**Behavioural Interventions delivered to people in Rural areas via Telehealth:**

**A narrative systematic review of studies from the last 12 years**

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**Abstract**

People who live in rural areas have historically experienced a disparity when receiving behavioural health services. Specialty treatment providers are often located in cities and require people who need help to travel great distances. The recent advent of COVID 19 has highlighted this issue but has also pushed forward the necessity of developing alternative means of service delivery which can be beneficial for people in rural areas. One such alternative is telehealth, which utilises telecommunications technologies in place of traditional media. Clients could receive much needed treatment via synchronous telehealth using videoconferencing technology, asynchronous telehealth, which could be an effective consultation tool, patient monitoring with the help of fitness trackers or diaries and mobile health which makes use of applications on mobile devices. This review seeks to answer the following questions: A.) What behavioural interventions are currently being adapted to be delivered via telehealth to people in rural areas? B.) What types and methods of telehealth delivery is most used? C.) How effectively are these interventions being applied? D.) What elements make them effective? E.) What are the challenges of delivering ABA interventions via telehealth technologies to rural areas? F.) What solutions have the studies presented to overcome these challenges?

**Methodology**

Five databases were searched using multiple keywords optimised to find studies that are most relevant to the research questions. The studies needed to have been conducted in rural areas, implemented behavioural interventions, delivered via telehealth and should have been conducted in the last ten years.

**Results**

The behavioural interventions that the researchers trialled in the qualifying studies were Cognitive Behavioural Therapy and Behavioural strategies such as contingency management, shaping, prompting, and fading. The most common type of telehealth used was hybrid telehealth which is a combination of two or more types, followed by asynchronous telehealth and synchronous telehealth. An element that may have contributed to success was the level of therapist involvement in the treatment and the immediacy of feedback. The interventions were also found to be cost effective and highly acceptable by the participants. The researchers reported having encountered technical difficulties, limited availability and knowledge on equipment, internet inconsistencies, constant distractions due to uncontrolled settings and reduced participant adherence in the absence of therapist involvement. Some of the solutions suggested included providing a nearby centralised venue with good internet and equipment access, utilising more easily accessible technologies such as mobile phones, setting up a specific area in the home for treatment, and increasing therapist involvement in care.

**Conclusion**

Although only few studies met the inclusion criteria, this review was able to determine that behavioural interventions can be delivered effectively to people in rural areas and be highly acceptable by the target population despite existing limitations.

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## Literature Review

### The Right to Health

In 1946 the World Health Organisation (WHO) defined health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (p. 981). They believed that the provision of medical, psychological, and other related knowledge is essential to the attainment of this ideal of health. Furthermore, they suggested that health is one of the most basic of human rights and it should be available to all regardless of race, creed, political affiliation, or socioeconomic status. During the time of the drafting of this constitution, the world had just found its way out of the darkness of the second world war, and nothing was more important it seems, than establishing a universal definition of the term "health" and how it should be interpreted by all people moving forward. Two years later in 1948, the United Nations drafted the Universal Declaration of Human Rights. Article 25 of said declaration states that every person and their families have the right to an adequate standard of living which includes food, clothing, housing, medical care, and access to necessary social services (Streich, 2008). The inclusion of medical care and access to social services among the major basic needs of human existence such as food and shelter, emphasises the importance of these elements for a person's overall wellbeing. These longstanding declarations that are imbedded at the very foundation of these major global organisations agree, that everyone has a right to health, and everyone has a right to receive it equally.

Most countries have legislation promoting the right to health and healthcare and have in some shape or form, adopted these well-established doctrines into their own legal and healthcare systems. Backman et al., (2008) conducted a review of

legislation from 194 countries which concur with the previous statement. Some nations have adapted these international treaties in their national legislation while others like Aotearoa New Zealand, do not have specific legislation detailing the right to healthcare. In lieu of this, New Zealand and other countries like Australia, Canada, and the United Kingdom have ratified international Human Rights treaties which serves to affirm the right to health (Handa, 2021). Furthermore, there is legal basis for the right to healthcare described in the Treaty of Waitangi which is recognised as a foundation of good health in New Zealand (Brewer & Andrews, 2016). Most countries have considered healthcare and especially mental healthcare as a right of each citizen.

It cannot be understated how imperative the right to health and healthcare is to the wellbeing of every person, and although the report by Backman and colleagues suggested that countries abide by these agreements, many countries fail to uphold the standards they detail. Some do not even have governing bodies established to evaluate adherence to this specific right. This means that, although healthcare is a focal point in each country, it is not often delivered equally. When it comes to providing adequate services, several obstacles and challenges come to the fore. Developing countries do not always have enough financial stability to support healthcare systems, or the system of service provision is poorly designed as in the case of the United States of America which ranks last in almost every parameter when compared to other major developed nations (Schneider et al., 2021). There is also the matter of a country's size and the centralisation of services in metropolitan areas. Larger countries cannot help but have communities in the outer fringes that do not share the same benefits as those much closer to the seats of government, tourism, and industry.

Ideally, medical services and mental health services, should be provided and made available equally and uniformly throughout a nation. Unfortunately, this ideal has not currently been attained which is evident in the disparity in the provision of treatment between urban and rural areas that is prevalent globally (Guerrero et al., 2018; Howell & McFeeters, 2008; Morales et al., 2020). This is an issue even in Aotearoa New Zealand, a country of comparatively small size (Jaye et al., 2022).

According to the US Census Bureau, rural areas are those that cannot otherwise be defined as urban, and they define urban areas as a geographical location with a nucleus of 50,000 or more people. Rural areas are often composed of smaller communities that rely on agriculture, fisheries, or game to sustain themselves. They are usually occupied by people from low socio-economic backgrounds (Dercon, 2009; Ravallion et al., 2007) and are likely to have lower levels of education, factors that may have fostered disparity. Findings show that people who live in rural areas have consistently less access to health services than those who live in urban areas (Clawar et al., 2018). Several issues arise that may be linked to the disparity when it comes to receiving mental health services in rural areas. Firstly, to get help rural residents are required to travel long distances to get the same level of care as people in cities. The need to travel to receive treatment adversely impacts the frequency and regularity of check-ups and visits for non-acute conditions. This means that the further a person needs to travel to meet medical needs, the less regular their visits (Arcury et al., 2005). Furthermore, the Rural Health Information Hub, (2021) has determined the following factors as challenges that necessitates travelling and keeps people residing in rural areas from seeking and receiving treatment.

**Shortage of healthcare providers:**

There has been a steady decline in the number of qualified mental health providers globally. In the United States it is projected that there will be a shortage of psychiatrists of between 14,000 and 31,000 by 2024 (Satiani et al., 2018). Rural communities cover 61.7% of the areas that experience the most of this shortage (Rural Health Information Hub, 2021).

**Lack of necessary service infrastructure:**

Most major clinics and therapy centres are in big cities. As a result, people who live away from these areas are unable to receive treatment regularly unless they arrange for, often costly transportation. In most cases they are required to do so several times a month.

**Poor availability of reliable internet services:**

This limitation has been found to impact the health outcomes of affected people such as those living in rural areas (Quinton et al., 2019). The internet has become a means of communicating over great distances and catching up to the rest of the world in terms of technological advancement, knowledge and current events. The disruption in internet access more commonly experienced by people in rural areas than those in urban areas widens the disparity between the two (International Telecommunications Union, 2020).

Additionally, people living in rural areas have developed incorrect and antiquated ideas regarding healthcare that can adversely affect health seeking behaviour.

**Poor or inadequate health literacy in healthcare:**

Findings suggest that people living in urban areas have a higher level of health literacy compared to people in rural areas (Aljassim & Ostini, 2020). The study elaborates that rurality alone is not a significant determinant for health literacy, however, it suggests that the low socioeconomic status of people in rural areas coupled with outdated education systems likely contributes to the lower health literacy rate. This challenge is most prevalent in developing countries. People who do not have sufficient understanding of the concepts behind treatments, particularly mental health interventions, are less likely to seek help or are unfamiliar with available services.

**Hold antiquated beliefs about treatment:**

People living in rural areas may also harbour notions towards treatment or may cling to treatment methods that are obsolete and not as effective based on previous experience or hearsay. This is again an issue more common in developing countries but is prevalent even in the United States. There is a cultural stigma towards receiving treatment, especially when it relates to mental health (Crawford & Brown, 2002; Stewart et al., 2015). Furthermore, small rural communities are often close knit and information is often passed around at a rapid pace. This curtails an individual's privacy which can further discourage a person from seeking treatment.

These challenges extend beyond medical services and include allied health services, podiatry, nursing services, mental health, particularly Behavioural Services which are the primary focus of this review.

In recent years, likely due to the unfortunate confluence of several international concerns including the COVID 19 pandemic, climate change issues and

civil unrest, there has been a marked increase in mental health awareness and advocacy. Kuehn (2022) reports on the efforts of the WHO to encourage member countries in making reforms for addressing mental health and behavioural problems, the deadline for which had to be moved from 2020 to 2030 due to the slowness of the response. However, the current state of the world may have just spurred nations to become more aggressive and proactive in promoting mental wellbeing. This trend influences health seeking behaviour in people, and it is essential to meet these needs. Studies have shown that the prevalence of mental health issues are consistent and similar between rural and urban areas (Judd & Humphreys, 2001; Ziller et al., 2010). However, people in urban areas are more likely to receive quality treatment at lower cost as they are not as heavily impeded by the challenges discussed earlier. As it stands, without alternatives, people will have to continue to either travel great distances to receive traditional mental health and behavioural services or not receive treatment at all. To understand the trend of mental health in the 21st century, we must first have a brief look at a history of mental health services.

