Clinical and cost-effectiveness of Telehealth for Indigenous and culturally and linguistically diverse (CALD) people: A scoping review

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Abstract

Background: Health inequalities for Indigenous people and culturally diverse patients or remote area dwellers are well established. Models of care such as telehealth might have the potential to reduce disparity of access to health services for Indigenous and culturally diverse ethnic groups.

Objectives: To examine the modalities and clinical and non-clinical effectiveness of telehealth services available to Indigenous peoples and those from culturally and linguistically diverse backgrounds (CALD).


Results: Of the initial 601 articles, 10 met the inclusion criteria (7 of clinical effectiveness and 3 of non-clinical effectiveness), with participants from the USA, Australia, New Zealand, and Canada, with sample sizes ranging from 19 to 1,665 participants (overall 327 Indigenous and 2,030 CALD patients). Telehealth was delivered via telephone or by videoconference- with or without data uploads- and follow-up ranging from 6 months to 5 years.

Discussion: The findings suggest that telehealth shows some promise in: diabetes, depression, neuro/cognitive assessment, and health program adherence/service utilisation/cost. However, our confidence in the accuracy of the results is undermined by the mixed quality of designs and outcome measurements, and the high risk of bias derived from not proper random selections and small sample sizes.

Conclusions: The available literature suggests acceptable clinical and non-clinical effectiveness of telehealth against usual care in Indigenous and/or CALD groups but methodological limitations diminish their value in informing practice. Therefore, we consider it is premature to use the findings of these primary studies to draw conclusive recommendations about clinical or other effectiveness of telehealth for the two target groups. Further randomised trials with adequate sampling frames and objective outcome assessments are warranted.

Running head: Telehealth effectiveness for culturally diverse
Keywords: Telehealth; telemedicine; cultural diversity; Indigenous peoples; review.

Introduction
The challenges for Indigenous peoples and culturally and linguistically diverse (CALD) patients in achieving equity in health care derive from the well-established barriers in accessing and navigating mainstream health services. These may include rural or remote location, limited language proficiency, concerns on culturally appropriate health services, lower health literacy, lack of insurance influencing affordability, and less frequent use of preventive services, for various reasons (Escarce JJ, Kapur K, & National Research Council (US) Panel on Hispanics in the United States, 2006; Javanparast, Naqvi, & Mwanri, 2020) Telehealth is the remote delivery of clinical and non-clinical services including health promotion (American Academy of Family Physicians, 1994) using technology at distance without physical clinician-patient contact. This has emerged as a supplementary model of care to overcome some of the distance and clinical staff availability barriers that perpetuate health disparities.

The strict social distancing periods imposed due to the COVID-19 pandemic generated a surge of telehealth use by many clinical services (Bate et al., 2021) and occupational groups. Multiple reviews have investigated the clinical and cost-effectiveness of telehealth in industrialised nations and English-speaking countries, including during the global COVID-19 pandemic, (Anthony Jnr, 2021; de la Torre-Díez, López-Coronado, Vaca, Aguado, & de Castro, 2015; Monaghesh & Hajizadeh, 2020) but it is uncertain whether it will remain part of usual care in some parts of the world. (Fisk, Livingstone, & Pit, 2020) Reports of changes in the patient-clinician dynamics, associated with telemedicine use, indicate general satisfaction with the convenience and access to care, although satisfaction is variably measured or documented. (Orlando, Beard, & Kumar, 2019) In contrast, others feared telehealth would be detrimental for the patient-provider relationship, or that financial incentives to use it could have a potential to undermine quality of care (Tsirtsakis A, 2020) by encouraging over-servicing. Additional concerns including technological, cognitive and sensory barriers, especially in older populations.

Strong lobbying by mainstream bodies to embed telehealth as a permanent part of the service has been observed in recent months, particularly for those with mobility problems and patients living in rural or
remote areas. (Hall Dykgraaf et al., 2021; Maese, Seminara, Shah, & Szerszen, 2020; North S, 2021) Many Indigenous people prefer receiving health care at the place they were born or the community they live in (Harfield et al., 2018) In remote areas, these challenges are compounded due to limited services and infrastructure and travel to mainstream specialist services (St Clair, Murtagh, Kelly, Ford, & Wallace, 2018) can dislocate Indigenous peoples from family and traditional lands negatively impacting health and wellbeing. (Nolan-Isles et al., 2021). For other groups like migrants from CALD backgrounds we do not know enough about the health benefits of telehealth. While reports from primary studies have been released on mixed overall benefits of telehealth in general populations, (Flumignan et al., 2019; McLean et al., 2012) we are unaware of a systematic synthesis on the direct impact of telehealth, across services, on the health outcomes of Indigenous people and CALD communities. These groups suffer disproportionally higher burden of disease, socioeconomic disadvantage and inequitable access to healthcare, regardless of whether they live in geographically remote or urban areas. (Cyr, Etchin, Guthrie, & Benneyan, 2019)

This scoping review aims to fill that gap by gathering objective evidence and summarise findings (Arksey & O'Malley, 2005) of the nature, extent, and outcomes of research investigating the clinical and non-clinical effectiveness and cost-benefit of telehealth for Indigenous and CALD patient groups and equivalent people in the community services, for the past two decades. We are aware of the heterogeneity of cultural groups within CALD communities (Pham et al., 2021) and the vast diversity of Indigenous Peoples both within countries and across the world and the unique historical social exclusion and transgenerational family dislocation experienced by Indigenous Peoples which can be attributed to the long lasting effects of colonisation. (Walls & Whitbeck, 2012) However, we chose to undertake the research to include Indigenous and culturally diverse ethnic groups as they share some of the cultural safety concerns, impact of restricted access to mainstream health services due to language, literacy or spiritual beliefs, and the burden of avoidance of services due to staff lack of cultural competency. (Jongen, McCallum, & Bainbridge, 2018) Our goal was to flag areas for improvement and to identify the appropriateness of embedding telehealth in routine care for these populations. We aimed to answer the following research questions:
(1) What study designs have examined the effectiveness of telehealth services for Indigenous patients/people and/or patients/people from CALD backgrounds, and for what health conditions?

(2) What telehealth modalities for provision of care or health education, available in urban and/or rural settings to Indigenous people or CALD groups, have been evaluated for clinical effectiveness, and non-clinical or cost effectiveness?

