutha, 2007). However, the lack of accredited interpreters creates a barrier to access services, particularly in aged care assessment services (ACAS) where people from CALD backgrounds are likely to undergo their initial dementia assessment and entry into the service system (Vrantsidis et al., 2014). The lack of available accredited interpreters for rural CALD communities in Australia and for rare languages are additional barriers to timely diagnosis of dementia in CALD individuals (Vrantsidis et al., 2014).

Telemedicine (TM) involves the use of telecommunications technology to deliver healthcare services, which may include education, diagnosis, assessment and care (Nesbitt, Hilty, Kuenneth, & Siefkin, 2000). Health practitioners have used telemedicine to diagnose dementia in older people who cannot attend or travel long distances for assessment. Studies have found that telemedicine can be as accurate as face-to-face (FTF) diagnosis, with similar levels of patient satisfaction (Barth, Nickel, & Kolominsky-Rabas, 2018; Martin-Khan et al., 2012).

Video-interpreting in a clinical context involves the use of TM with an interpreter located in a different location to the clinician and CALD patient to assist with medical consultations. Telephone and video-interpreting were found to be just as effective as FTF interpreting, with similar levels of patient satisfaction (Joseph, Garruba, & Melder) in younger CALD individuals. Therefore, using alternative telecommunication modalities to deliver interpreter assisted healthcare may overcome the barriers of interpreter availability when diagnosing dementia in older people from CALD backgrounds.

The purpose of this literature review is to summarise the evidence of using video-interpreting in dementia assessments which involves a range of neurocognitive and memory screening tools with an interpreter in a different location to the clinician and the CALD patient. This is a part of a broader study exploring the use of video-interpreting during the dementia assessment process. Ethical approval of the study was granted by the Melbourne Health Human Research Ethics Committee (Ethics ID: 2017/279) and all participants in the study have provided consent.

# Methods

## Search strategy:

Online literature searches of PubMed, CINAHL, EMBASE and psycINFO were conducted in January 2018 using keyword combinations of telemedicine, videoconferencing, dementia, cognitive impairment, mental health, older people, CALD backgrounds, interpreters, assessment and diagnosis. The search was limited to papers published in English from 2003 to 2018. Search fields were restricted to title or abstract for the most relevant articles to be selected. The full list of search strategies is found in Table 1.

Articles found in each of the databases were collected and imported into Endnote X8 (Thomson Reuters, Canada). After duplicates were removed, one researcher (KH) scrutinised the abstracts of each paper to identify relevant articles based on the inclusion criteria and retrieved full texts for relevant studies. Reference lists from full text articles included in the study were further examined for relevant articles that may have eluded the search process.

## Inclusion criteria:

Papers were included if they focused on TM for dementia assessments or video-interpreting and had a study population with a mean age above 65 years. Papers in English that were published in the last 15 years with the full text available were also included.

## Data extraction and analysis:

After identifying papers through the search strategy, the results of each article were extracted into one document for thematic analysis which generated major themes related to the use of TM or video-interpreting to assess dementia in older people or people from CALD backgrounds. Two researchers independently read each article (BH, SS) and independently manually coded and extracted the document to derive major themes which were collectively agreed upon.

# Results

We identified 26 papers that met our search criteria (Table 2). Of the 26 studies, 16 were from the United States, five were from Australia, two each from Canada and Europe (Portugal and Denmark) and Hong Kong. 21 papers investigated the agreement and reliability, satisfaction and acceptability and feasibility of using TM for diagnosis of dementia in an older population. The most common assessment tool used was the Mini-Mental Standard Examination (MMSE, nine studies). Five papers investigated the role of video-interpreting (Locatis et al., 2010; Mucic, 2010; Nápoles et al., 2010; Schulz, Leder, Akinci, & Biggs, 2015; Vestal, Smith-Olinde, Hicks, Hutton, & Hart, 2006). Only one study was conducted in the participants' home.

## SATISFACTION/ACCEPTABILITY

Fifteen papers described the satisfaction with and acceptability of using TM for dementia assessments (Barton, Morris, Rothlind, & Yaffe, 2011; Castanho et al., 2016; Cullum, Weiner, Gehrmann, & Hynan, 2006; Galusha-Glasscock, Horton, Weiner, & Cullum, 2016; Grosch, Weiner, Hynan, Shore, & Cullum, 2015; Locatis et al., 2010; Morgan et al., 2014; Mucic, 2010; Nápoles et al., 2010; Parikh et al., 2013; Poon, Hui, Dai, Kwok, & Woo, 2005; Powers, Homer, Morone, Edmonds, & Rossi, 2017; Price, Pérez-Stable, Nickleach, López, & Karliner, 2012; Schulz et al., 2015; Shores et al., 2004; Vestal et al., 2006; Weiner, Rossetti, & Harrah, 2011; Wofford, Campos, Johnson, & Brown, 2013). Satisfaction and acceptability was determined from the point of view from participants including the client, the clinician and the interpreter. Acceptability may be defined as whether the intervention or service met the patient's expectations and also whether the service or intervention is socially acceptable (Dyer, Owens, & Robinson, 2016); whereas, satisfaction is related to the process rather than the outcome of care. In all studies, neither satisfaction nor acceptability was defined. Seven studies were found that explored the satisfaction of participants assessed for dementia over TM (Barton et al., 2011; Grosch et al., 2015; Morgan et al., 2014; Parikh et al., 2013; Powers et al., 2017; Shores et al., 2004; Vestal et al., 2006). The most typical method of measuring patient satisfaction was using surveys (Morgan et al., 2014; Parikh et al., 2013; Powers et al., 2017; Shores et al., 2004; Vestal et al., 2006). Two papers used the TM patient survey (Shores et al., 2004; Vestal et al., 2006), while two did not describe the tool used to measure patient satisfaction using TM (Barton et al., 2011; Grosch et al., 2015; Poon et al., 2005). Patients who were assessed for dementia using TM expressed overall satisfaction with the technology which included high levels of satisfaction with understanding the information conveyed over video (Morgan et al., 2014; Parikh et al., 2013; Powers et al., 2017; Shores et al., 2004; Vestal et al., 2006), privacy (Morgan et al., 2014; Parikh et al., 2013; Powers et al., 2017; Shores et al., 2004; Vestal et al., 2006), saving on travel time (Powers et al., 2017; Shores et al., 2004; Vestal et al., 2006) and audio/visual quality (Poon et al., 2005). Only one survey examined satisfaction from the clinician's perspective and found that clinicians were also highly satisfied with the use of TM for dementia assessments (Shores et al., 2004).