**Brief History and Current State of Mental Health Services.**

The task of detailing the entire history of mental health services far surpasses the scope of this study. Suffice it to say, the study of mental conditions and the provision of mental health services has a long and storied past. Mental health treatment has steadily changed and developed to cater to the changing needs of the people. From its beginnings as the collection of philosophies by ancient scholars like Plato and Aristotle, to its evolution as a science in the 1860s with the publishing of Gustav Theodor Fechner's work, Elements of Psychophysics, up until present (Wertheimer & Puente, 2020). During these times when the exploration and understanding of psychology was in its infancy, people with mental conditions were

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sent to "lunatic" asylums. These institutions were built in many countries like the facility in Karori Wellington, New Zealand, where physical restraints were used. At the time, the best treatment these institutions offered was exercise and physical labour (Bunton, 2011). At the turning of the century, perceptions, and sympathies towards the mentally distressed were beginning to change, and the asylums were soon renamed as mental hospitals. It was not until after the First World War when soldiers returned with serious Post Traumatic Stress Disorder (PTSD) in the form of shellshock, that the world truly began to acknowledge the fragility of the human psyche and what was required to treat it. This was a time of a great shift in sentiments towards the mentally aggrieved, and a time of many breakthroughs in the growing field of mental health treatment.

During the 19th century and leading into the 20th century, many innovations came about that continued to redefine mental health service. These innovations included the following:

- Sigmund Freud's Psychoanalytic model: A theory of the mind developed by Sigmund Freud which discusses the processes of the subconscious. He believed a human being was moderated by the presence of the Id, Ego, and the Superego wrestling for control. He suggested that people use defence mechanisms and stages of mental development. His theory attempted to explain mental illnesses, how they develop, how they can be prevented and how they could be treated (Barlow et al., 2018).

- Electroshock therapy: The induction of seizures by delivering 70 to 400 volts of electricity through a person's brain using an equipment with the end goal of resolving mental conditions (Breeding, 2016). Some form of this therapy persists to this day.

- Anti-psychotic medications: Medication designed to manage or treat symptoms of mental disorders. In 1952 the antipsychotic properties of the drug chlorpromazine were discovered, which paved the way for the further discovery and development of pharmacological interventions (Carpenter & Davis, 2012).

- Lobotomisation: This is a neurosurgical process that is no longer in practice due to its barbaric and harmful implications, and the large body of evidence asserting its lack of therapeutic effects (Faria, 2013; Terrier et al., 2019).

These practices, some now better understood as being unethical, were what one would expect to experience should they need treatment. It comes as no surprise then that stigma regarding mental health conditions and treatment developed and propagated.

It is also around this time that the revolutionary concepts of a new branch of psychology was taking root in the form of works by John B. Watson who pioneered the development of Watsonian Behaviourism and later Stimulus-response psychology, and the writings B.F. Skinner, who would go on to be known as the founder of Experimental Analysis of Behaviour and the father of Radical Behaviourism (Cooper et al., 2020). Their work, along with the work of other behaviourists who understood the necessity of merging the philosophy of psychology with the factual, systematic approach of science, grew behaviourism into the basis of some of the most evidence-based psychological treatments and services we have today. In recent years, what had once started as Watsonian Behaviourism has become a part of what is now known as Applied Behaviour Analysis (ABA), which is the main topic that will be discussed in this review.

**Applied Behaviour Analysis**

Furman and Lepper (2018) defined ABA as "the scientific study of behaviour change, using the principles of behaviour, to evoke or elicit a targeted behavioural change" (p. 104). Baer et al. (1968) described ABA as a "self-examining, self-evaluating, discovery-oriented research procedure for studying behaviour" (p. 91). The core concept of ABA maintains that behavioural change is caused by stimuli in the environment. Behaviourists recognise that to understand behaviour, one must understand the interactions between organism and stimuli in the environment. ABA is a field of psychological study that is mainly concerned with "solving socially important problems in socially important settings" (p. 91) and has yielded significant interventions in several fields including education, clinical psychology, developmental disabilities, and autism, among others (Slocum et al., 2014, p. 42). It is built upon the foundation of three domains that define the essence of ABA (Cooper et al., 2020) which are:

- Behaviourism: The philosophy of the science of behaviour.
- Basic research: The experimental analysis of behaviour.
- Applied research: The development of technologies and strategies to improve behaviour.

Guiding ABA research and practice are seven dimensions that determine if a study may be considered behavioural in nature. Research in ABA must be:

1. Applied: The research or intervention must be committed to making changes in behaviour that is beneficial to the person.

2. Behavioural: The research or intervention must abide by specific criteria when choosing which behaviour to influence. The target behaviour must be reliably

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measurable and the changes in target behaviour must be attributable to the intervention alone and not to changes in the behaviour of the observer.

3. Analytic: The research must clearly present functional relationships between the target behaviour and manipulated changes in the environment or events.

4. Technological: Readers of the research must be able to successfully replicate it following the steps detailed in the research.

5. Conceptually systematic: The procedures utilised in producing changes in behaviour and possible explanations for those changes must be described in terms of relevant principles.

6. Effective: The change in behaviour brought about by the research or the intervention must improve the target behaviour to a meaningful degree.

7. Generality: The change in behaviour, as a result of the research or interventions, must apply to different settings and contexts, must spread to other behaviours not otherwise targeted and last over time.

Traditionally, the method of delivering ABA interventions had been face-to-face in a clinical setting, usually in universities or special facilities. In his seminal work, John B. Watson (1994) a pioneer of the field of behaviourism, stated that ABA as a natural science must consist primarily of direct observations of a target behaviour. He stated that to get the most accurate and reliable information, the target behaviour must be observed first-hand by the clinician or researcher, preferably through multiple sessions over a research specific period of time, as well as by a number of additional observers. It holds true today that direct, face-to-face observation and in person delivery of interventions are considered the gold standard. Indirect measures such as interviews and tests are also utilised, but outcomes they measure should be well defined and corroborated so as not to leave doubt about their

accuracy and reliability (Johnston et al., 2020).Under the tenets mentioned earlier and

with an established gold-standard for practice, interventions and strategies produced

by ABA are often proven to be reliably effective and supported by evidence (Leaf et

al., 2022; Smith, 2013). Furthermore, not only does ABA hold scientific values

paramount, but it also aims to ensure that any change it produces is socially relevant

and is of benefit to the client and to society. The ongoing work by researchers and

practitioners in the field of Behaviour Analysis gave rise to significant developments

such as the work of Ivar Lovass for children with Autism Spectrum Disorders (ASD).

His work guided the development of the Early Intensive Behavioural Intervention

(EIBI) treatment for children with ASD (Özerk et al., 2016). As recently as 50 years

ago researchers began developing packaged behavioural interventions, a combination

of multiple behavioural strategies delivered in a programme, in pursuit of socially

significant behavioural impact. These packages include contingency management,

cognitive behavioural therapy (CBT), Pivotal Response Training, Picture Exchange

Communication System (PECS and many others (Sigafoos & Schlosser, 2008).

**Delivering ABA to Rural Communities**

ABA has steadily become readily available particularly for people who

experience no difficulties in receiving treatment. These services are more commonly

available in large institutions and specialty clinics. Unfortunately, these institutions

and clinics, where most professionals conduct their practice, are often found within

urban areas leading to the disparity mentioned previously. In a study to determine the

differences between services received by children with autism in rural and non-rural

areas, parents from both locations reported that behavioural services were most

needed by their children (Mello et al., 2016). However, parents from rural areas were

less likely to implement behavioural interventions at home due to the difficulty of

acquiring the service. Further, those in rural areas who do have access to behavioural services were more likely to rate ABA services as less effective compared to those who reside in urban areas. The low rating is likely due to the poor adaptation of services designed to be delivered in urban areas, when offered to clients in rural areas. Some interventions are simply offered in a form inconsistent with the challenges experienced by remote settings thus the service is not always optimal. This supports the need for a review of behavioural services and the means by which they could be better delivered to people who live outside of big cities. One such method of delivery which was designed to address geographical limitations is telehealth.

**What is telehealth?**

Telehealth is defined by the Institute of medicine (Lustig, 2012) as, "the use of medical information exchanged from one site to another via electronic communications to improve the patient's health status" (p. 133). It started as a method to overcome limitations brought about by distance to medical services, high cost of receiving face-to-face care, the inability to travel or inadequate transportation options (Gogia, 2020). It is also a means of providing specialised care across great geographic distances like between countries, to remote islands and even in space.

The origin of telehealth can be traced back to the invention of the telegram, which allowed for communication faster than mail which was the norm. When the telephone was invented, it made it even more convenient for people to get in touch with their medical service providers (Maeder et al., 2021). As telecommunications technology expanded, particularly with the advent of the internet in the early 1980s, so did the scope of Telehealth. Researchers, as early as 1996, began to theorise that the internet would be an integral part of mental healthcare services. Today, internet

access is practically a basic human need (Dow et al., 1996). Tools and technologies

with which to access the internet have also become more available and easier to use.