Methods
This manuscript reports on the primary outcomes (effectiveness) of the scoping review with protocol released in Open Access Framework (https://osf.io/ktd27/). Findings from all other secondary outcomes regarding the feasibility and acceptability of these modalities for Indigenous people and/or CALD groups -part of our larger project- will be reported separately in narrative form in another manuscript currently underway. Details are in our protocol (https://osf.io/ktd27/). For the purpose of this research, we use the words race/racial as per the included publications, although no definitions were provided, and differentials refer to the target ethnic/racial groups against the comparator (different racial group or different location). Consistent with the World Health Organisation, telehealth was defined as “The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities” (World Health Organization, 2010)

Data sources and search strategy
We searched for English language peer-reviewed published articles from Medline, CINAHL, PsycInfo, and manual searches from reference lists of captured literature reviews from January 2000 to January 2021, using a set of terms covering several expressions for telehealth and Indigenous/CALD populations, as shown in the detailed search strategy (Supplement 1, Table S1.1).
Inclusion criteria

The target population was patients of any age who identified as Indigenous and/or from culturally or linguistically diverse backgrounds. Eligible interventions included the use of telephone, videoconferencing, internet, mobile applications, web-based, internet program, or other technology for virtual care (consultation, diagnosis, prognosis, treatment, patient education, referral, follow-up care) by generalist or specialist health professionals or formally trained community or Indigenous health workers. The comparator was face-to-face consultation or usual care in parallel or before telehealth implementation, as described by the eligible articles, noting that some usual care might include a telephone follow-up component. The context/setting of the telehealth delivery could be any community setting, general practice, residential aged care facility, or a service run from a hospital or community centre with telecommunication facilities where patients would have travelled to receive the service. Comparisons of one telehealth modality versus another were ineligible.

Primary outcomes included

- Clinical effectiveness reporting demonstrable benefit of any telehealth for any clinical purpose (screening, assessment, referral, prescribing, rehabilitation, support or therapy, and health education), examples including reductions in depression scores, improvements in diabetes laboratory parameters.
- Non-clinical effectiveness, such as cost-effectiveness (reduction in hospital or ED visits, reduction in face-to-face appointments, cost per QUALY, cost of service).

Eligible study types

We considered published quantitative peer-reviewed articles of empirical investigations of telehealth, which involved Indigenous people and/or CALD populations, for inclusion if (a) the design had a control group including the same cohort before the intervention (before and after), or constituted a
randomised controlled trial, and (b) the study included at least one of the primary outcome measures. We excluded single case studies, studies with small sample sizes (≤10), modelling studies, editorials, letters to editor, studies without numeric estimates, and conference abstracts without sufficient information on primary outcomes. Studies examining use of telehealth for education of staff were beyond the scope of this review. Systematic or narrative reviews were not eligible, but manual searches from their reference lists were undertaken to identify relevant primary studies. Preprints (non-peer-reviewed) and articles in the grey literature (reports, websites) were beyond the scope of this study.

Screening and data extraction
Screening of titles and abstracts was conducted independently by paired co-investigators (SF, JM, CH, AD, MC) using EndNote software. Discrepancies were resolved by discussion within the dyads and by inclusion of a third assessor (MC) when required. Full text screening was also conducted by paired independent assessors after importing the PDFs into EndNote X9. Included studies were documented using a purpose-built template covering: author name, publication date and study type, and patient population. Data extracted for each article included – country, setting, description of intervention type/duration, outcome measures, outcome results, and intervention description. We did not undertake backward or forward citation analysis.

Data synthesis and results reporting
We followed the PRISMA-ScR reporting guideline (PRISMA, 2015) and the Template for Intervention Description and Replication (TIDieR) framework (Hoffmann et al., 2014) describing who delivered the intervention, purpose, contents, follow-up duration, and comparator. We reported effectiveness studies quantitatively, comparing intervention and control estimates without an attempt to meta-analyse or undertake sensitivity analyses, due to anticipated heterogeneity of methods and outcomes. Subgroup analysis was only intended descriptively if there were at least two studies covering the same Indigenous/CALD group and condition.
Risk of bias assessment

Critical quality appraisal followed the Cochrane Risk of Bias Tool 1, as outlined in the Handbook (Higgins JPT et al., 2020) and following these prompts: Random sequence generation, Allocation concealment, Blinding of outcome assessment, Selective outcome reporting. Other bias: conflict of interest or industry funding source. Sources of bias were graded as low, high, or unclear, with each judgment justified using a quote from the published article.

Results

Study and participant characteristics

Overall, 601 studies were captured in the initial search, of which we assessed 57 for full text eligibility. Main reasons for exclusion were non-inclusion of our target population and ineligible study designs such as feasibility pilots, surveys or qualitative consultations (Figure 1 and Supplement 1, Table S1.2).

INSERT <Figure 1. PRISMA diagram illustrating screening and selection process> HERE

In total 10 studies published between 2006 and 2019, met our inclusion criteria (despite our search covering the period 2000-2021): seven of clinical effectiveness (four randomised controlled trials (RCT), (Riegel, Carlson, Glaser, & Romero, 2006; Weinstock et al., 2011; Williams, Cairns, Simmons, & Rush, 2017; Yeung, Hails, Chang, Trinh, & Fava, 2011) one controlled cohort,(Sicotte, Moqadem, Vasilevsky, Desrochers, & St-Gelais, 2011) and two cross-over trials)(Russell et al., 2019; Wadsworth et al., 2016) and three reporting non-clinical effectiveness (one RCT, one cohort and one cross-over)(Hall, 2018; Shore, Brooks, Savin, Manson, & Libby, 2007; Triff et al., 2013) (Figure 1). The studies covered a total of 2,357 middle age and older adult participants from USA, Australia, New Zealand, and Canada, with individual studies including 19-1,665 participants (overall 327 Indigenous and 2,030 CALD across all included studies). The clinical studies used telehealth for screening of
cognitive/neuropsychological conditions, (Russell et al., 2019; Wadsworth et al., 2016) the management of diabetes (Trief et al., 2013; Weinstock et al., 2011; Williams et al., 2017) or depression, (Yeung et al., 2011) or the assessment of subsequent health service utilisation for heart failure (Riegel et al., 2006) or tele-haemodialysis (Sicotte et al., 2011) (Tables 1 & 2). The non-clinical study outcomes evaluated behaviour change after an education program for prostate cancer, (Hall, 2018) compliance with a diabetes program, (Trief et al., 2013) or service costs. (Shore et al., 2007)

<Insert Tables 1 and 2 about here>

**Table 1. Study characteristics and participant profile of studies of Telehealth clinical effectiveness with a comparison group by clinical outcomes (N=4 Indigenous, N=3 CALD)**

**Table 2. Study characteristics and participant profile of studies of TH non-clinical effectiveness with a comparison group by outcomes (N=3).**