There were five papers exploring the satisfaction and acceptability of video-interpreting (Mucic, 2010; Nápoles et al., 2010; Price et al., 2012; Schulz et al., 2015; Wofford et al., 2013). Three studies described the assessment tool to assess patient satisfaction (Locatis et al., 2010; Schulz et al., 2015; Wofford et al., 2013). Video-interpreting was found to be satisfactory to patients in three studies (Locatis et al., 2010; Schulz et al., 2015; Wofford et al., 2013). However, a common finding was the preference for FTF interpreting (Locatis et al., 2010; Schulz et al., 2015). One study reported lower satisfaction from interpreters using video-interpreting in clinical settings compared with FTF interpreting. However, this result was only statistically significant for establishing rapport between the patient and clinician (Price et al., 2012). Clinicians were also satisfied with video-interpreting (Schulz et al., 2015; Wofford et al., 2013) particularly due to the duration of the assessment and consequently favoured using the technology again (Wofford et al., 2013).

Powers *et.al* 2017 examined TM for assessing and diagnosis of dementia among rural veterans and found that the no-show and cancellation rate was 5.4% lower for TM assessments compared to FTF assessments (Powers et al., 2017). In another study, Weiner *et.al* (2011) found that refusals and no-show rates for TM assessments were 3% (Weiner et al., 2011). Three studies, examining

acceptability using surveys found that participants would use TM assessments again (Parikh et al., 2013; Shores et al., 2004; Vestal et al., 2006; Wofford et al., 2013).

## FEASIBILITY

Feasibility is a measure of an intervention to determine if the intervention is sustainable and suitable (Bowen et al., 2009). We categorised feasibility into technological and logistical elements. No papers were found examining the financial or economical feasibility of TM.

Technological feasibility mostly related to the audio-visual quality of the TM session. Audio-visual quality was deemed 'inadequate' 22% of the time in one study (Shores et al., 2004), and 'poor' among 11.5% of participants in another study (Castanho et al., 2016). In Schulz *et.al*'s (2015) study which used video-interpreting, audio echo and picture quality affected TM sessions in 15% of patients and 22% of clinicians (Schulz et al., 2015). This finding concurs with similar issues of audio-visual quality affecting the TM session in an earlier study (Locatis et al., 2010). Another study found that patients rated the audio-visual quality of their TM session as good or excellent 72% of the time (Wofford et al., 2013). The need for a secure and encrypted connection was stated by Wofford *et.al* (Wofford et al., 2013).

There were differences in the logistical setup of TM in studies. Setup of the TM included being the in same clinical building or in different buildings and different geographical locations. Regarding local setup of TM, it was found that small rooms and environmental disturbances (moving to a different room for TM, finding a private location, ambient noises from TM session) caused frustration among patients (Mucic, 2010; Wofford et al., 2013). TM assessments or consultations were found to be longer than FTF assessments due to longer set up times (Cullum, Hynan, Grosch, Parikh, & Weiner, 2014; Cullum et al., 2006; Locatis et al., 2010; Weiner et al., 2011), sometimes up to 6 hours of preliminary work by staff (Weiner et al., 2011). One study found that the mean testing time was longer for TM compared to FTF methods, however this difference was not statistically significant (Cullum et al., 2014).

## AGREEMENT AND RELIABILITY

Agreement is a measure of how similar results are between repeated measures, while reliability is defined as how well individual patients are distinguishable from each despite measurement errors (de Vet, Terwee, Knol, & Bouter, 2006). Eleven papers were found that measured agreement and reliability of neurocognitive assessments administered by TM compared with either FTF or telephone methods (Castanho et al., 2016; Cullum et al., 2014; Cullum et al., 2006; Galusha-Glasscock et al., 2016; Grosch et al., 2015; Loh, Donaldson, Flicker, Maher, & Goldswain, 2007; Loh et al., 2004; Martin-Khan et al., 2012; McEachern, Kirk, Morgan, Crossley, & Henry, 2008; Wadsworth et al., 2016; Wong, Martin-Khan, Rowland, Varghese, & Gray, 2012). The most common neurocognitive assessments administered in these studies include: MMSE (Castanho et al., 2016; Cullum et al., 2014; Cullum et al., 2006; Galusha-Glasscock et al., 2016; Grosch et al., 2015; Loh et al., 2007; Loh et al., 2004; Martin-Khan et al., 2012; McEachern et al., 2008; Wadsworth et al., 2016), GDS (Loh et al., 2007; Loh et al., 2004), and RUDAS (Martin-Khan et al., 2012; Wong et al., 2012). There were no agreement or reliability measures examined in the papers that investigated the use of video-interpreting.