Devices such as personal computers, laptops, tablets, and smartphones are internet

ready as well as equipped with the latest videoconferencing applications that allow

physicians to assess and even treat a client remotely (Baumann & Scales, 2016).

Today, even people who live in the furthest reaches can receive the treatment they

need, provided they have access to the internet and own the necessary equipment.

Studies supporting the use of telehealth technologies within and across

countries are numerous. For example, Barkaia et al. (2017) found intercontinental

telehealth to be effective in training therapists to provide services for improving

communication skills of children with Autism Spectrum Disorder (ASD). They also

determined that telehealth intervention delivered between the USA and the country of

Georgia was feasible and effective. In another study, Sivaraman et al. (2020)

attempted to use telehealth to train six children on the Autism Spectrum from

different parts of the world to wear masks (Sivaraman et al., 2021). With

videoconferencing technology, the research team was able to successfully provide

behavioural interventions across four different countries (Belgium, India, Mexico, and

Costa Rica) from the United States as well as deliver training for participating

caregivers. These are only a few of the studies that provide evidence for the broad

reach of telehealth. While its reach beyond countries may be undeniable, its ability to

cater to rural areas demands further investigation.

**The four types of Telehealth**

Telehealth has continued to advance in time with developing

telecommunication technologies. To date, there are four types of telehealth currently

available, and each type could be used independently or more commonly, in tandem, to provide the best remote care to clients.

**Synchronous or Real-time Telehealth**

This form of telehealth mainly utilises telephones and videoconferencing to allow for clients to check with medical professionals. Real-time telehealth is often used for consultations, diagnosis, or treatment particularly when direct observation or interaction is required. In mental health, particularly in ABA practice, evidence suggests that there are significant advantages to using synchronous telehealth for a plethora of conditions including autism, depression and anxiety. Sutherland et al. (2018), conducted a meta-analysis of 14 articles that utilised various telehealth services delivered in real time and found that they are equally as effective as in person services and more beneficial for people who need to travel long distances to receive said services. Harris et al. (2022) discovered that the use of real-time telehealth or "virtual visits" were beneficial for adults with autism. Their study reported that virtual visits made it more comfortable for adults with autism to interact with their clinicians as it avoided unnecessary interactions with other people which is expected when coming into the actual medical centre or clinic. This also had the added benefit of reducing risk of illness. They reported that provider-client interaction is better during virtual visits than during face-to-face interactions.

Synchronous telehealth has also been used for training technicians, caregivers, and parents of children with mental conditions and neurological disabilities. Shanok et al. (2021), described using synchronous telehealth to train parents of children with autism in managing disruptive behaviours. They reported a significant decrease in disruptive behaviours after the participating parents were subjected to a training

programme delivered via telehealth. Meanwhile Singh et al. (2021) reported a significant decrease in self-injurious behaviours among the children with autism who participated in their study using synchronous telehealth technology. The study describes a collaboration between clinicians and a treatment team through telehealth in the real-time development and implementation of a behavioural support plan. These studies and more describe the efficacy of synchronous telehealth technologies.

**Asynchronous or Store and Forward Telehealth**

This type of telehealth involves the collection of medical information such as imaging and clinical observations and delivers it to a separate health service which may or may not be farther away. Asynchronous telehealth is often used in conjunction with other telehealth modalities to provide a complete health service (NZ Telehealth Forum and Resource Centre, n.d.). It is often utilised in radiology or dermatology where images are passed between services. They can also be helpful in mental health services particularly in the form of diaries, reports, observations, or other recorded data. In a systematic review Nguyen et al. (2021) found that healthcare provided with the help of asynchronous telehealth is on par with in-person care for some conditions, particularly chronic illnesses. The study also suggests that Store and forward telehealth systems can be more cost effective in the long run.

In ABA, where observation of target behaviours is essential, video recording is often a necessity especially when the target behaviour occurs only in specific settings. Unfortunately, even with careful planning, scheduling conflicts and other factors can hinder direct observation, most especially over the internet. For this issue, an asynchronous telehealth programme called Naturalistic Observation and Diagnostic Assessment (NODA) has been developed and is currently in service. This

technology enables parents or care providers to record behaviours and send them through secure electronic systems to clinicians for analysis and review. This service also provides a means of recording the client in different settings to account for generalisation of the target behaviour. Nazneen and a team of researchers (2015) studied the application of this programme and report that it is an effective way for parents and caregivers to gather relevant video data for diagnostic and treatment purposes. Smith et al. (2017) corroborates these findings with their own research which found a high level of interobserver agreement between diagnosis conducted in-person and via NODA recorded and transmitted videos. Asynchronous telehealth may help decrease the time it takes between the detection of initial symptoms of mental conditions, diagnosis and treatment which was an issue before these technologies became easily available.

Lastly, asynchronous telehealth takes the form of delayed feedback in the form of responses and comments on modules and assigned tasks. Therapists design specific intervention and training modules which are then completed by clients either within a specific timeframe or on their own time. These modules are then returned to the therapists who then analyse the data from the modules, provide feedback that will lead to the improvement of skills and finally evaluate the outcomes upon intervention completion. This method of telehealth delivery nearly eliminates the interaction between client and therapist which some clients prefer.

**Remote Patient Monitoring**

This type of telehealth also referred to as telemonitoring uses data gathering technologies that collect physiological or environmental information from a client for immediate or delayed analysis and response. These often use wearable technologies

such as smart watches or heart monitors that detect measures such as pulse rate, blood pressure, level of activity and even sleep patterns. It allows medical services to constantly determine the wellbeing of their client, particularly in conditions that require rapid response such as heart conditions, diabetes or for the elderly.

At first glance this type of telehealth does not seem suited to the direct observation gold-standard that is expected of ABA interventions. Indeed, a systematic review by DeHart et al. (2021), revealed that only few Behavioural Services providers practicing in rural settings had knowledge of or implemented patient monitoring telehealth. However, telemonitoring has been found effective when used in conjunction with other type of telehealth such as mobile telehealth or mHealth which will be discussed in the next section. Telemonitoring with mHealth, was effective in improving the self-management and regimen adherence behaviours of people with type 2 diabetes in a systematic review conducted by Agastiya et al. (2022). They determined that consistent data gathering and response, allowed people with Type 2 diabetes to develop positive self-management skills to improve their conditions. Additionally, in a Clinical Practice Statement, Freshwater et al. (2022) included regular monitoring of activities and sleep as likely contributors in developing behaviours to combat obesity. They report that routine monitoring by behavioural clinicians may enable the collaborative development of strategies to stimulate positive eating behaviours and decrease behaviours that lead to obesity. Lastly, researchers are trying to devise a way to use patient monitoring to gather data on smokers to map their behaviours to further determine how best to help them quit (Zhang et al., 2022). This and similar studies detail the possibilities presented by telemonitoring in enacting behavioural change on a larger scale.

**Mobile Telehealth or mHealth**

This type of telehealth makes use of smartphones and mobile devices that have become ubiquitous in the last ten years. Much like telemonitoring, mHealth uses available devices to gather data relevant to the users' needs such as biometrics, schedules, and activities. Some technologies also respond to user reports such as diaries and check-ins. A difference between mHealth and patient monitoring is that this data gathering is often entered into applications or software that is designed to immediately respond to user cues by sending alerts via calls or text messaging.

A systematic review conducted by Wang et al. (2022) analysed articles relating to mHealth technologies being used for improving Physical Activity and healthy diet behaviours in cancer survivors. The review analysed 23 studies and determined that interventions that made use of data derived from mHealth technologies reported positive behavioural changes and improved quality of life. Furthermore, the participants of these studies rated the technologies highly. Another example of this technology is mMotiv8, a smoking cessation app designed by Dallery et al. (2021) which they tested on 14 participating smokers. mMotiv8 prompted the participant to perform a breath test which detected Carbon Monoxide which is evidence of recent smoking, using a breathalyser attachment to the smartphone. The app also takes photographs of the participant to ensure that no other person performs the breath test. Smoking abstinence is rewarded with money which is saved into a reloadable bank card. The studies showed that mMotiv8 successfully gathered the target data and performed as intended. With its help, the researchers were able to note a decrease in smoking behaviours from the participants. Furthermore, the participants reported high levels of acceptability for the programme. This form of telehealth can

also be used in tandem with other types creating the 5th telehealth which is an amalgamation of any of the four other types.

**Prevalence of Telehealth and COVID 19**

Telehealth has been in use for more than 50 years and has slowly evolved to be easier to use and more accessible. In the last three years, there has been a surge in the use and development of telehealth technologies due to the viral pandemic known as COVID 19.

Towards the end of 2019, in the city of Wuhan China, reports started to emerge about a spate of illnesses with respiratory symptoms similar to pneumonia. By January, the virus was identified as a new strain of coronavirus and by February it was named COVID 19. This virus was first determined to have come from bats being sold in wet markets in Wuhan, China. The virus transferred to human hosts where it evolved with immediate effects. Now a virus targeting humans, it spread to many people through droplet and airborne channels which necessitated the use of masks and the implementation of social distancing protocols to prevent further proliferation. In March of 2020, COVID 19 was declared a pandemic by WHO which prompted nations to act (Cravalho et al., 2021). The Centre for Disease Control in the United States recommended restrictions for gatherings of more than 50 people (The New York Times, n.d.). New Zealand instituted an alert level system and went up to Level 4 which was a complete lockdown of the country (McGuinness Institute, n.d.) the rest of the world also initiated lockdowns at roughly the same time which essentially ground the world to a sudden halt. At that point in time, only essential workers like those working in healthcare as well as people who worked in supermarkets were able to move about, some places often requiring passes to get around. This meant that

nonessential trips and services were inaccessible. Supermarkets set up contactless collection of online purchases as well as shopping schedules, recreational activities like cinemas were completely shut down and specialty medical services were paused which included mental health services (Babalola et al., 2022; Officer et al., 2022; Sekharan, 2022).