**Intervention characteristics**

All studies related to Indigenous populations and two of the articles relating to CALD populations included participants in rural or remote areas (Table 3). Five studies covered interventions targeting CALD participants (Hall, 2018; Riegel et al., 2006; Trief et al., 2013; Weinstock et al., 2011; Yeung et al., 2011), and five targeted Indigenous participants. (Russell et al., 2019; Shore et al., 2007; Sicotte et al., 2011; Wadsworth et al., 2016; Williams et al., 2017) Telephone interventions were exclusively used in two studies, (Riegel et al., 2006; Williams et al., 2017) with all others including videoconferencing either alone, or supplemented with electronic data uploads or phone calls. Patients were usually in the community, (Hall, 2018; Riegel et al., 2006; Sicotte et al., 2011; Trief et al., 2013; Weinstock et al., 2011; Williams et al., 2017) but one study was conducted with patients in an outreach clinic or residential aged-care facility, (Russell et al., 2019) and in another the patients attended a satellite Alzheimer’s disease clinic. (Wadsworth et al., 2016) Telehealth providers were mostly nurses, educators and researchers, with two studies delivering supervised offline by medical specialist and/or with multidisciplinary involvement, (Sicotte et al., 2011; Yeung et al., 2011), and one intervention designed
for self-administration. (Hall, 2018) Staff delivering the interventions were bilingual in the two US studies of Hispanic patients. (Riegel et al., 2006; Weinstock et al., 2011) and another of Chinese American patients; (Yeung et al., 2011) interventions were reported to use culturally sensitive instruments in the studies of Maori and Chinese patients. (Williams et al., 2017; Yeung et al., 2011)

Insert <Table 3. Intervention characteristics of eligible articles (10 articles for 9 eligible studies) for clinical and non-clinical outcomes> about here

Cognitive assessments for American Indians and Aboriginal and Torres Strait Islander Australians were once-off interventions; (Russell et al., 2019; Wadsworth et al., 2016) telephone-only interventions for Maori patients with diabetes, (Williams et al., 2017) Mexican patients with heart failure, and Chinese patients (Yeung et al., 2011) with depression lasted six months; tele-haemodialysis support for Canadian First Nations people had 12-month follow-up; (Sicotte et al., 2011) and diabetes monitoring for Hispanic patients and African American patients was available for five years. (Trief et al., 2013; Weinstock et al., 2011) When reported, the content of the assessment, treatment, education, and follow-up frequency of interventions, as well as the provider type were highly comparable between the face-to-face and telehealth modalities (Table 3), although the description of what constituted usual care/face-to-face was minimalist in the largest trial. (Trief et al., 2013; Weinstock et al., 2011) compared to the description of telehealth intervention. Detailed description of the intervention components, location, and providers are presented in Supplement 2, Table S2.1.

Clinical effectiveness outcomes
The overall performance of telehealth against usual care in achieving expected health outcomes for patients indicates mixed findings. For example, cognitive assessment and health service use appearing to be comparable regardless of service modality (Table 4). Generally there was no apparent superiority of outcomes for studies using multidisciplinary teams over those using researchers, nurses, educators to deliver the intervention. Likewise, both crossover trials and controlled cohort also demonstrated
effectiveness as RCTs did; and follow-up of 6, 12, or 48 months did not suggest changes in effectiveness by modality either.

Insert <**Table 4. Estimates of comparative effectiveness by outcome type (N=9 studies)**> here

We review this in further detail by target condition under investigation as follows:

**Diabetes**
A diabetes program for Maori and New Zealand Europeans participating in the green prescriptions program (an initiative including written advice to a patient/family to support healthier lifestyle) reported small improvements with both telehealth-based and face-to-face modalities, and no difference by modality or ethnicity.(Williams et al., 2017) Changes were small though statistically significant, but attrition rates overall were large and greater in the Maori group (overall 49% vs. 24% for Europeans at 6 months; and for Maori only 41% attrition for face-to-face and 56% for telehealth). The large US diabetes program with the longest follow-up(Weinstock et al., 2011) confirmed racial disparities at baseline and found similar improvements in self-efficacy and reductions in HbA1c levels at 12 months for both telehealth and in-person modalities, but they were not sustained at 5 years for African Americans or Anglo descendants, only for Hispanic patients who had the highest baseline HbA1c levels. Note was also made that those from non-Anglo/Caucasian groups were less likely to be involved in uploading laboratory results routinely to facilitate monitoring.

**Neuropsychological/cognitive**
A study of remote American Indian patients found that, in eight of the twelve test components, cognitive assessment by research assistants via telehealth was not statistically significantly different to the face-to-face assessment. The authors concluded that this rendered telehealth a reasonable alternative for people with and without cognitive impairment.(Wadsworth et al., 2016) Likewise, videoconference
administration of a culturally appropriate cognitive assessment reported high level of agreement in scores with the face-to-face assessment for Aboriginal Australians. (Russell et al., 2019)

**Depression**

In another randomised trial of culturally sensitive telehealth engagement program targeting depression for Chinese American migrants in primary care, on univariate analysis, depressive symptoms or quality of life appeared better using telehealth than through face-to-face care. However, the differences in achieving treatment response and remission were not statistically significant on adjusted analysis. Absence of bilingual clinicians- rather than the treatment modality- were factors described as contributing to the low response to treatment. (Yeung et al., 2011)

**Health service utilisation post Telehealth**

Self-care telephone education by bilingual nursing staff appeared to decrease heart failure re-admission rates and Hispanic in-patient healthcare costs at 1, 3, and 6 months, but outcomes with in-person education was not statistically significantly different. (Riegel et al., 2006) Likewise, in another study, the number of hospital transfers, amounts of haemodialysis per patient, and control of phosphate after tele-haemodialysis for Canadian First Nations patients did not differ from the corresponding parameters for those receiving in-person haemodialysis. (Sicotte et al., 2011) The absence of difference in these two small studies suggests that telehealth might be an adequate alternative for specific sub-populations.

**Non-clinical effectiveness outcomes**

Adjusted analysis of the largest diabetes education RCT demonstrated that, while adherence to self-management was significantly higher in the telehealth group than in the controls, Hispanic or African American patients were less adherent and spent fewer days than their Caucasian counterparts adhering to the self-care program at every time point over the entire 5-year period even though the activities were individualised and based on cultural norms. (Trief et al., 2013)
A small cohort study, investigating African American men, evaluated the impact of an e-health educational avatar video with health literacy and behavioural questions about prostate cancer, reported statistically significant improvements in self-reported scores for intention to discuss having a Prostate-specific Antigen test with their doctor and intention to spread knowledge of prostate cancer among their ethnic networks. However, the telehealth intervention did not achieve changes in men’s intention to having a physical or rectal examination. (Hall, 2018)

The small crossover trial of American Indians in rural areas found that the cost of telehealth via videoconference including data transmission was far less than the cost of the outreach service where clinicians consulted face-to-face in the rural area 600 miles away from their centre. (Shore et al., 2007)

*Study quality*

The risk of bias assessment conducted suggests that the quality of effectiveness investigations is less than optimal, with the main flaws being convenience samples in 7 out of 9, inability to conceal random allocation in all, and unclear blinding of outcome assessment (Figure 2). While attrition was reported as <20% in 7 out of 9 studies and selective reporting of outcomes was not an issue, outcomes were self-reported in three studies and sample sizes were under 85 in over half the studies (5 out of 9), all of which reduces confidence in the validity of the effectiveness measures.