*RUDAS:*

There were two studies that found statistical significance in the agreement and reliability of administering the RUDAS via TM compared with FTF assessments. Martin-Khan *et.al* (2012) conducted a large prospective study of 205 participants presenting at a memory clinic in a metropolitan area of Brisbane, Australia (Martin-Khan et al., 2012). Participants were recruited to have either two FTF assessments, or one FTF and one TM assessment. When comparing the agreement between the two groups, it was found that the difference in agreement was 1%, and that the weighted kappa of 0.51 was statistically significant. Another study measuring the RUDAS also found high inter-rater agreement and reliability of RUDAS administered over TM. Wong *et.al*'s (2012) study of a statistically calculated sample size of a no difference range of RUDAS score of less than 1 administered in randomised counterbalance order of FTF and TM, found the mean difference of RUDAS scores was 0.04, and the Pearson correlation for reliability was 0.79 ($p<0.001$) (Wong et al., 2012).

*GDS:*

Two studies by the same author examined the reliability and rater agreement of the GDS via TM compared with FTF. In Loh *et.al*'s (2004) study (Loh et al., 2004), the GDS was administered FTF then via TM in a cohort of 20 patients with dementia from rural areas. Bias was reduced by randomising assessors. Evidence was found that the GDS could be reliably assessed using TM (Pearson correlation=0.78, mean difference= 0.3±2.1 (-3.9 to 4.5)). However, analysis using the Bland-Altman method indicates that there is a statistically significant disagreement between the two modalities. This indicates that participants attained a higher score using TM compared with FTF. The authors attributed this difference to clinical condition of the patient on the day, particularly delirious patients. These results are found again in a methodologically similar study by the same study group (ICC=0.78, Kappa=0.8, $p<0.0001$). However in contrast to the first study, the Bland-Altman plot for the GDS did not indicate systematic bias (Loh et al., 2007).

*MMSE:*

Nine studies examined the agreement and reliability of assessing the MMSE over TM as compared with FTF. There was strong evidence to indicate that the MMSE can be reliably assessed over TM, as eight studies found statistically significant correlations (table 3) between the two modalities (Castanho et al., 2016; Cullum et al., 2014; Cullum et al., 2006; Grosch et al., 2015; Loh et al., 2007; Loh et al., 2004; Wadsworth et al., 2016). A study by Shores *et.al* in 2004 also found that the MMSE can reliably be used to diagnose dementia over TM (Shores et al., 2004). This study differed from the other seven studies in that participants were not administered the MMSE both FTF and via TM, but mean differences between dementia and non-dementia groups were compared when the MMSE was administered over TM. Similarly, six studies measuring the agreement between TM and FTF assessments also found statistically significant agreement (table 3) between the modalities (Cullum et al., 2006; Grosch et al., 2015; Loh et al., 2007; Martin-Khan et al., 2012; McEachern et al., 2008; Wadsworth et al., 2016).

## Discussion

This literature review has highlighted the current evidence and existing gaps in using TM as compared with FTF methods when undertaking dementia assessments with older people. We summarise the evidence under our broad headings: satisfaction and acceptability, feasibility, and agreement and reliability.

Patient satisfaction is related to the outcomes of the intervention, while acceptability is defined in the broader sense as the societal-communal perceived legitimacy of the intervention (Dyer et al., 2016). There were a number of studies that examined the satisfaction and/or the acceptability of TM for dementia assessments and/or interpreting. However we found no studies that defined satisfaction or acceptability, often conflating or interchanging the two terms. Most papers measured satisfaction outcomes and typically only focused on the participant's satisfaction. In general, it was found that patients were satisfied with the outcomes of TM for diagnosing memory problems, particularly with mild dementia-related conditions. Only one paper examined satisfaction from the clinician's perspective, which found high satisfaction with assessing memory and outcomes using TM (Shores et al., 2004). More robust studies are needed to examine the satisfaction of clinician's use of TM for the diagnosis of dementia.

Based on the definition of acceptability by Dyer *et.al* (2016) (Dyer et al., 2016), three studies found that using TM to assess memory problems associated with dementia was highly accepted by older people. Although these papers included two questions related to acceptability such as questions on 'using videoconferencing again' and 'preference using telemedicine compared with in clinic assessments', the results of some of these studies should be taken with caution. In Vestal *et.al*'s study, TM was set up and undertaken in an urban environment (Vestal et al., 2006), as in Parikh *et.al*'s (2013) study. Such a closed test environment improves internal validity of the study, but does not reflect real world acceptability of the technology, particularly in rural populations where distance and geography will affect the quality of the modality. As such, there would be an expectation of survey bias in such studies, because the setup is near perfect and without interruption. Shore *et.al*'s (2004) study has more validity as the setup of TM is more remote, with the patient at a nursing home and the clinician at a remote location in the clinic (Shores et al., 2004). While there is evidence for the acceptability of TM by older people, clinician's acceptability of diagnosing dementia via TM remains a significant gap in the literature. There is also little evidence about the acceptability of video-interpreting in the home setting with an interpreter in a different location.