All over the world COVID restrictions have compelled people to seek alternative means of meeting their healthcare needs. Telehealth became the immediate solution to this dilemma which prompted a shift in the way clinicians provide care (Crockett et al., 2020). The findings by Snoswell et al., (2022) and Thomas et al. (2022) show a significant increase in the use of telehealth technologies as a direct effect of COVID 19. In Australia, telehealth usage increased from .2% in February 2020 to 35% in April of the same year. Srinivasan et al. (2022) also reported that based on the findings of their study across 38 countries, telehealth use among clinicians in a developmental-behavioural paediatric practice had increased from 36% to 88% worldwide after the pandemic began, particularly in wealthy countries. In New Zealand specifically, studies show that 98.9% of 528 professionals participating in a study reported using telehealth and 32.2% reported using the technology exclusively to provide mental health services (Farrer et al., 2022). A study by Dowell et al. (2022) found that telehealth was helpful in spreading information about immunisation and other health programmes to the Māori population. It also helped in promoting learning of other healthcare technologies and enabled Māori leaders to come together when it would have otherwise been impossible due to COVID. Srinivasan and colleagues further reported that the type of telehealth technology used the most was videoconferencing and the second most was asynchronous telehealth.

**Telehealth and Available Services.**

It is essential to understand that telehealth itself is not a treatment, rather it is a medium through which services can be provided. Using a combination of video/phone assessment and training programmes or modules, telehealth has put care back into the lives of people who could access it. There is a substantial body of evidence and literature on Telehealth that describe its uses in different contexts and in tandem with a variety of different interventions.

**Telehealth and Behavioural Interventions**

With the arrival of scientific advancements, the gold-standard of direct observations for ABA interventions and research have become supplemented with technologies such as video and audio recording. Telehealth takes this a step further. Behavioural interventions such as shaping, contingency management and others have been adapted to be delivered via telehealth with the help of the internet. In 2022, Hong and colleagues developed and tested the implementation of a remote intensive group behavioural therapy for families of children with selective mutism who lived in rural areas. The therapy programme included addressing principles underlying the selective mutism behaviour and employing strategies such as contingency management, shaping, fading and positive reinforcement delivered in a group setting. They also implemented a training regimen for the caregivers of the participating children. Most of the intervention as well as the training was conducted using videoconferencing technology. The study described more than half of the respondents as "treatment responders" and reported an increase in the skills and knowledge among the caregivers. Furthermore, participating families gave the therapy programmes high satisfaction ratings across the board.

In another study, researchers used telehealth to deliver Functional Communication Training (FCT) to children with behavioural problems (Hall et al., 2020). FCT is procedure based on the concept of differential reinforcement in ABA where the likelihood of the occurrence of a target behaviour is either increased or decreased through the manipulation of reinforcement. In the case of this research where the target behaviour was self-injury, the researchers determined the possible purposes of the behaviour based on the underlying principles of ABA by conducting a functional assessment (i.e., ignore, attention, tangible, or escape). They then determined and reinforced an alternative behaviour that could serve the same purpose while ceasing reinforcement for the undesirable one. Synchronous videoconferencing technology (Zoom) was used in this study as well as store and forward parent or guardian reports of stress which were analysed by the researchers at a separate location. They found that FCT could be delivered via telehealth to successfully reduce or eliminate the target problem behaviours and reinforce alternative functional means of communication. The researchers were also able to measure a decrease in stress levels experienced by the parents related to the problem behaviours. This and more studies conducted especially in the last 3 years have been consistently showing that behavioural interventions could be delivered via telehealth with relatively high rates of success.

**Telehealth and Cognitive Behavioural Therapies (CBT)**

Developed by Aaron Beck in the 1960s, Cognitive behavioural therapy (CBT) is an integration of the concepts of cognitive and behavioural therapies (Chand et al., 2022). It is designed to approach the conceptualisation, assessment, and treatment of mental illness with a focus on more scientifically sound treatment methodology. The behavioural component of this intervention programme demands that it is supported

by evidence and is adherent to the standards of ABA (Craske, 2017). Meanwhile, the cognitive components involve determining and understanding thoughts and feelings in relation to the target mental condition (Thoma et al., 2015). This evidence-based behavioural intervention is intended to identify and reduce cognitive and behavioural patterns that may cause distress and limitations to an individual's daily life, through a series of concentrated and directed techniques delivered over a span of time specific to the target condition (Wenzel, 2017).

A large body of literature provides evidence for the efficacy of CBT as a treatment for a myriad of mental conditions. It can be delivered traditionally, face-to-face as in the study by Khalsa and colleagues in 2015 which combined CBT with yoga for clients with anxiety who were otherwise resistant to treatment, or in a clinical setting. CBT has also been adapted to be delivered through telehealth as tested by Jolstedt et al. in 2018, and Stefan et al. in 2019 who sought to determine the feasibility of telehealth delivered CBT in treating anxiety. Each study tested the interventions on different groups including children, and adults with generalised anxiety disorders. Both studies were conducted in rural areas and collected data that suggests the feasibility and efficacy of CBT delivered via telehealth particularly when treating anxiety.

CBT has also been found to be an effective intervention for depression as well as insomnia. In a two-pronged study, Li et al. (2021) evaluated the efficacy of CBT for insomnia and for depression to determine each intervention's effect on overall depression scores and insomnia. They found significant evidence to suggest that both forms of CBT were effective in lowering the target conditions and had reduced rates of remission as compared to a control group. Meanwhile, Patterson et al. (2021) tested the feasibility of delivering CBT through telehealth for African American

women with Human Immunodeficiency Virus living in the rural south of the USA. The researchers monitored client adherence to HIV treatment with the store and forward telehealth Wisepill, symptoms of depression as well as satisfaction ratings for the use of telehealth. They found the CBT intervention to be effective at increasing adherence to treatment regimes, decreasing symptoms of depression and it was highly acceptable according to patient reports and surveys.

CBT delivered via telehealth has also been found to be effective in treating phobias. Titov et al. (2008) tested the efficacy of an internet-based CBT programme for treating social phobias in 98 diagnosed individuals. The researchers wanted to see if the treatment could feasibly be delivered using telehealth and whether a self-guided or therapist guided approach would be best. They found the intervention to be effective in treating social phobias among the participants and determined that therapist guided internet CBT was more effective than the alternative, although the self-guided option was found to be efficacious as well. Following this line of research, Berger et al. (2011) also contrasted self-help CBT programmes delivered via telehealth with a therapist guided adaptation, as well as a third arm with gradually increasing communication from a therapist. Again, they found the telehealth delivered CBT intervention to be effective however they did not concur with the earlier research about the difference between the two kinds. In their findings they state that both self-help and therapist guided CBT delivered via telehealth were equally as effective.

Other research has been conducted on telehealth delivered CBT to tackle conditions such as insomnia (Cunningham & Shapiro, 2018; Tsai et al., 2022), alcoholism (Kelemen et al., 2022; Rose et al., 2012), and PTSD (Possemato, 2011). These studies employed strategies that make use of the internet not only to deliver the intervention but also to actively monitor their effects. The combination of CBT and

telehealth has been conducted in different settings including universities (Gericke et al., 2021) and in urban and rural communities, the latter being the focus of this thesis. These studies and more form the evidence that support the use of CBT delivered via telehealth.

**Telehealth and Caregiver Training**

Currently, there is a significant shortage of board-certified ABA professionals as well as behavioural technicians globally. Yingling et al. (2022) report that although there has been a significant increase in the number of professionals between 2018 to 2021, the number of children diagnosed with autism and other conditions still far exceeds the number of service providers and a level of disparity persists. This not only greatly affects the people with disabilities, but also their family members, parents, and caregivers, particularly if they are underprepared for the responsibilities or wholly reliant on their service providers. A possible solution to this problem is empowering parents and guardians to implement interventions on their own with some support from professional. Telehealth has been adapted to do exactly that, allowing professionals to conduct training via the internet. Yi and Dixon (2022) presented a study wherein they discuss how to develop an ABA training protocol for parents and caregivers. They also determined ways to increase adherence to the protocol using the Acceptance and Commitment Therapy (ACT) model. Finally, they studied the effectiveness of the protocol with a Randomised Control Trial (RCT) as well as collecting participant satisfaction ratings. They discovered that the protocol successfully increased the skills of the parents and that those that received the ACT therapy made more progress than those who did not. Furthermore, they reported that the participants rated the curriculum positively. Meanwhile Parsons et al. (2017) performed a systematic review of studies that provided intervention training to parents

of children with ASD. Each of the selected studies provided training which comprised of videoconferencing technologies as well as written and computer-based modules. The reviewed studies all presented evidence pointing towards the feasibility and efficacy of providing remote parent training, determined by the measures of improved social and communication skills among the children as well as parent skills or knowledge assessments. The researchers acknowledge that there is a notable difference in the characteristics and needs of people who live in urban and rural areas.