INSERT <Figure 2. Risk of bias domains examined (N=10 studies/9 articles)> about here

*Discussion*

This comprehensive synthesis of published research investigated the clinical and non-clinical effectiveness of telehealth for both Indigenous and CALD patients. We emphasise the importance of this in a ‘new world’ where telehealth may become the norm for service delivery over the next few years, and note the risk of further disadvantage in service access and continuity of care for both Indigenous and CALD patients. However, the differential benefit for diverse populations needs separate investigation given the cultural consideration in the measurement of effectiveness.
Main findings

Our findings suggest that telehealth services might be as reliable as face-to-face approaches in specific situations: assessment of cognitive disorders screening amongst American Indians and Australian Aboriginal and Torres Strait Islander patients; (Russell et al., 2019; Wadsworth et al., 2016) management and remission of depressive symptoms in Chinese American migrants; (Yeung et al., 2011) self-management of heart failure to reduce hospital readmissions of Mexican Americans; (Riegel et al., 2006) tele-haemodialysis support among Canadian First Nations patients to prevent hospital transfer rates; (Sicotte et al., 2011) and lifestyle counselling and diabetes monitoring of Maori patients. (Williams et al., 2017) No differences in health service use or cost were found with the use of telehealth for heart failure among Mexicans in USA, or First Nation Canadians undergoing dialysis. (Riegel et al., 2006; Sicotte et al., 2011) Telehealth proved more cost-effective than in-person psychiatric assessments for rural American Indians. (Shore et al., 2007)

The studies of telehealth education using self-report as outcome measures found that diabetes education via telehealth improves glycaemic control and increases self-reported adherence to self-management when compared to face-to-face, but Hispanic and African American patients were less likely to engage with self-management activities at all stages of follow-up than Caucasian groups, despite the availability of bilingual staff and culturally relevant dietary recommendations. (Trief et al., 2013; Weinstock et al., 2011) Additionally, the e-health educational intervention on prostate cancer screening for African Americans- without the presence of a healthcare provider- described enhanced self-reported intention to discuss with clinicians and peers, but did not change intention to have related testing procedures. (Hall, 2018) None of these studies reported the consumer perspective.

While promising, the above findings about telehealth outcomes in Indigenous/CALD population groups, notably all from prior to the pandemic, must be viewed with caution due to the mixed quality and methodological flaws of the included studies. These included that not all were randomised, small
sample sizes, use of convenience samples and self-reported outcomes. Despite searching on three databases, the number of trials using appropriate study designs to investigate effectiveness for these population groups was limited, and interventions only covered four main areas: diabetes or depression management, neuro/cognitive assessment, and health program adherence/service utilisation.

**Comparison with other studies**

The heterogeneity of implementation strategies for telehealth is well known and makes it difficult to determine which component (provider, technology mode, design features, or recipient) is the key factor in effectiveness. (Morrison, Yardley, Powell, & Michie, 2012) While our two studies of cognitive screening showed equal performance of the two modalities (telehealth versus in-person), diagnostic accuracy may of course be influenced by the (cross-)cultural appropriateness of instruments used. For example, differentials in specific tests can stem from the influence of language, culture, age, educational level, and visual impairment, (Worrall, Yiu, Hickson, & Barnett, 1995) so results from Aboriginal and Torres Strait Islander Peoples in Australia need to be viewed with caution, as an instrument validated across cultural groups (Storey, Rowland, Basic, Conforti, & Dickson, 2004) was not used.

As part of our review process, we screened but excluded a number of other reviews and two economic modelling studies (see details in Supplement 2, Tables S2.3, S2.4, S2.5).

Importantly, while the COVID-19 pandemic restrictions led to a substantial increase in the use of telehealth for remote monitoring, follow-up, education and referrals and likely assisted in controlling further spread, (Monagheesh & Hajizadeh, 2020) more is known about throughputs than effectiveness or patient outcomes at this stage. A recent review reported multiple creative digital approaches to healthcare during the pandemic for general populations, and highlighted their lack of focus on assessing equity of access. (Strudwick et al., 2021) Our updated search in October 2021, did not find any additional effectiveness studies related to the use of telehealth during the pandemic amongst our target groups. A survey of remote Aboriginal clients in Northern Australia expressed reservations about
telehealth for mental illness management, (Amos, Middleton, & Gardiner, 2021) and a commentary paper by North American clinicians perceived prescribing benefits of telehealth for Indigenous communities alongside inability to incorporate cultural healing practices.(Wendt et al., 2021) Evaluations of the impact of virtual care on Indigenous and CALD groups during the pandemic may be underway but have not been published and fall beyond the scope of this study at present.

**Embedding telehealth in routine care**

Preliminary narrative findings from others on the multiplicity of virtual approaches suggest that overall telehealth achieved popularity during the pandemic, but broader or ongoing implementation requires infrastructure and elucidation of affordability and preference by both clinician and patient.(Shanbehzadeh, Kazemi-Arpanahi, Kalkhajeh, & Basati, 2021) Based on the available evidence in this review, efforts for future improvement in lifestyle management of diabetes either via telehealth or face-to-face should focus on retention strategies for Maori participants. In turn, the internet-based diabetes education programs for CALD diabetic patients should enhance education on the importance of uploading personalised results for comprehensive management. As cultural appropriateness was not an identified issue for CALD groups, tackling poor adherence to lifestyle intervention may need to be supplemented with motivational interviewing that identifies and addresses other barriers.