Bowen *et.al* (2009) summarises that there are eight frequently researched domains of feasibility studies for interventions (Bowen et al., 2009). These include: Acceptability, Demand, Implementation, Practicality, Adaptation, Integration, Expansion, and Limited-efficacy testing. Our investigation of the literature revealed that the studies examining feasibility largely focused on the technological and logistical aspects, related to the Implementation domain. The evidence showed that good audio-visual quality and the set-up were important aspects of successful and satisfactory experiences of TM. There were a limited amount of studies that investigated the practicality of TM, which is defined by Bowen *et.al* as the resources, time and commitment that is required to implement the intervention (Bowen et al., 2009). Three studies found that there was extra set-up time involved with TM (Cullum et al., 2014; Cullum et al., 2006; Weiner et al., 2011). However, none

of these studies accurately measured the time required for set-up. Furthermore, there was no thorough examination of the financial feasibility of TM that could be identified in the literature. However, in one study the cost of TM per session was listed (Weiner et al., 2011). While there were some estimation of the financial cost of travel in some studies (Powers et al., 2017), none of these studies used robust economic metrics to accurately measure the cost saved using TM compared with FTF assessments, and there were no studies investigating the financial feasibility from the healthcare perspective. The financial feasibility of implementing TM for dementia assessments requires further research, as potential cost-savings for healthcare systems could be beneficial.

In our review, we found more evidence for the reliability and agreement of assessing dementia using the MMSE compared to the RUDAS or GDS. This might be potential bias due to the number of U.S related studies where the MMSE is the predominantly used tool in the field of neuropsychology. Nevertheless, all studies were unanimous in the statistically significant measures of agreement and reliability when comparing TM with FTF assessments. Two studies examining the agreement and reliability of the RUDAS scores indicate that TM is reliable, including one large population study (Martin-Khan et al., 2012). However, the RUDAS was developed particularly for use with CALD populations, and neither of the two studies investigated the agreement and reliability in a CALD population (Storey et al., 2004)(Storey et al., 2004)(Storey et al., 2004)(10)(10)(Storey et al., 2004). Although the evidence is strong for the reliability of the MMSE to be administered via TM in English-speaking populations, the administration of the RUDAS via TM needs to be validated in CALD populations, considering it has been developed for use in this population. This is especially the case considering the significant proportion of older people from CALD backgrounds living in Australia who may benefit from this method of assessment.

## Limitations

There are a few limitations with our review. We only focused on papers in English and the population in most of our studies spoke the predominant language of their country. As a result, the external validity of our summary of evidence is predominantly limited to English. A common bias in many studies is the exclusion of non-English speaking participants, which affects external validity. We advocate for more research to be undertaken with participants from CALD backgrounds.

## Conclusion

This study has found evidence of the usability of TM for dementia assessments (22) and for video-interpreting from in a different location to the patient (23). However, there have been no studies exploring video-interpreting for dementia assessments with an interpreter in a different location to the clinician and the CALD patient in a home setting.

The integration of technology in modern society is ubiquitous, and healthcare systems are addressing ways of trailing new innovations to address barriers to healthcare. In our examination of the literature, there is mixed evidence for the use of TM to assess memory. There is evidence to indicate that memory assessments conducted via TM are as reliable as FTF assessments, and that participants are satisfied and find TM acceptable. There was less evidence about the feasibility of TM from the healthcare perspective, particularly regarding the acceptability and potential financial cost-

savings. More research is needed to examine the financial feasibility, and the healthcare perspective on the implementation and adoption of TM for memory assessments.

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## Table 1: Search Strategy

### Search 1:

| PUBMED search strategy | | Date searched: 22/12/2017 |
|---|---|---|
| **ID#** | **Search terms** | |
| **#1** | **Telehealth or telemedicine or telegeriatrics[Title/Abstract]** | 26,455 |
| **#2** | **videoconferencing[Title/Abstract] OR video conferencing[Title/Abstract] OR video-conferencing[Title/Abstract])** | 1,782 |
| **#3** | **#1 OR #2** | 27,024 |
| **#4** | **assessment[Title/Abstract] OR assess[Title/Abstract] OR diagnosis[Title/Abstract] OR diagnosing[Title/Abstract]** | >1,000,000 |
| **#5** | **older person OR older people OR elderly OR elder person OR elderly people OR geriatrics[title/abstract]** | >1,000,000 |
| **#6** | **dementia[Title/Abstract] OR cognitive impairment[Title/Abstract] OR memory[Title/Abstract] OR mental health[title/abstract]** | 424,537 |
| **#7** | **#4 AND #5 AND #6 AND #7** | 63 |

| psycINFO | | Date searched: 04/01/2017 |
|---|---|---|
| **ID#** | **Search terms** | **Hits:** |
| **#1** | **(telehealth or telemedicine or telegeriatrics).ti,ab** | 2,162 |
| **#2** | **(videoconferencing or video conferencing or videoconferencing).ti,ab.** | 1,255 |
| **#3** | **#1 OR #2** | 3,141 |
| **#4** | **(assessment or assess or diagnosis or diagnosing).ti,ab.** | 505,840 |
| **#5** | **(older person or older people or elderly or elder person or elderly people or geriatrics).ti,ab.** | 64,570 |
| **#6** | **(dementia or cognitive impairment or memory or mental health).ti,ab.** | 236,331 |
| **#7** | **#2 AND #3 AND #4 AND #5** | 7 |