Telehealth has provided professionals with an opportunity to spread ABA skills and knowledge to a larger number of people over greater distances and at a reduced cost. as a result even those who are not aware of ABA may have some understanding of its concepts and apply them for their own benefit or for those to whom they provide care. This may not immediately supplement the shortage of service providers and address the bigger issue of access disparity but giving parents and caregivers the option to deliver interventions independently or with minimal supervision ensures that the person with disability receives some form of the help they need.

**Telehealth Limitations and Challenges**

With the mounting evidence on the efficacy of telehealth one can almost be forgiven for assuming it is a flawless and successful technology that will accomplish all it has been designed to do. But telehealth, much like other developing programmes and systems of care, comes with its own challenges and limitations that hinder its potential. Here is a brief overview of some limitations of using telehealth.

**Reduced Engagement**

Evidence suggests that attaining and maintaining the focus and participation of clients over videoconferencing is a limitation of telehealth. Harris et al. (2022) reported that adults with autism often became distracted by things such as the service provider's background, their own technology, or other more preferred activities in the home. Furthermore, as a side effect of the sudden increase in the use of videoconferencing technology such as Zoom, people have begun to experience exhaustion referred to as Zoom Fatigue. Zoom Fatigue is described as exhaustion brought about by factors relating to the constant use of videoconferencing technology mainly to conduct work meetings. It is often characterised by lack of participation, motivation, and negative feelings towards Zoom meetings. Shoshan and Wehrt (2022) discovered that feelings of loss, comparing current experience with how things were before the pandemic and technical issues were likely causes of this phenomenon while others suggest that the quality of the meetings also affect participants' level of exhaustion (Elbogen et al., 2022; Fauville et al, 2021). Researchers have developed a measuring scale for this issue called the Zoom Exhaustion and Fatigue Scale (ZEFS), a 15-item survey designed to measure the levels of exhaustion experienced by participants. People receiving mental health services via telehealth also experience these symptoms, especially if they had previously been receiving face-to-face care prior to the sudden change in the service medium. Those who live in rural areas are equally susceptible to Zoom Fatigue and reduced therapy engagement as they are more likely to experience technical challenges which will be discussed later.

Some of the suggestions to combat Zoom Fatigue include enhancing video meeting management and technical improvements which may prove to be most challenging. Professionals are advised to allow for breaks throughout the consultation

whilst maintaining focus, engaging with the client by encouraging their participation and by introducing activities.

**Technological Issues**

Another limitation that is consistently reported in studies using telehealth, particularly when it is delivered to rural areas or those with limited equipment are technological in nature. According to Harris and colleagues (2022), participants who were exposed to telehealth experienced technical problems such as poor video or audio quality, difficulty accessing websites and programmes that refused to start. Furthermore, the computer literacy required to follow some of the steps to even begin using the programmes could be challenging to people with disabilities, steps such as downloading the apps or even just optimising their equipment. This issue led to poor user reports for the study conducted by Chan et al. (2020) when the mostly advanced aged participants could not access the website to begin the intervention. Another component of this limitation is regarding the internet. The increase in the use of telehealth technologies was brought about by necessity and did not come with immediate changes in the form of improved services, infrastructure, or their availability, not to mention the challenges regarding internet access which is essential to receiving such services. Unstable or non-existent access to the internet make it tough for telehealth to be used as effectively. This issue is most severely felt by people in rural areas who, despite the advancement in broadband technologies, continue to experience a disparity in receiving internet compared to urban areas (Curtis et al., 2022; Gururpur & Miao, 2022). Also, a study by Quinton et al. (2019) suggests that internet access affected telehealth use for people living in a rural town in Tennessee, USA, which in turn affected their health outcomes.

This problem is one that is recognised and is being addressed worldwide. For example, the United States government have initiated policies to help remote areas gain access to the internet which has proven to be beneficial (Whitacre & Gallardo, 2021). Similar internet access improvement initiatives are in place in Aotearoa New Zealand (Ministry of Economic Development, 2009) and Australia (Alizadeh et al., 2020). This bodes well for the people living in rural areas in the long run, however, it will all be moot if the telehealth systems themselves are not better suited to cater to remote and rural locations. It is essential that telehealth technologies aimed at rural areas are found feasible, acceptable, and well adapted to the needs of the people, which is what this review seeks to investigate.

**Rationale**

This systematic review aims to provide useful information that may improve the delivery of behavioural interventions via telehealth to rural areas. The division between rural and urban areas are no longer merely geographical. The gap is now also demarcated by a disparity in the accessibility of specialty services including behavioural therapy. Telehealth was designed to bridge this gap but it cannot reach its true potential due to the limitations in technology, knowledge and strategies and interventions adapted for this specific target population. This review hopes to answer questions that would help future researchers develop solutions to the problems telehealth is facing, so that it can be the solution to its accessibility shortcomings. To that end this review was guided by the following research questions.

- What behavioural interventions are currently being adapted to be delivered via telehealth to people in rural areas?
- What type and method of telehealth delivery is most common?

- How effectively are these interventions being applied?

- What elements make them effective?

- What are the challenges of delivering ABA interventions via telehealth technologies to rural areas?

- What solutions have the studies presented to overcome these challenges?

## Methodology

### Literature Search

For the literature search the researcher followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (PRISMA, 2020). PRISMA is a protocol designed to guide researchers when conducting systematic reviews. It lays out step by step, detailed instructions that enables researchers to plan and therefore anticipate possible challenges for the review and allows for the evaluation and successful replication of a review based on the guideline. PRISMA also ensures that the systematic review is conducted consistently without any redundant steps as well as reduces the need for unplanned decision making during the study (Shamseer et al., 2015).

In order to answer the research questions, the following keywords were selected to find relevant studies: (Access OR Accessibility OR Accessible OR Increase OR increasing OR uptake OR influx OR Prevalence OR Availability OR Available) AND (Remote OR Rural OR Underserved OR "under-served" OR "Poor Communities" OR "Poor Areas" OR "lower socioeconomic" OR "lower income") AND (Online OR "Online-based" OR Internet OR "Internet-based" OR "Web-based" OR Telehealth OR telemedicine OR Telerehabilitation) AND ("behavioral Interventions" OR "behavioral Therapy" OR "behavioral Therapies" OR "behavioral

Treatment" OR "behavioral Interventions" OR "behavioral Therapy" OR "behavioral Therapies" OR "behavioral Treatment" OR "behavioral treatments"), which includes 48 words, with a variation for SCOPUS which uses the ({ }) symbol in lieu of the ("") symbol.

There were four segments in this search thread. The first segment included words pertaining to accessibility and possible trends relating to the study questions. The second segment referred to the setting where the ideal studies for the review would have been conducted, particularly in rural or remote areas. The third segment of the thread targeted articles identifying Telehealth or online-based method of intervention delivery. The fourth and final segment aimed at articles that utilised behavioural interventions.

On 26/07/2022 five electronic databases were searched including: SCOPUS, Web of Science, ProQuest, PubMed Central and EBSCO CINAHL Complete. Specific search parameters were also adjusted to ensure that the search came up with the most relevant articles.

- The first parameter checked was whether the articles are Peer Reviewed. Peer reviewed articles remain as the most trustworthy sources of data even in the digital age (Nicholas et al., 2015.) Selecting only peer reviewed articles will contribute to a level of reliability and validity of studies included in the review.

- The second parameter checked when searching the databases was a specific timeframe. In the case of this study the timeframe is between 2010 and 2022. The inclusion of this parameter coincides with advancements in internet technologies. Prior to the proliferation of the internet, Telehealth could mean the use of telephones for consultation and treatment. This parameter increased

the likelihood that the articles qualified would refer to the most up-to-date telehealth technologies from the last 12 years, including during the time of COVID-19.

**Inclusion Criteria**

Studies were gathered using the selected keywords and a duplication check was conducted to eliminate similar studies collected from different databases. Next, the articles were screened in four levels each with their own specific inclusion and exclusion criteria discussed in this segment.

- Level One. The title of the articles selected for this level of selection must have included the words "internet, "internet-based", "web-based", "online", "remote", "remote delivery", "telehealth", "tele-psychiatry", or "telerehabilitation" in the title. Articles whose titles do not have the words in the inclusion criteria or only have the following words, "telephone", "cell phone", "smartphone", "computer", "applications", "eHealth", "wearable technology", "virtual", "digital", or "video treatment", are not qualified. The rationale behind the inclusion criteria was to eliminate articles that did not directly explore the use of online or web-based technologies. The intention behind the exclusion criteria was to prioritise studies that utilised the internet specifically, as other technologies may focus on an alternative aspect of telehealth like in the case of apps or wearable technologies.

- Level Two. The inclusion criteria for the abstract analysis were article abstracts that included the words "behaviour", "behavioural therapy", "Cognitive-Behavioural Therapy" or "CBT". Exclusion criteria were abstracts that mentioned none of the words in the inclusion criteria or those that only included

the word "cognitive". The rationale for this inclusion criteria was to eliminate studies that make use of non-behavioural interventions. Most articles that included the word "behaviour" were often preceded by the word "cognitive" however cognitive treatments in and of themselves were not considered relevant to the current review.

- Level Three. This level of selection focused on another set of words that pertained to the research question. The inclusion criteria for selection of articles in the third screening had abstracts that explicitly discussed interventions in "remote/rural areas", "underserved areas" or "poor areas". This level of selection ensured that the studies being conducted did not only mention rural areas but were executed in those areas specifically.