The findings that telehealth for rural residents was more cost-effective than outreach visits, and that telehealth performance was similar to face-to-face for neurophysiological assessment, depression, diabetes control and haemodialysis, suggest that embedding telehealth in routine care may be feasible and appropriate for these minority groups. This will be worth exploring with further high-level study designs in view of potential intermittent COVID-19 lockdowns.
Implications for practice and future research

Our review found promise in the findings that telehealth has the potential to improve alternative access to health services for our target cultural groups. However, most articles failed to describe the cultural appropriateness of interventions and none presented the user views on cultural safety. A strong consumer co-design element is needed, to ensure the cultural appropriateness and explore the validity of these service models further. Given the relatively small number of publications found, further evidence supporting its use or effectiveness across culturally diverse populations in the future could strengthen confidence in our recommendations. This highlights the need to incorporate evaluations alongside the introduction of these services and is particularly important during periods of COVID-19 social restrictions, and/or in areas of clinician shortage. An obvious next step is for healthcare services/providers to make a concerted effort to routinely examine effectiveness of this technology for Indigenous and culturally diverse groups using high-level evidence studies such as larger sample RCTs or cohort studies with a parallel control group.

Telehealth may be a helpful adjuvant in consulting with patients, and we cannot emphasise enough the need for healthcare provider sensitivity so that virtual care does not pose barriers to the rapport in the therapeutic relationship. Regardless of whether consultations are face-to-face or via telehealth, we could argue that in the current climate of intermittent social distancing, developing a culturally competent health service is a priority to avoid further disadvantage to ethnically diverse groups.

Strengths and limitations of this review

We systematically searched three databases (Medline, CINAHL and PsycInfo) for recently published articles, and supplemented the coverage by title/abstract screening of citations of potentially relevant systematic reviews. Paired authors independently screened all titles and abstracts. Full text eligibility and data extraction were conducted by one reviewer and cross-checked by another. Risk of bias was undertaken using a validated tool.
We deliberately excluded preprints or institutional/government reports which were non peer-reviewed during 2020-2021, a time of intense telehealth activity. A future update of this review could cover those draft investigation reports when they are formally published. Our review excluded non-English articles, and we cannot out-rule having missed some articles due to absence from searched databases, or – despite the comprehensive nature of our search terminology- failure to include relevant terms. The heterogeneity of designs precluded meta-analysis.

Conclusions

In a comprehensive review of the available literature, we found that telehealth has the potential to offer clinical and non-clinical benefit to patients from Indigenous and CALD backgrounds, at least in specific areas such as diabetes management, depression management, neuro/cognitive assessment, and health program adherence/service utilisation/cost. Studies generally used the technology in a culturally appropriate environment, with ethnic-specific providers or materials. However, our confidence in these results accurately reflecting success and/or reproducibility is undermined by the mixed quality of designs and outcome measurements, and the high risk of bias derived from non-random selections and small sample sizes. We consider it is too early to draw conclusive recommendations on the clinical or non-clinical effectiveness of telehealth in Indigenous or culturally diverse patient groups. Further randomised trials with adequate sampling frames and objective outcome assessments are warranted.

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Disclosure Statement

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References


Table 1. Study characteristics and participant profile of studies of Telehealth clinical effectiveness with a comparison group by clinical conditions and outcomes (n=4 Indigenous, n=3 CALD)