| EMBASE | | Date searched: 04/01/2017 |
|---|---|---|
| **ID#** | **Search terms** | **Hits:** |
| **#1** | **(telehealth or telemedicine or telegeriatrics).ti,ab** | 13,437 |
| **#2** | **(videoconferencing or video conferencing or videoconferencing).ti,ab** | 2,316 |
| **#3** | **#1 OR #2** | 14,890 |
| **#4** | **(assessment or assess or diagnosis or diagnosing).ti,ab** | >1,000,000 |
| **#5** | **(older person or older people or elderly or elder person or elderly people or geriatrics).ti,ab** | 339,899 |

| | | |
|---|---|---|
| **#6** | **(dementia or cognitive impairment or memory or mental health).ti,ab.** | 236,331 |
| **#7** | **#1 AND #2 AND #3 AND #4 AND #5** | 25 |

| CINAHL | | Date searched: 15/01/2017 |
|---|---|---|
| **ID#** | **Search terms** | **Hits:** |
| **#1** | TI ( telehealth or telemedicine or telegeriatrics ) OR AB ( telehealth or telemedicine or telegeriatrics ) | 5,649 |
| **#2** | TI ( videoconferencing or video conferencing or videoconferencing ) OR AB ( videoconferencing or video conferencing or videoconferencing ) | 955 |
| **#3** | #1 OR #2 | 6,314 |
| **#4** | TI ( assessment or assess or diagnosis or diagnosing ) OR AB ( assessment or assess or diagnosis or diagnosing ) | 583,632 |
| **#5** | TI ( older person or older people or elderly or elder person or elderly people or geriatrics ) OR AB ( older person or older people or elderly or elder person or elderly people or geriatrics ) | 98,250 |
| **#6** | TI ( dementia or cognitive impairment or memory or mental health ) OR AB ( dementia or cognitive impairment or memory or mental health ) | 150,394 |
| **#7** | **#3 AND #4 AND #5 AND #6** | 23 |

# Search 2:

| PUBMED search strategy | | Date searched: 22/12/2017 |
|---|---|---|
| **ID#** | **Search terms** | |
| **#1** | **telehealth[Title/Abstract]** | 3209 |
| **#2** | **telemedicine[Title/Abstract]** | 9175 |
| **#3** | **videoconferencing[Title/Abstract] OR video conferencing[Title/Abstract] OR video-conferencing[Title/Abstract])** | 1772 |
| **#4** | **#1 OR #2 OR #3** | 12,582 |
| **#5** | **interpreting** | |
| **#6** | **Video-interpreting OR video interpreting** | |
| **#7** | **assessment[Title/Abstract] OR assess[Title/Abstract] OR diagnosis[Title/Abstract] OR diagnosing[Title/Abstract]** | >1,000,000 |
| **#8** | **migrant[Title/Abstract]) OR immigrant[Title/Abstract]) OR refugees[Title/Abstract]) OR oversea[Title/Abstract]) OR non english[Title/Abstract]) OR non-english[Title/Abstract]) OR (culturally[Title/Abstract] AND linguistically diverse[Title/Abstract])) OR CALD[Title/Abstract]** | 27,504 |
| **#9** | **#4 AND #5 AND #6** | 11 |

| CINAHL search strategy | | Date searched: 12/01/2018 |
|---|---|---|
| **ID#** | **Search terms** | **Hits:** |
| **#1** | **(Telehealth or telemedicine or videoconferencing or video conferencing or video-conferencing or interpret*).ti,ab** | 66829 |
| **#2** | **Assessment OR assess OR diagnosis OR diagnosing** | 583028 |
| **#2** | **Mental health** | 76605 |
| **#3** | **migrant or immigrant or refugees or overseas or non english or non-english or culutrally linguistically diverse or CALD or limited english** | 20278 |
| **#4** | **#4 AND #5 AND #6** | 21 |

| psycINFO search strategy | | Date searched: 12/01/2018 |
|---|---|---|
| **ID#** | **Search terms** | **Hits:** |
| **#1** | **(Telehealth or telemedicine or videoconferencing or video conferencing or video-conferencing or interpret*).ti,ab** | 175,567 |
| **#2** | **Assessment or assess or diagnosis or diagnosing).ti,ab** | 506,501 |
| **#2** | **Mental health.ti,ab** | 152,574 |
| **#3** | **(migrant or immigrant or refugees or overseas or non english or non-** | 28,043 |

| | | |
|---|---|---|
| | **english or culutrally linguistically diverse or CALD or limited english).ti,ab** | |
| **#4** | **#4 AND #5 AND #6** | 35 |

| **EMBASE search strategy** | | **Date searched: 12/01/2018** |
|---|---|---|
| **ID#** | **Search terms** | **Hits:** |
| **#1** | **(Telehealth or telemedicine or videoconferencing or video conferencing or video-conferencing or interpret*).ti,ab** | 139,566 |
| **#2** | **Assessment or assess or diagnosis or diagnosing).ti,ab** | 3,845,103 |
| **#2** | **Mental health.ti,ab** | 139,566 |
| **#3** | **(migrant or immigrant or refugees or overseas or non english or non-english or culutrally linguistically diverse or CALD or limited english).ti,ab** | 38,987 |
| **#4** | **#4 AND #5 AND #6** | 50 |