- Level Four. The inclusion criteria for this level of screening were explicit discussion of themes and terms previously screened for in the earlier levels. It also served to assess the entire article and discover whether they were experimental or reviews, not otherwise specified in the title or the abstracts.
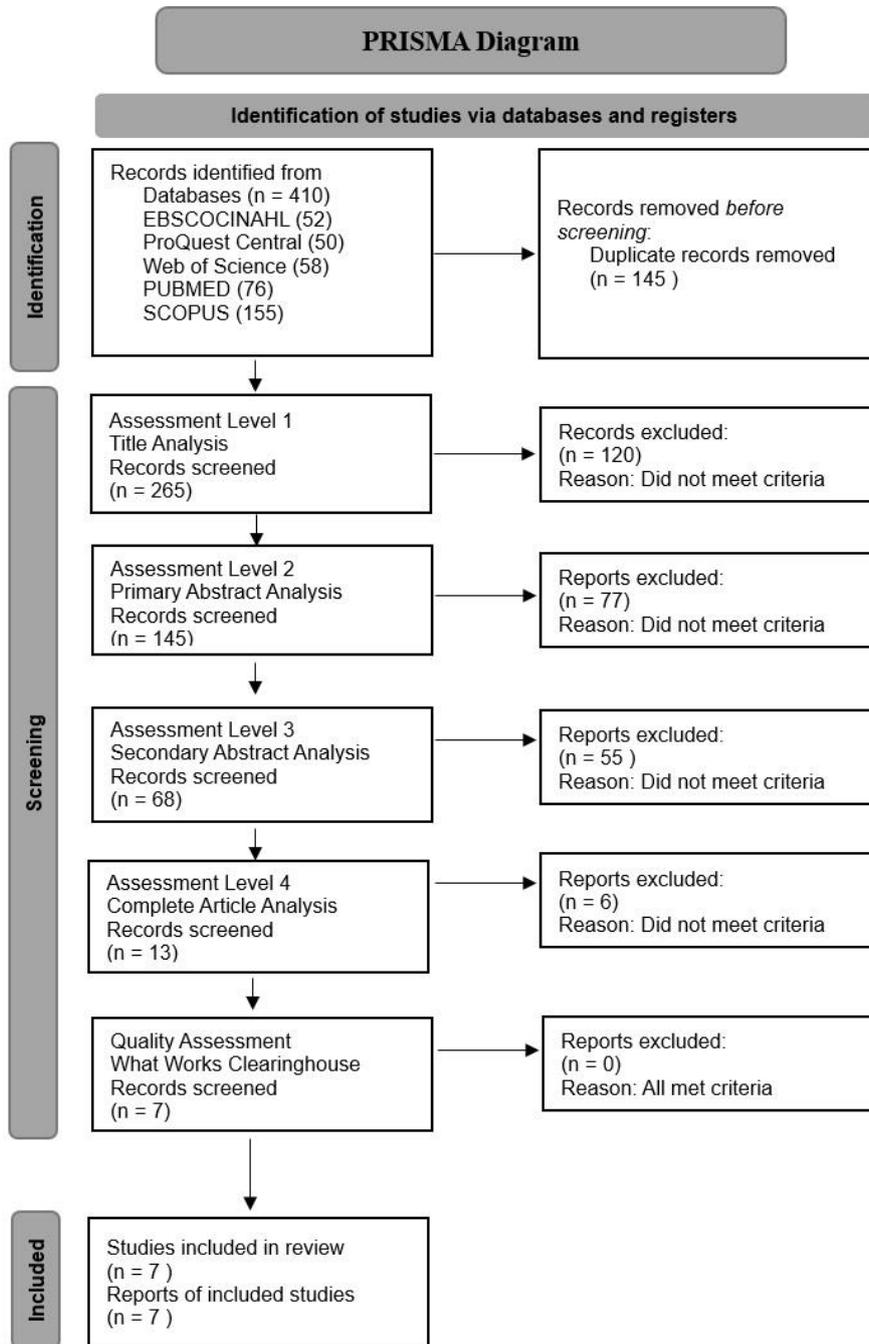
Inter-observer agreement was collected for 20% of articles at two levels of assessment by a second observer. The second observer is a current Masters in Behaviour Analysis candidate who was given instructions on how to conduct the analysis but did not require any additional training. The observer was provided with a form which included instructions for each level of selection. For the first level the observer was given a form with the titles of 20% of the articles that were collected based on the search terms. For the next levels the observer was given a form with links to the articles to easily access and assess the abstracts. An Inter-Observer Agreement (IOA) is a psychometric measure that ensures reliable and valid measurement of target behaviour, or in this case, the selection of articles for review

(Watkins & Pacheco, 2000). The formula used to calculate IOA was: A (smaller number) / B (larger number) X 100 (ABA Connect, 2018).   On average the researcher and the observer achieved an IOA of 95%. (See Appendix A and B for the IOA forms used).

**Quality Assessment**

Lastly, the articles that qualified at the final level of selection were assessed for quality using the What Works Clearinghouse (WWC) evaluation guideline. The WWC is an initiative by the Department of Education in the United States of America to create a guideline for the review of the quality of research. This guideline was initially designed for research pertaining to education but has, since its conception in 2002, been used for research in other fields including mental health and psychology (Hitchcock et al., 2014). The WWC website (2022) describes the purposes of the WWC which is to review and summarise the quality of research in education. Several elements of a study are assessed by the standards of WWC before it can qualify for review including study design, rate of attrition and outcome criteria. Appendix C shows the WWC assessment chart.

PRISMA Diagram

**Identification of studies via databases and registers**

**Identification**

Records identified from
 Databases (n = 410)
 EBSCOCINAHL (52)
 ProQuest Central (50)
 Web of Science (58)
 PUBMED (76)
 SCOPUS (155)

Records removed *before screening*:
 Duplicate records removed
 (n = 145 )

**Screening**

Assessment Level 1
Title Analysis
Records screened
(n = 265)

Records excluded:
(n = 120)
Reason: Did not meet criteria

Assessment Level 2
Primary Abstract Analysis
Records screened
(n = 145)

Reports excluded:
(n = 77)
Reason: Did not meet criteria

Assessment Level 3
Secondary Abstract Analysis
Records screened
(n = 68)

Reports excluded:
(n = 55 )
Reason: Did not meet criteria

Assessment Level 4
Complete Article Analysis
Records screened
(n = 13)

Reports excluded:
(n = 6)
Reason: Did not meet criteria

Quality Assessment
What Works Clearinghouse
Records screened
(n = 7)

Reports excluded:
(n = 0)
Reason: All met criteria

**Included**

Studies included in review
(n = 7 )
Reports of included studies
(n = 7 )

The PRISMA diagram shows that 410 articles qualified after the initial search
of the five databases. 52 articles were recovered from EBSCO CINAHL
COMPLETE, 69 from ProQuest Central, 58 from Web of Science, 76 from PUBMED
and 155 from SCOPUS. The articles were then exported to an Endnote library into

specific folders and one general folder for a duplication check after which 265 articles qualified. Of the 265 articles 145 passed after the first screening. A secondary observer assessed 20% (93) of articles in this level with a IOA rating of 92%. 68 articles qualified past the second screening. The secondary observer assessed 20% (29) of articles at this level with an IOA rating of 95%. 13 articles made it past the third screening and finally seven articles qualified after the quality review was conducted following What Works Clearinghouse guidelines.

Table 1 shows the details of the studies that qualified for review including demographic information, experimental design, type of condition or target behaviour for treatment, behavioural strategy or intervention and service delivery information. This table also displays the types of outcome measurement used by each study.

**Table 1** *Study Design and Components*

| Study | Study Type/ Experimental Design | Demographic Data | Target Condition/ Behaviour | Behavioural Services | Level of Therapist Communication | Intervention Type | | Parent/ Caregiver Training |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Direct | Indirect | |
| Chan et al., (2020) | Randomised Control Trial (RCT) Intervention | 202 Men with prostate cancer (Mostly White, well educated high earning men with average age of 70 years old) | Prostate Cancer / health behaviour | Behavioural Intervention Reinforcement management | Support varied between treatment groups. Level 1 (none) Level 2 (weekly short survey, Personalized plans) Level 3 (L2 + Wearable tech and message feedback) Level 4 (L3 + 3 x Weekly Voice/video calls.) | ✓ | | No Caregiver Training Component |
| Heitzman et al., (2014) | Quasi-experimental design (QED) Training | 7 parents of children with Autism | Autism | Behavioural Skills Training OASIS | Immediate support from Synchronous Videoconferencing Sessions. Delayed asynchronous response via email and module feedback and comments. | | ✓ | Training Component Included |
| Hong et al., (2022) | Quasi-experimental design (QED) Intervention and Training | 9 Families (9 Children with Selective Mutism) 9 parents/caregivers | Selective Mutism | Intensive Group Behavioural Treatment Shaping Contingency Management | Immediate support from Synchronous Videoconferencing Sessions. Bug-in-ear technology feedback during training. Delayed asynchronous response via email and module feedback. | ✓ | ✓ | Training Component Included |
| Jolstedt et al., (2018) | Quasi-experimental design (QED) Intervention and Training | 19 children with Generalised Anxiety or Separation Anxiety and their parents. | Anxiety | CBT | Delayed asynchronous response via messaging and module feedback and therapist reports. | | ✓ | Training Component Included |
| Jones et al., (2015) | Quasi-experimental design (QED) Training | 78 participating clinicians (51% social workers and 49% other disciplines. | Anxiety | CBT Coping CAT | Immediate support from Synchronous Videoconferencing Sessions. Delayed asynchronous response from module evaluation and feedback. | | ✓ | Training Component Included |
| Junkins et al., (2021) | Randomised Control Trial (RCT) Intervention | 11 Female African American participants with HIV and Diagnosed Depression | HIV / Depression | CBT Adherence Life steps Behavioural activation | Immediate support from Synchronous Videoconferencing Sessions. Delayed asynchronous response from module evaluation, feedback. | ✓ | | No Training Component |
| Thase et al., (2020) | Randomised Control Trial (RCT) Intervention and Cost Analysis | 154 major depressive disorder diagnosed adults not taking medication. | Depression | CBT Good Days Ahead Programme | Immediate support from Synchronous Videoconferencing Sessions. Delayed asynchronous response from module feedback and review of recordings. | ✓ | | No Training Component |