<table>
<thead>
<tr>
<th>Author, publication year, country</th>
<th>Study type &amp; sample size</th>
<th>C&amp;I/D</th>
<th>Target group and comparison group if applicable</th>
<th>Purpose of intervention &amp; condition</th>
<th>Modalities compared</th>
<th>Mean Age per group in years (SD &amp;/or 95%CI)</th>
<th>Main outcomes assessed</th>
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<tr>
<td>Cognitive/ mental</td>
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<tr>
<td>Russell, 2021</td>
<td>Prospective field cross-over trial, Total=33</td>
<td>TH: 17 received videoconference first</td>
<td>Medically stable Aboriginal &amp; Torres Strait Islander nursing home residents or outreach patients (rural only)</td>
<td>A cognitive assessment (KICA)* to screen for dementia - specific to Aboriginal Torres Strait Islanders</td>
<td>TH: KICA- Screen administered over videoconference via an iPAD</td>
<td>62.9 (9.8) (range 45–81)</td>
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</tr>
<tr>
<td>Wadsworth (USA), 2016</td>
<td>Cross-over trial, Total: 84</td>
<td>TH: 42 underwent TH testing first then face-to-face</td>
<td>Rural American Indians in Oklahoma – Choctaw, Cherokee, Creek, Chickasaw</td>
<td>To compare reliability of various types of neuropsychological assessment</td>
<td>TH: videoconferencing</td>
<td>Range 46-88 Mean 64.89 (9.73)</td>
<td>• Test scores across 12 forms of neuropsychological assessment**</td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weinstock, 2011</td>
<td>Randomised controlled trial, Total=1,665</td>
<td>Hispanic and African American</td>
<td>Comprehensive diabetes self-care</td>
<td>TH: a home telemedicine unit to videoconference with a</td>
<td></td>
<td>Whites: 71.28 (6.95)</td>
<td>• Diabetes control as per HbA1c level</td>
</tr>
<tr>
<td>Author, publication year, country</td>
<td>Study type &amp; sample size</td>
<td>Target group and comparison group if applicable</td>
<td>Purpose of intervention &amp; condition</td>
<td>Modalities compared</td>
<td>Mean Age per group in years (SD &amp;/or 95%CI)</td>
<td>Main outcomes assessed</td>
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</tr>
</tbody>
</table>
| **USA**                          | TH: 844  
Face-to-face: 821 | Diabetics living in medically underserved or Healthcare provider shortage areas [urban & rural] | management and follow up | diabetes educator and regularly uploaded lab results  
C: Usual face-to-face care via primary care guidelines | Hispanics: 70.33 (7.06)  
African Americans: 70.27 (5.88) | Body weight  
Waist circumference  
Systolic BP / Diastolic BP  
HbA1c  
Resting HR  
TC / TC/HDL / HDL / LDL / Trigs  
Physical activity  - Briskly/moderate walking  
Quality of care  
Care utilisation/No. transfers to the hospital  
Systolic/diastolic BP pre and post  
Serum Hb albumin pre and post  
Glycosylated Hb/glucose pre and post  
Kt/V, Phosphate & PTH pre and post  
Number of sessions per month  
Number of medication changes per month  
Heart failure rehospitalization  
All-cause hospitalisations  
Days in hospital (heart failure and all-cause)  
Multiple readmissions (>1 in 3 or 6 months) |
| **Williams, New Zealand 2017**   | Open-label randomised trial  
Total: 138  
68 Maori  
70 NZ Europeans | Explicitly Maori culturally sensitive approach but also NZ Europeans [urban & rural] | To compare the effect of face-to-face and telephone modes of delivery of the national diabetes green prescription lifestyle programme on participation and health outcomes | TH: telephone 6 months  
Maori and NZE  
C: face to face 6 months Maori and NZE | Maori Women: 53 (10)  
Men: 56 (12)  
NZE Women: 57 (13)  
Men: 62 (13)  
Mean 55  
12 women  
7 men | - Body weight  
- Waist circumference  
- Systolic BP / Diastolic BP  
- HbA1c  
- Resting HR  
- TC / TC/HDL / HDL / LDL / Trigs  
- Physical activity  - Briskly/moderate walking  
- Quality of care  
- Care utilisation/No. transfers to the hospital  
- Systolic/diastolic BP pre and post  
- Serum Hb albumin pre and post  
- Glycosylated Hb/glucose pre and post  
- Kt/V, Phosphate & PTH pre and post  
- Number of sessions per month  
- Number of medication changes per month  
- Heart failure rehospitalization  
- All-cause hospitalisations  
- Days in hospital (heart failure and all-cause)  
- Multiple readmissions (>1 in 3 or 6 months) |
| **Sicotte, Canada 2011**         | Cohort with own historical control | T: American Indian residents of either Cibougamau or Chisasibi, 18yrs + and receiving conventional dialysis [rural only] | To compare the health and care utilisation of patients receiving telehaemodialysis services in two communities where patients previously received conventional haemodialysis | T: telehaemodialysis for at least 9 and up to 12 months  
C: Face-to-face pre intervention cohort Receiving conventional dialysis for at least 9 months | - Body weight  
- Waist circumference  
- Systolic BP / Diastolic BP  
- HbA1c  
- Resting HR  
- TC / TC/HDL / HDL / LDL / Trigs  
- Physical activity  - Briskly/moderate walking  
- Quality of care  
- Care utilisation/No. transfers to the hospital  
- Systolic/diastolic BP pre and post  
- Serum Hb albumin pre and post  
- Glycosylated Hb/glucose pre and post  
- Kt/V, Phosphate & PTH pre and post  
- Number of sessions per month  
- Number of medication changes per month  
- Heart failure rehospitalization  
- All-cause hospitalisations  
- Days in hospital (heart failure and all-cause)  
- Multiple readmissions (>1 in 3 or 6 months) |
| **Other chronic condition**      | Randomised control trial  
Total: 134  
TH: 69 | Community-dwelling Hispanic patients hospitalized with heart | To assess effectiveness of telephone case monitoring, education & guidance on heart failure & all-cause rehospitalisation rates | TH: telephone case management supported by educational software program, calls 5 days post-discharge then | Mean 72.1 (11.0) | - Body weight  
- Waist circumference  
- Systolic BP / Diastolic BP  
- HbA1c  
- Resting HR  
- TC / TC/HDL / HDL / LDL / Trigs  
- Physical activity  - Briskly/moderate walking  
- Quality of care  
- Care utilisation/No. transfers to the hospital  
- Systolic/diastolic BP pre and post  
- Serum Hb albumin pre and post  
- Glycosylated Hb/glucose pre and post  
- Kt/V, Phosphate & PTH pre and post  
- Number of sessions per month  
- Number of medication changes per month  
- Heart failure rehospitalization  
- All-cause hospitalisations  
- Days in hospital (heart failure and all-cause)  
- Multiple readmissions (>1 in 3 or 6 months) |
<table>
<thead>
<tr>
<th>Author, publication year, country</th>
<th>Study type &amp; sample size</th>
<th>C.A.I. for Indigenous</th>
<th>Target group and comparison group if applicable</th>
<th>Purpose of intervention &amp; condition</th>
<th>Modalities compared</th>
<th>Mean Age per group in years (SD &amp;/or 95%CI)</th>
<th>Main outcomes assessed</th>
</tr>
</thead>
</table>
| Yeung, 2011, USA                     | Randomised controlled trial | Face-to-face: 65 | Chinese Americans with depression in primary care settings [urban only] | Recognition and treatment of depression | guided by software algorithm | Mean 50 (14.5) | • Acute care costs (heart failure and all-cause)  
• All-cause mortality |
|                                   | Total = 190  
Face-to-face = 97 | C: Face-to-face: non-standardised informal patient education prior to hospital discharge  
TH: telepsychiatry-based Culturally Sensitive Collaborative Treatment  
C: Face-to-face Usual Care from primary care providers |                                    |                                    |                              |                                    | **Odds of achieving response and remission  
Score in 17-item Hamilton Depression Rating Scale |

**TH: Telehealth; *KICA: Kimberley Indigenous Cognitive Assessment; BP: blood pressure.**  
**12 assessments covered Mini-Mental State Examination, Hopkins Verbal Learn Test-Revised, Boston Naming Test, and 9 memory, language fluency, time track and maths assessments.
Table 2. Study characteristics and participant profile of studies of TH non-clinical effectiveness with a comparison group by outcomes (N=3)

<table>
<thead>
<tr>
<th>Author, publication year, country</th>
<th>Study type &amp; sample size</th>
<th>Target group and comparison if applicable</th>
<th>Purpose of intervention &amp; condition</th>
<th>Modalities compared</th>
<th>Mean Age per group in years (SD &amp;/or 95% CI)</th>
<th>Main outcomes assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trief, 2013 USA</td>
<td>RCT</td>
<td>Hispanic and African American diabetics living in medically underserved or healthcare provider shortage areas (rural only)</td>
<td>To assess compliance with management in a comprehensive diabetic management and follow up program</td>
<td>TH: a home telemedicine unit to videoconference with a diabetes educator Face-to-face: usual face-to-face care</td>
<td>Mean 70.8 (6.63)</td>
<td>Self-reported adherence</td>
</tr>
<tr>
<td></td>
<td>Total=1,665 Face-to-face 821 TH: 844</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Number of days performing diabetes self-care activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Overall adherence to self-care activities</td>
</tr>
<tr>
<td>Hall, 2018 USA</td>
<td>Cohort with pre-post measures design Total = 41</td>
<td>African American males (urban only)</td>
<td>To evaluate impact of a culturally appropriate prostate cancer education package for African American males</td>
<td>TH: post-e-health avatar video + self-education Face-to-face: before self-education</td>
<td>Mean 43.7 (13.0)</td>
<td>Intention to get an annual physical exam</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Intention to discuss the possibility of getting a digital rectal exam to screen for prostate cancer with a doctor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Intention to discuss the possibility of getting a PSA exam to screen for prostate cancer with a doctor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Intention to spread awareness about prostate cancer among other African American men</td>
</tr>
<tr>
<td>Shore, 2007 USA</td>
<td>Cross-over of all participants N=53</td>
<td>American Indian and Alaska Native patients (urban and rural)</td>
<td>To compare cost of implementing telehealth instead of rural visits</td>
<td>TH: videoconference from University to home C: Face-to-face rural visit by clinical team</td>
<td>Mean 54 (range 46-71)</td>
<td>Cost of established usual care vs. cost of new telehealth virtual clinic</td>
</tr>
</tbody>
</table>