# Search 3:

| PUBMED search strategy | | Date searched: 3/01/2018 |
|---|---|---|
| **ID#** | **Search terms** | |
| **#1** | **videoconferencing[Title/Abstract] OR video conferencing[Title/Abstract] OR video-conferencing[Title/Abstract] OR video interpreting[Title/Abstract] OR video-interpreting[Title/Abstract] OR video interpretation[Title/Abstract] OR video-interpretation[Title/Abstract] OR interpret*[title/abstract]** | 353,142 |
| **#2** | **culturally linguistically diverse[Title/Abstract]) OR CALD[Title/Abstract] OR non english[Title/Abstract] OR non-english[Title/Abstract] OR nonenglish[Title/Abstract]** | 2811 |
| **#3** | **#1 AND #2** | 5 |
| **#4** | **older person OR older people OR elderly OR elder person OR elderly people OR geriatrics OR telegeriatrics** | 253,752 |
| **#5** | **pain or pain management** | 527,767 |
| **#6** | **#3 AND #4 AND #5** | 0 |
| **#7** | **#3 AND #4** | 17 |

| EMBASE search strategy | | Date searched: 12/01/2018 |
|---|---|---|
| **ID#** | **Search terms** | |
| **#1** | **(videoconferencing or video conferencing or video-conferencing or video interpreting or video-interpreting or video interpretation or video-interpretation or interpret*).ti,ab.** | 451,886 |
| **#2** | **(culturally linguistically diverse OR CALD OR non english OR non-english OR non-English OR migrant).ti,ab** | 12,175 |
| **#3** | **(older person OR older people OR elderly OR elder person OR elderly people OR geriatrics OR telegeriatrics).ti,ab** | 335,747 |
| **#4** | **Pain clinic OR pain** | 787,481 |
| **#5** | **#1 AND #2 AND #3 AND #4** | 0 |
| **#6** | **#1 AND #2 AND #3** | 27 |

| psycINFO search strategy | | Date searched: 12/01/2018 |
|---|---|---|
| **ID#** | **Search terms** | |
| **#1** | **(videoconferencing or video conferencing or video-conferencing or video interpreting or video-interpreting or video interpretation or video-interpretation or interpret*).ti,ab.** | 4,066 |
| **#2** | **(culturally linguistically diverse OR CALD OR non english OR non-english OR** | 6,419 |

| | | |
|---|---|---|
| | **non-English OR migrant).ti,ab** | |
| **#3** | **(older person OR older people OR elderly OR elder person OR elderly people OR geriatrics OR telegeriatrics).ti,ab** | 64,651 |
| **#4** | **(Pain clinic OR pain).ti,ab** | 81,897 |
| **#5** | **#1 AND #2 AND #3 AND #4** | 0 |
| **#6** | **#1 AND #2 AND #3** | 8 |

| **CINAHL search strategy** | | **Date searched: 12/01/2018** |
|---|---|---|
| **ID#** | **Search terms** | |
| **#1** | **TI ( videoconferencing or video conferencing or video-conferencing or video interpreting or video-interpreting or video interpretation or video-interpretation or interpret* ) OR AB ( videoconferencing or video conferencing or video-conferencing or video interpreting or video-interpreting or video interpretation or video-interpretation or interpret* )** | 61,535 |
| **#2** | **TI ( culturally linguistically diverse OR CALD OR non english OR non-english OR non-English OR migrant ) OR AB ( culturally linguistically diverse OR CALD OR non english OR non-english OR non-English OR migrant )** | 6,148 |
| **#3** | **TI ( older person OR older people OR elderly OR elder person OR elderly people OR geriatrics OR telegeriatrics ) OR AB ( older person OR older people OR elderly OR elder person OR elderly people OR geriatrics OR telegeriatrics )** | 98,160 |
| **#4** | **(Pain OR pain management).ti,ab** | 179,662 |
| **#5** | **#1 AND #2 AND #3 AND #4** | 0 |
| **#6** | **#1 AND #2 AND #3** | 23 |

**Table 2 Summary of studies included in the literature review (n=26)**

| Author | Title | Sample & Setting | Findings |
|---|---|---|---|
| Barton et al. 2011 | Video-Telemedicine in a Memory Disorders Clinic: Evaluation and Management of Rural Elders with Cognitive Impairment | Sample: 15<br>Mean age: 79.1<br>Setting: Rural setting in California | TM is effective in providing consultation and care to rural residents with cognitive impairment; Clinicians and patients were highly satisfied with TM. |
| Castanho et al.2016 | Assessing Cognitive Function in Older Adults Using a Videoconference Approach | Sample: 69<br>Mean age: 74.33<br>Setting: local health centers, assisted-living day-care centers and nursing homes in Portugal | Results showed associations between videoconference (VC), telephone and FTF during administration of cognitive screening tools; Tools administered through VC had high accuracy for participants with cognitive impairment; 97% of participants were highly satisfied with the method. |
| Cullum et al.2006 | Feasibility of Telecognitive Assessment in Dementia | Sample: 33<br>Mean age:73.3<br>Setting: Urban setting | Cognitive tests for dementia yielded highly similar results across the TM and in-person testing conditions; Participant satisfaction with TM was high although several indicated preference for personal contact. |
| Cullum et al.2014 | Teleneuropsychology: Evidence for Video | Sample: 202 | Similar results between FTF and TM cognitive test scores were found; Findings were consistent in subjects with and |