Table 1 shows that there was a total of 595 participants across seven studies, 487 of whom were adults between the ages of 18 to 70 while 108 were children between the ages of 4 and 13. All the participants reside in rural areas of their country or in the case of the study involving clinicians, have clients that reside in rural areas. The conditions or behaviours targeted by the behavioural interventions were health and lifestyle behaviours of men with prostate cancer (Chan et al., 2020), symptoms of autism (Hetzman et al., 2014), symptoms of selective mutism (Hong et al., 2022), symptoms of anxiety among children (Jolstedt et al., 2018) and youths (Jones et al., 2015) and depressive symptoms among women with HIV (Junkins et al., 2021) and among adults (Thase et al., 2020).

Table 1 shows that three (Chan et al., 2020; Junkins et al., 2021; Thase et al., 2020) of the seven studies qualified for this review were Randomised Control Trials (RCT) while the four remaining studies (Heitzman-Powell et al., 2014; Hong et al., 2022; Jolstedt et al., 2018; Jones et al., 2015) were Quasi-experimental Designs (QED).

Two studies (Chan et al., 2020; Junkins et al., 2021) were designed as direct interventions, two studies (Heitzman-Powell et al., 2014; Jones et al., 2015) evaluated the feasibility and efficacy of training programmes, two studies (Hong et al., 2022; Jolstedt et al., 2018) explored both an intervention component as well as a training component simultaneously while the final study (Thase et al., 2020) was an intervention and cost analysis.

The most common behavioural intervention employed in the reviewed studies was Cognitive behavioural therapy. Four of the seven studies investigated different adaptations of CBT Therapy for treatment such as Internet and Computer based CBT

(Jolstedt et al., 2018; Thase et al., 2020), CBT Adherence (CBT – AD) (Junkins et al., 2021) and the Child CBT programme, Coping Cat (Jones et al., 2015). One study (Chang et al., 2020), evaluated the implementation of ABA behavioural interventions such as contingency management and prompting, one (Heitzman-Powell et al., 2014) assessed the implementation of a behavioural skills training programme called Online and Applied System for Intervention Skills (OASIS) and one(Hong et al., 2022) explored the application of intensive group behavioural therapy using ABA strategies of fading shaping and contingency management.

Table 1 shows that five studies were interventions delivered directly to participants via telehealth (Chang et al., 2020; Hong et al., 2022; Jolstedt et al., 2018; Junkins et al., 2021; Thase et al., 2020) while two were mainly implementations of training programmes (Heitzman-Powell et al., 2014; Jones et al., 2015). The level of supervision provided by the therapists in each intervention were different among the studies. One study (Chang et al., 2020) had varying levels of therapist support between groups of participants where participants in level one received no direct therapist support while those in level four received several kinds of support including regular video consultations. One study (Hong et al., 2022) utilised Bug-in-ear technology in coordination with direct video consultation with participants. Four studies (Heitzman-Powell et al., 2014; Jones et al., 2015; Junkins et al., 2021; Thase et al., 2020) explored a combination of regular direct therapist support though videoconferencing and indirect support through feedback on online modules. Lastly, one study (Jolstedt et al., 2018) did not have a direct therapist support component and only utilised indirect feedback via module comments and evaluation.

**Table 2** *Outcome Measures and Results*

| Study | Completion Rates | Outcome Data — Effectivity/Feasibility | Outcome Data — Satisfaction/Acceptability | Outcome Data — Effectivity/Feasibility | Outcome Data — Satisfaction/Acceptability |
|---|---|---|---|---|---|
| Chan et al. (2020) | 82.7% at 3rd month follow-up. 77.2% at 6th month follow-up. | • Recruitment and Retention Measures • Total Lifestyle Behaviour | • Investigator Developed User Survey for each Component • Frequency of website access. | Recruited 202 men. Retention at 3rd month = 82.7% and at 6th month = 77.2%. Level 4 presented highest overall lifestyle behaviour increase compared to other levels. | "Very Satisfied" Ratings. Level 1 = 10% / Level 2 = 12% / Level 3 = 11% / Level 4 = 24%. Higher proportion of men in level 4 reported high satisfaction ratings. Higher proportion of men in level 1 reported high dissatisfaction ratings. Average website access in 3 months of intervention Level 1 = 2/Level 2 = 9/Level 3 = 11/Level 4 = 16 |
| Heitzman et al. (2014) | 100% completion Rate | • Parent OASIS Knowledge Assessment • Parent ABA Skills | • Researcher Designed User Satisfaction Rating • Cost Effectiveness (Measured miles saved by parents) | Measures / Mean pre-test / Mean post-test / Mean Skills Gained — OASIS Knowledge: 53.13% / 92.25% / 39.13% — ABA Skills Performance: 30.6% / 71.8% / 41.23% | Mean Satisfaction ratings (1-5) • Online Tutorials 4.71 • Telemedicine Coaching = 4.8. Mean Miles saved / family = 2,263. Total Miles saved = 9,052 |
| Hong et al. (2022) | 100% completion Rate | • Clinical Global Impression – Improvement scale (CGI-I). • Children's Global Assessment Scale (CGAS) • Frankfurt Scale of Selective Mutism • Child Behaviour Checklist (CBCL) | • Client Satisfaction Questionnaire 8 (CSQ-8) • Caregiver Strategy Use | CGI-I scores at post-treatment: • 55.6% Children classified as "minimally improved". • 44.4% Classified as "treatment responders". CGI-I scores at 4-month follow-up: • 66.7% Children classified as "minimally improved". • 44.4% Classified as "treatment responders". Measures / Pre-treatment / Post-treatment / Follow-up — CGAS: 48.75 / 55.50 / 65.35 — FSSM: 8.22 / 7.11 / 7.11 — CBCL: 58.22 / 55.56 / 55.22 | High Levels of Caregiver satisfaction • Mean at post-treatment = 29 • Mean at 4-month follow-up = 29.78 |
| Jolstedt et al. (2018) | 17 participants (89%) completed the treatment. Data only available for 15 participants. No participant completed all modules. | • Clinical Global Impression – Severity (CGI – S) • Clinical Global Impression – Improvement (CGI – I) • Children's Global Assessment Scale (CGAS) • Spence Children's Anxiety Scale (SCAS). | • 10 item Client Satisfaction Scale • Feedback from Clinicians (Semi-structured group interview among participating Clinicians.) | CGI-S • At post-treatment = 63% of participants (12 of 19) had CGI-S < 4. • Recorded as "below moderately ill". • At follow-up increased to = 68% of participants. CGI-I • Post-treatment 53% of participants (10 of 19) had CGI-I < 3. • Recorded as "Much improved". • At follow-up increased to = 58% (11 of 19) of participants. At follow-up 13 participants (68%) no longer needed treatment and discharged. Measures / Pre-treatment / Post-treatment / Follow-up — CGAS: 61.25 / 72.94 / 75.67 — SCAS Parent: 33.84 / 23.11 / 21.50 — SCAS Child: 32.44 / 19.40 / 25.70 — CSDS Parent: 12.28 / 6.00 / 7.79 — CSDS Child: 28.42 / 16.50 / 13.67 — CDI: 7.33 / 3.30 / 4.60 | 10 children and 9 parents completed client satisfaction scale. (Out of 50 points) • Child at post-treatment = 40.50 • Parents = 38.89. Two families did not think treatment was successful and would not recommend. • Families described increase knowledge • High satisfaction report from Clinicians <br> -- |
| Jones et al. (2015) | Inconsistent completion of research measures (Clinicians = 78%) (Client = 55%) | • Child CBT Multiple Choice test (CQ) testing clinician knowledge gain from training. • Multidimensional Anxiety Scale for Children (MASC) • Child Behaviour Checklist (CBCL) | • No reported measures of Acceptability and satisfaction in the study. | Measures / Mean pre-treatment / Mean post-treatment — CQ: 15.08 / 16.03 — MASC: 63.63 / 33.12 — CBCL: 69.63 / 62.89 | No reported measures of Acceptability and satisfaction in the study. Participating therapists "report" having felt as though they learned a lot. |
| Junkins et al. (2021) | 83% completed 3-mnth follow-up visit 95% completed 6-month follow-up. | • CES- Depression Scale • AIDS Clinical Trial Group ART Adherence Survey. • Wisepill raw data. | • Client Satisfaction Questionnaire (CSQ-8) • Adapted Scale for Acceptability and Feasibility. | Measures / Mean Baseline (CBT, ISP) / Mean Week 13 (CBT, ISP) / Mean Week 24 (CBT, ISP) — CES-D: 36.4, 37.5 / 20.2, 19.9 / 22.4, 23.5 — Wisepill: 71.1, 89.6 / 70.7, 81.4 / 53.1, 55.4 — Self-report: 89.6, 94.8 / 93.5, 89.6 / 91.8, 87 — ART Adherence: 17, 9 / 16, 9 / 16, 9 | Average CSQ-8 Score is 30.8 of 32. Individual Components found highly acceptable (of 100 points) • Depression Counselling = 97.2 • HIV treatment Adherence = 96.6 • Telemedicine use = 85.1 • In-depth exit interviews resulted in mostly positive comments. |
| Thase et al. (2020) | Completion Rates CBT = 79.2 CCBT = 81.8 | • Hamilton Rating Scale for Depression (HAMD) • Total Cost of care | • Cost-effectiveness Acceptability curve | Hamilton Rating Scale for Depression (HAMD) • CBT mean at week 16 = 9.2 • CCBT mean at week 16 = 8.9. Total Cost of care • CBT = USD 2,166 • CCBT = USD 1,247. Cost-effectiveness plane shows 99.7% likelihood CCBT resulted in lower cost than CBT. CCBT Reported as more cost-effective treatment. | Cost-effectiveness Acceptability curve = CCBT found to be more cost effective than CBT. |