* Same study as Weinstock 2011 trial reporting different outcome
Table 3. Intervention characteristics of eligible articles (10 articles for 9 eligible studies) for clinical and non-clinical outcomes

<table>
<thead>
<tr>
<th>Authors and publication year &amp; country</th>
<th>Sample size</th>
<th>Target population</th>
<th>Main intervention area</th>
<th>Telehealth components /approach</th>
<th>Face-to-face Usual care components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Indegenous</td>
<td>CAID</td>
<td>Techology</td>
<td>Provider</td>
</tr>
<tr>
<td>Williams 2017 NZ</td>
<td>138</td>
<td>T,E,F</td>
<td>✓</td>
<td>Phone</td>
<td>1</td>
</tr>
<tr>
<td>Weinstock 2011 USA*</td>
<td>1,665</td>
<td>T,E,F</td>
<td>✓</td>
<td>Video+e-data</td>
<td>1</td>
</tr>
<tr>
<td>Wadsworth 2016 USA</td>
<td>84</td>
<td>D</td>
<td>✓</td>
<td>Video</td>
<td>1</td>
</tr>
<tr>
<td>Russell 2019 Australia</td>
<td>33</td>
<td>D</td>
<td>✓</td>
<td>Video</td>
<td>1</td>
</tr>
<tr>
<td>Riegel 2006 USA</td>
<td>134</td>
<td>T,E,F</td>
<td>✓</td>
<td>Phone</td>
<td>1</td>
</tr>
<tr>
<td>Sicotte 2011 Canada</td>
<td>19</td>
<td>T,F</td>
<td>✓</td>
<td>Video+e-data</td>
<td>1</td>
</tr>
<tr>
<td>Yeung 2011 USA</td>
<td>190</td>
<td>T,F</td>
<td>✓</td>
<td>Video+phone</td>
<td>1</td>
</tr>
<tr>
<td>Trief 2013 USA*</td>
<td>1,665</td>
<td>T,F</td>
<td>✓</td>
<td>Video+e-data</td>
<td>1</td>
</tr>
<tr>
<td>Hall 2018 USA</td>
<td>41</td>
<td>E</td>
<td>✓</td>
<td>Video+Web</td>
<td>1</td>
</tr>
<tr>
<td>Shore 2007 USA</td>
<td>53</td>
<td>D</td>
<td>✓</td>
<td>Video</td>
<td>1</td>
</tr>
</tbody>
</table>

* These 2 articles refer to the same study, but reported different outcomes

MDT = multidisciplinary team; PHCP = primary healthcare provider.
Table 4. Estimates of comparative effectiveness by outcome type (N=9 studies)