| Author | Title | Sample & Setting | Findings |
|---|---|---|---|
| | Teleconference-Based Neuropsychological Assessment | Mean age: 68.5<br>Setting: Urban and rural setting | without cognitive impairment; TM based testing was found to be a reliable and valid mode of assessment administration. |
| Galusha-Glasscock et al.2016 | Video Teleconference Administration of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) | Sample: 18<br>Mean age: 69.67<br>Setting: Urban setting | FTF and TM modalities yielded similar test scores and correlations, supporting feasibility and reliability of administering the RBANS over VC. |
| Grosch et al.2015 | Video teleconference-based neurocognitive screening in geropsychiatry | Sample: 8<br>Mean age: - not stated<br>Setting: Dallas VA Medical Center and University of Texas (UT) Southwestern Medical Center, outpatient geropsychiatry clinic | Cognitive screening through TM methods is feasible and produces similar and reliable results for measures of cognitive functioning in older adults; Interviews with participants reflected satisfaction with the TM testing procedure |
| Locatis et al.2010 | Comparing In-Person, Video, and Telephonic | Sample: 241 participants, 24 health | In-person interpretation were rated higher by providers and interpreters while patients showed no preference. |

| Author | Title | Sample & Setting | Findings |
|---|---|---|---|
| | Medical Interpretation | providers, 7 interpreters<br>Mean age: - not stated<br>Setting: Urban setting | Video-interpretation was rated higher than telephonic interpreting. |
| Loh et al.2004 | Can patients with dementia be assessed at a distance? The use of Telehealth and standardized assessments | Sample: 20<br>Mean age: 82<br>Setting: Urban setting | TM assessments of SMMSE and GDS yield similar results compared to FTF assessments. |
| Loh et al.2007 | Development of a telemedicine protocol for the diagnosis of Alzheimer's disease | Sample: 20<br>Mean age: 79<br>Setting: Urban setting | Good agreement for diagnosing Alzheimer's disease using TM compared with FTF assessment. However, results may be affected by small sample size and systematic bias. |
| Martin-khan et al.2012 | The Diagnostic Accuracy of Telegeriatrics for the Diagnosis of Dementia via Video Conferencing | Sample: 205<br>Mean age: 76<br>Setting: 4 memory disorder clinics in Australia | Results show high levels of agreement between TM and in-person methods for diagnosing dementia. Diagnosis of dementia through TM is reliable after preliminary assessments have been performed. |
| McEachern et al.2008 | Reliability of the MMSE | Sample: 71 | MMSE scores did not differ significantly between TM and |

| Author | Title | Sample & Setting | Findings |
|---|---|---|---|
| | Administered In-Person and by Telehealth | Mean age: 72<br>Setting: Rural and remote memory clinic in Saskatoon | FTF assessments. Therefore, telehealth provides an acceptable means of assessing mental status of patients in remote areas. |
| Morgan et al.2009 | Improving access to dementia care: Development and evaluation of a rural and remote memory clinic | Sample: 137<br>Mean age: 72.9<br>Setting: Rural and remote settings | Pre- and post-clinic assessments administered through TM are feasible and acceptable approaches to service delivery for rural and remote seniors and their caregivers. |
| Morgan et al.2014 | The Telehealth Satisfaction Scale (TeSS): Reliability, validity, and satisfaction with telehealth in a rural memory clinic population | Sample: 223<br>Mean age: 71.5<br>Setting: Rural setting – memory clinic in western Canadian Prairie province of Saskatchewan | The TeSS is a valid and reliable scale. Scores on the TeSS indicate high satisfaction with telehealth among the participants from the rural medical clinic. |
| Mucic et al.2010 | Transcultural telepsychiatry and its impact on patient | Sample: 61<br>Mean age: Men (42), Women (44) | Patients reported high levels of satisfaction and willingness to use TM again and recommend it to others. TM via their mother tongue was preferred rather than interpreter- |

| Author | Title | Sample & Setting | Findings |
|---|---|---|---|
| | satisfaction | Setting: Urban setting - Little Prince Psychiatric Centre, Copenhagen, Denmark | assisted care. |
| Napoles et al.2010 | Clinician Ratings of Interpreter Mediated Visits in Underserved Primary Care Settings with Ad hoc, In-person Professional, and Video Conferencing Modes | Sample: 29 clinicians<br>Mean age: 51<br>Setting: hospital-based and three community-based clinics | Patients and clinicians rated the quality of video interpretation similarly to FTF interpretation, but cultural competency levels were better for FTF interpreting compared with video interpreting. |
| Parikh et al.2013 | Consumer Acceptability of Brief Videoconference based Neuropsychological Assessment in<br>Older Individuals with and without Cognitive Impairment | Sample: 40<br>Mean age: 70.8<br>Setting: Dallas, Texas metro area-community-based | TM was well accepted by participants, even those with cognitive impairment showed good acceptability of TM assessment. |
| Poon et al.2005 | Cognitive intervention for community-dwelling older persons with memory | Sample: 22<br>Mean age: - not stated | TM is a feasible and acceptable method of providing cognitive assessments to older people with mild cognitive |

| Author | Title | Sample & Setting | Findings |
|---|---|---|---|
| | problems: telemedicine versus face-to-face treatment | Setting: community centre | impairment. |
| Powers et al.2017 | Creation of an Interprofessional Teledementia Clinic for Rural Veterans: Preliminary Data | Sample: 95<br>Mean age: 77.8<br>Setting: Rural setting | TM technology is a feasible method to evaluate dementia and improve access to follow-up for rural residents. Participants were satisfied with TM. |
| Price et al.2012 | Interpreter perspectives of in-person, telephonic, and videoconferencing medical interpretation in clinical encounters | Sample: 52<br>Mean age: 50<br>Setting: Urban setting | Interpreters preferred video interpreting over telephonic interpreting particularly for clinical assessments involving educational or psychosocial components. |
| Schulz et al.2015 | Improvements in patient care: videoconferencing to improve access to interpreters during clinical consultations for refugee and immigrant patients | Sample: 47<br>Mean age: 31<br>Setting: Urban setting | Participants were satisfied with using an interpreter over video. Using an interpreter over video was well accepted by doctors and patients compared with telephone interpreting. |
| Shores et al.2004 | Identifying undiagnosed dementia in residential | Sample: 85 | Assessing dementia using TM is just as accurate as FTF methods and participants reported a high satisfaction with |