<table>
<thead>
<tr>
<th>Author, date</th>
<th>Total Number CALD/Indigenous</th>
<th>No. Usual care</th>
<th>No. Telehealth</th>
<th>Indicator description</th>
<th>Usual care Estimate</th>
<th>Telehealth Estimate</th>
<th>Difference or p value *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Williams 2017</td>
<td>88/138</td>
<td>48</td>
<td>40</td>
<td>Body weight @ 6 months</td>
<td>106.2±24.4</td>
<td>103.9±25.4</td>
<td>0.67</td>
</tr>
<tr>
<td>Williams 2017</td>
<td>57/138</td>
<td>33</td>
<td>24</td>
<td>TC (mmol/L) @ 6 months</td>
<td>4.9±1.7</td>
<td>4.5±1.0</td>
<td>0.19</td>
</tr>
<tr>
<td>Williams 2017</td>
<td>64/138</td>
<td>34</td>
<td>30</td>
<td>HbA1c (mMol/mmol) @ 6 months or</td>
<td>60.8±18.9</td>
<td>64.5±21.0</td>
<td>0.39</td>
</tr>
<tr>
<td>Black 248</td>
<td></td>
<td></td>
<td></td>
<td>Adjusted mean HbA1C levels (%) and SE by racial/ethnic group @ 12 months</td>
<td>Black:7.17 (0.13)</td>
<td>Black:7.21 (0.11)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Weinstock, 2011 Hispanic 585</td>
<td>N/R</td>
<td>N/R</td>
<td></td>
<td></td>
<td>Hisp: 7.60 (0.08)</td>
<td>Hisp: 7.27 (0.08)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Black 248</td>
<td></td>
<td></td>
<td></td>
<td>Adjusted mean HbA1C levels (%) and SE by racial/ethnic group @ 5 years</td>
<td>Black:7.20 (0.16)</td>
<td>Black:6.95 (0.16)</td>
<td>0.026</td>
</tr>
<tr>
<td>Weinstock, 2011 Hispanic 585</td>
<td>N/R</td>
<td>N/R</td>
<td></td>
<td></td>
<td>Hisp: 7.82 (0.10)</td>
<td>Hisp: 7.32 (0.10)</td>
<td>0.032</td>
</tr>
<tr>
<td>Wadsworth, 2016</td>
<td>83</td>
<td>83</td>
<td>83</td>
<td>Mini mental state examination /score out of 30 (mean)</td>
<td>27.7 (2.4)</td>
<td>27.5 (2.7)</td>
<td>0.166</td>
</tr>
<tr>
<td>Wadsworth, 2016</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>Clock drawing test /score out of 6 (mean)</td>
<td>5.8 (0.6)</td>
<td>5.6 (0.9)</td>
<td>0.096</td>
</tr>
<tr>
<td>Wadsworth, 2016</td>
<td>84</td>
<td>84</td>
<td>84</td>
<td>Boston Naming test score</td>
<td>12.9 (2.2)</td>
<td>12.5 (2.6)</td>
<td>0.002</td>
</tr>
<tr>
<td>Wadsworth, 2016</td>
<td>84</td>
<td>84</td>
<td>84</td>
<td>Verbal learn test retention % (SD)</td>
<td>70.0 (35.1)</td>
<td>77.0 (29.9)</td>
<td>0.005</td>
</tr>
<tr>
<td>Russell, 2019</td>
<td>33</td>
<td>16</td>
<td>17</td>
<td>Mean KICA /Score out of 25 (mean)</td>
<td>21.4 (SD 3.6)</td>
<td>21.7 (SD 3.4)</td>
<td>0.81</td>
</tr>
<tr>
<td>Yeung, 2011</td>
<td>190</td>
<td>93</td>
<td>97</td>
<td>Adjusted odds ratio of achieving response and remission [95% CI]</td>
<td>3.9 [1.9, 7.8]</td>
<td>4.4 [1.9, 9.9]</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Sicotte 2011</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>Phosphate mM/L</td>
<td>Chibo 1.9 (0.4)</td>
<td>Chibo 1.8 (0.5)</td>
<td>0.71</td>
</tr>
<tr>
<td>Author, date</td>
<td>Total Number CALD/Indigenous</td>
<td>No. Usual care</td>
<td>No. Telehealth</td>
<td>Indicator description</td>
<td>Usual care Estimate</td>
<td>Telehealth Estimate</td>
<td>Difference or p value *</td>
</tr>
<tr>
<td>-------------</td>
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<td>---------------</td>
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<td>---------------------</td>
<td>--------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Sicotte 2011</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>Kt/V $ \text{ (amount of dialysis per patient) }$</td>
<td>Chibo 1.5 (0.2)</td>
<td>Chisa 1.6 (0.1)</td>
<td>0.40</td>
</tr>
<tr>
<td>Riegel, 2006</td>
<td>134</td>
<td>65</td>
<td>69</td>
<td>Heart failure readmission rate @6 m (%)</td>
<td>33.8 %</td>
<td>31.9 %</td>
<td>0.85</td>
</tr>
<tr>
<td>Riegel, 2006</td>
<td>134</td>
<td>65</td>
<td>69</td>
<td>All-cause readmission rate @ 6 m (%)</td>
<td>56.9 %</td>
<td>58.0 %</td>
<td>1.0</td>
</tr>
<tr>
<td>Riegel, 2006</td>
<td>134</td>
<td>65</td>
<td>69</td>
<td>Health Status MLHF score @6 m</td>
<td>12.9 ±10.9</td>
<td>12.1 ±12.3</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Riegel, 2006</td>
<td>134</td>
<td>65</td>
<td>69</td>
<td>Quality of life EQ-5D visual scale @6 m</td>
<td>73.7±17.4</td>
<td>73.4±17.4</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Riegel, 2006</td>
<td>134</td>
<td>65</td>
<td>69</td>
<td>Depression by PHQ-9@6 m</td>
<td>2.0 ±2.1</td>
<td>15 ±2.0</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Non-clinical</td>
<td></td>
<td></td>
<td></td>
<td>Number hospital transfers post telehaemodialysis @12 m</td>
<td>1.2</td>
<td>1.5</td>
<td>p= 0.45</td>
</tr>
<tr>
<td>Sicotte 2011</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>Heart failure inpatient costs 6 m (mean USD)</td>
<td>$6,151 ±$16,650</td>
<td>$5,567 ±$13,137</td>
<td>p &gt;0.05</td>
</tr>
<tr>
<td>Riegel 2006</td>
<td>134</td>
<td>65</td>
<td>69</td>
<td>All-cause inpatient costs 6 m (mean USD)</td>
<td>$13,967 ±$22,932</td>
<td>$10,015 ±$16,104</td>
<td>p &gt;0.05</td>
</tr>
<tr>
<td>Riegel 2006</td>
<td>833</td>
<td></td>
<td></td>
<td>Overall adherence by minority groups vs. white participants</td>
<td>N/R</td>
<td>N/R</td>
<td>p &lt;0.001</td>
</tr>
<tr>
<td>Trief, 2013</td>
<td></td>
<td></td>
<td></td>
<td>Number of days performing diabetes self-care activities by minority groups vs. white participants</td>
<td>N/R</td>
<td>N/R</td>
<td>p &lt;0.001</td>
</tr>
<tr>
<td>Hall, 2018</td>
<td>41</td>
<td>41</td>
<td>41</td>
<td>Change score in Getting a physical exam at least once a year (mean score &amp; SD)</td>
<td>3.93 (1.35)</td>
<td>3.95 (1.30)</td>
<td>p = 0.868</td>
</tr>
<tr>
<td>Hall, 2018</td>
<td>41</td>
<td>37</td>
<td>37</td>
<td>Change score in Discussing with a doctor about receiving a digital rectal exam (mean score &amp; SD)</td>
<td>3.32 (1.53)</td>
<td>3.32 (1.42)</td>
<td>p = 1.00</td>
</tr>
<tr>
<td>Author, date</td>
<td>Total Number CALD/Indigenous</td>
<td>No. Usual care</td>
<td>No. Telehealth</td>
<td>Indicator description</td>
<td>Usual care Estimate</td>
<td>Telehealth Estimate</td>
<td>Difference or p value *</td>
</tr>
<tr>
<td>-------------</td>
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<td>---------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>---------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Hall, 2018</td>
<td>41</td>
<td>37</td>
<td>37</td>
<td>Change score in Discussing with a doctor about receiving a PSA test (mean score &amp; SD)</td>
<td>2.81 (1.41)</td>
<td>3.22 (1.27)</td>
<td>p = 0.041</td>
</tr>
<tr>
<td>Hall, 2018</td>
<td>41</td>
<td>41</td>
<td>41</td>
<td>Change score in Spreading awareness among other African American men about prostate cancer screening (mean score &amp; SD)</td>
<td>2.66 (1.33)</td>
<td>2.95 (1.16)</td>
<td>p = 0.032</td>
</tr>
<tr>
<td>Shore, 2007</td>
<td>60</td>
<td>53</td>
<td>53</td>
<td>Cost of clinic model run by psychiatrists</td>
<td>$31,465</td>
<td>$19,312</td>
<td>-</td>
</tr>
<tr>
<td>Shore, 2007</td>
<td>60</td>
<td>53</td>
<td>53</td>
<td>Cost of clinic model run by PhD psychologist</td>
<td>$14,501</td>
<td>$12,976</td>
<td>-</td>
</tr>
<tr>
<td>Shore, 2007</td>
<td>60</td>
<td>53</td>
<td>53</td>
<td>Cost of clinic model run by Master Psych</td>
<td>$11,676</td>
<td>$11,920</td>
<td>-</td>
</tr>
<tr>
<td>Shore, 2007</td>
<td>60</td>
<td>53</td>
<td>53</td>
<td>Cost of clinic model run by social worker</td>
<td>$11,440</td>
<td>$11,832</td>
<td>-</td>
</tr>
</tbody>
</table>

N/R: not reported
TH: Telehealth
KICA: Indigenous cognitive assessment

*p values >0.05 indicate that TH effectiveness was no different to face-to-face care effectiveness

$Kt/V$ represents a measurement of the 'amount of dialysis' delivered to a patient: it takes into account the efficiency of the dialyser, the treatment time and the total volume of urea in the patient’s body. $K$ is urea removal rate, $t$ duration of dialysis session, so $Kt$ amount of urea removed during a dialysis session. $V$ volume of distribution of urea which is equal to the patient’s total body water.