| Author | Title | Sample & Setting | Findings |
|---|---|---|---|
| | care veterans: comparing telemedicine to in-person clinical examination | Mean age: 78.7<br>Setting: Urban setting | TM. |
| Vestal et al.2006 | Efficacy of language assessment in Alzheimer's disease: comparing in-person examination and telemedicine | Sample: 10<br>Mean age: 73.9<br>Setting: Urban setting - North Little Rock Veterans Affairs Hospital, Dallas | Assessment of language skills in mild AD patients can be performed through TM to achieve results that are not significantly different to FTF assessment; Participants indicated a high degree of acceptance with the TM examination. |
| Wadsworth et al.2016 | Remote neuropsychological Assessment in Rural American Indians with and without Cognitive Impairment | Sample: 84<br>Mean age: 64.89<br>Setting: Rural setting - Talihina, Oklahoma | MMSE and other neuropsychological test scores were highly similar between assessment conditions FTF and TM with no significant differences; Remote neuropsychological assessments conducted by TM is feasible and reliable. |
| Weiner et al.2011 | Videoconference diagnosis and management of Choctaw Indian dementia patients | Sample: 85<br>Mean age: 69.67<br>Setting: Rural (Talihina) and urban (Dallas) | Diagnosis and treatment of cognitive disorders can be undertaken through TM for adults from remote areas if cultural barriers are overcome. TM is feasible and is well accepted by participants from the Choctaw Indian population. |

| Author | Title | Sample & Setting | Findings |
|---|---|---|---|
| | | settings | |
| Wofford et al.2013 | Providing a Spanish interpreter using lowcost videoconferencing in a community health centre: a pilot study using tablet computers | Sample: 25 patients, 18 clinicians, 5 interpreters<br>Mean age (patients): 42.3<br>Setting: Urban setting - community health care medicine clinic, USA | Patients and clinicians were satisfied with video interpretation (from a remote location) during a clinical consultation. |
| Wong et al.2012 | The Rowland Universal Dementia Assessment Scale (RUDAS) as a reliable screening tool for dementia when administered via videoconferencing in elderly post-acute hospital patients | Sample: 42<br>Mean age: 75<br>Setting: Urban setting | There was no significant difference between RUDAS scores using FTF methods compared with TM methods. Results show that the RUDAS can be reliably administered over TM methods. |

**Table 3. Summary of agreement and reliability results from included studies**

| | **MMSE** | | | | |
|---|---|---|---|---|---|
| **Study** | **Size** | **VC scores Mean (SD)** | **FTF scores Mean (SD)** | **Agreement** | **Reliability** |
| Grosch et.al 2015 | 8 | 28.00 (1.31) | 27.38 (2.39) | p=0.202 (Bradley-Blackwood) | ICC=0.42 (p=0.128) |
| Wadsworth et.al 2016 | 84 | 27.5 (2.7) | 27.7 (2.4) | p=0.166 (paired t-test) | ICC=0.92 (p<0.001) |
| McEachern et.al 2008 | 71 | 22.34 (3.24) | 22.70 (3.32) | p=0.223 (paired t-test) | Not measured |
| Cullum et.al 2014 | 202 | 27.6 (3.09) | 27.6 (3.10) | Not measured | ICC=0.905 |
| Cullum et.al 2006 | 33 | 26.3 (3.7) | 26.1 (3.3) | p=0.36 (Bradley-Blackwood) | Pearson correlation R=0.89*<br><br>ICC=0.88 |
| Loh et.al 2004 | 20 | 24.0 94.9) | 24.3 (4.9) | | R=0.90 |
| Loh et.al 2007 | 20 | 24.2 (3.7) | 23.3 (3.6) | Kappa coefficient=0.8 (p<0.0001) | ICC=0.89 |
| Martin Khan et.al 2012 | 205 | 24.1 (4.3) | 23.6 (5.1) | Difference in $P_0$ Was 1% (weighted kappa=0.51) | Not measured |
| Castanho et.al 2016 | 69 | - | - | Not measured | Pearson Correlation for TICSM-VC vs. MMSE r=0.885 (p<0.001) |
| | **RUDAS** | | | | |
| Martin-Khan et.al 2012 | 205 | 21.7 (4.8) | 22 (4.8) | Difference in $P_0$ Was 1% (weighted kappa=0.51) | Not measured |
| Wong et.al 2012 | 42 | 25 | 25 | Mean difference=0.04, (p=0.91) | Pearson Correlation R=0.79 (p<0.001) |
| | **GDS** | | | | |
| Loh et.al 2004 | 20 | 6.1 (3.2) | 5.8 (3.0) | Mean difference=0.3 (SD:2.1) | Pearson correlation R=0.78 |

| | | | | | |
|---|---|---|---|---|---|
| Loh et.al 2007 | 20 | 2.6 (2.1) | 2.6 (2.1) | Mean difference=0.2 (SD:0.92) | ICC=0.78 |