The researchers for all seven studies collected data on completion rates among their participants. Table 2 shows that two studies (Heitzman-Powell et al., 2014; Hong et al., 2022), had 100% completion rates among all the timepoints and components measured. One study had a completion rate between 90% to 95% at the 6th month evaluation. Three studies (Chan et al., 2020; Jolstedt et al., 2018; Thase et al., 2020) had completion rates between 80% to 89%. One study (Jones et al., 2015) had the lowest completion rates at 78% among participating clinicians and 55% among clients.

Table 2 shows the types of measurement tools used by the studies in this review to determine the efficacy, feasibility, and acceptability of behavioural interventions.

Twenty different measurement tools were used by the studies in this review. Clinical Global Impressions (CGI) as well as the Children's Global Assessment Scale (CGAS) were used in two studies (Hong et al., 2022; Jolstedt et al., 2018). Hong et al. (2022) and Jones et al. (2015) both used the Children's Behaviour Checklist measure. Two studies measured the level of skill and knowledge of participants relating to Behavioural interventions with a 48-item parent knowledge assessment, an ABA skills assessment (Heitzman-Powell et al., 2014) and a Child CBT Multiple Choice Quiz (CQ) (Jones et al., 2015).

Two studies measured level of depression symptoms among their participants with the Centre for Epidemiological Study – Depression (CES-D) (Junkins et al., 2021) measurement tool and the Hamilton Rating Scale for Depression (HAMD) (Thase et al., 2020). Jolstedt et al. (2018) and Jones et al. (2015) both used measures for levels of Anxiety symptoms like the Spence Children's Anxiety Scale (SCAS) and

the Multidimensional Anxiety Scale for Children (MASC). Chan et al. (2020) gathered recruitment and retention measures to determine intervention feasibility as well as measures for health behaviour such as the Community Health Activities Model Programme for Seniors (CHAMPS) and Food Frequency Questionnaire (FFQ).

Lastly one study used the Frankfurt Scale of Selective Mutism (FSSM) to measure symptoms of selective mutism, one study (Junkins et al., 2021) used the AIDS Clinical Trial Group ART Adherence Survey for treatment adherence data and Thase et al. (2020) measured the cost effectiveness of the intervention they had implemented.

Of the seven studies in this review, one (Jones et al., 2015) had not reported measures of acceptability or user satisfaction. One study (Thase et al., 2020), determined satisfaction using a cost effectiveness acceptability curve. Heitzman-Powell et al. (2014) also determined cost effectiveness in the form of travel distance saved. The most common tool which was used by two studies (Hong et al., 2022; Junkins et al., 2021) to measure acceptability and client satisfaction was the Client Satisfaction Questionnaire (CSQ -8). A variation of this tool which is the ten-item Client Satisfaction Scale was used by Jolstedt et al. (2018). Two studies (Chan et al., 2020; Heitzman-Powell et al., 2014) developed their own client satisfaction measurement tools.

Table 2 shows the findings of the studies. Hong et al. (2022) who used the CGI-I measurement tool reported that 55.6% of participants were classified as "minimally improved" at post-treatment and 66.7% at 4-month follow-up. Participants who are classified as minimally improved present evidence of positive statistical change in the level of functioning which means there is an increase in their

functionally due to a possible decrease in the symptoms of anxiety or other factors (Busner et al., 2009). Jolstedt et al. (2018) who used the same measure also reported that 53% of participants were classified as "much improved" at post-treatment and 58% at follow-up. Participants who were found to be "much improved" showed a noticeably positive change in level of functioning. Furthermore, the two studies who shared the use of CGAS measures reported increases in the functioning levels of their participants. Hong et al. (2022) reported an increase in mean CGAS scores from 48.75 at pre-treatment to 55.50 at post-treatment and 65.35 at follow-up. Similarly, Jolstedt et al., (2018) reported an increase from a mean of 61. 25 to 72.94 points at pre-treatment to post-treatment and 75.67 points at follow-up. According to Vitiello (2022), a CGAS score of 70 and above suggests significant reduction of symptoms that affect a child's functioning and presents as a noticeable increase in overall functioning. In the context of the study by Hong et al. (2022), the increase in CGAS scores suggests an increase in functional communication among their participants who have selective mutism. Meanwhile for the study by Joltedt et al., (2018), this means a reduction in the levels of anxiety among their participants.

Lastly, both studies that used the CBCL measurement tool report near similar levels of symptom decrease with Hong et al. (2022) reporting a decrease from a mean of 58.22 points at pre-treatment to 55.56 points at post-treatment and Jones et al. (2015) reporting a decrease from 69.63 to 62.89 at pre and post treatment respectively. This means that the interventions may have had an effect on the symptoms experienced by the participants moving them closer to the average score of 50.

Heitzman-Powell et al. (2014) reported an increase in parent knowledge and ABA intervention skills between pre-treatment testing and post-treatment testing.

Participants had a mean knowledge gain of 39.13% and a mean skill gain of 41.23%. Jones et al. (2015) who also measured the knowledge gain of participating parents reported an increase from a mean of 15.08 points at pre-treatment to 16.03 points at post-treatment measures. These measures show the increase in the knowledge of the participating parents as well as their skill level. This suggests that the interventions had a statistically significant contribution on the level of intervention skills of the participants and facilitated an increase in their knowledge regarding ABA.

The studies that utilised measures for depression reported a decrease in depressive symptoms possibly due to the intervention. Junkins et al. (2021) reported that mean baseline scores of participants in the CBT group were 36.4 at baseline then 20.2 and 22.4 at week 13 and week 24, while symptoms of participants in the ISP group went from having a mean score of 37.5 at baseline to 19.9 and 23.5 in the proceeding evaluations. The outcome measure used for these data is a scale which represents the symptoms of depression among participants. A decrease from 37.5 to 19.9 is significant and may be indicative of the effectiveness of the intervention. Meanwhile, the participants in the study by Thase et al. (2021) showed significant decrease in depression symptoms as measured by the Hamilton Depression Rating Scale. In week one participants from the regular CBT group had a mean score of 19.6 and those in the computer CBT group had 19.8. At the endpoint of the interventions the average HAMD scores were 9.2 and 8.9 respectively. This suggested that the intervention may have successfully reduced symptoms of depression. Furthermore, the findings suggested that Computer CBT is not inferior to regular CBT.

Jolstedt et al. (2018) and Jones et al. (2015) reported findings that suggest that telehealth behavioural interventions were effective at reducing the symptoms of anxiety among their participants. Jolstedt and colleagues noted a decrease in

symptoms from a mean of 32.44 points at pre-treatment to 19.40 and 25.70 at post-treatment and follow-up respectively using the Spence Children's Anxiety Scale (SCAS), while Jones and team noted a decrease from a mean of 63.63 points to 33.12 points between pre- and post-treatment measures using the Multidimensional Anxiety Scale for Children (MASC). Both measures indicate the level of anxiety symptoms and impairment experienced by participants to the study and the findings showed a significant decrease likely due to the intervention.

Chan et al. (2020) determined recruitment and retention as measures of the successful implementation of the intervention programme. They reported having recruited 202 participants and retained 82.7% and 77.2% of them at 3rd and 6th month evaluations respectively which they stated as acceptable measures. They also noted that among all the participants, those placed in the level 4 group reported greater increase in physical activity, greater increase in positive diet behaviours and had a higher overall lifestyle behaviour increase when compared to the other groups, particularly level 1. It is important to note that participants in level four were those that received significantly more communication and support from a coach than those in level one which they attribute the differences in their findings to.

Meanwhile, Hong et al. (2022) also gathered data specific to Selective Mutism symptoms experienced by their participants. They reported a decrease from a mean score of 8.22 at pre-treatment to 7.11 at post-treatment and follow-up using the Frankfurt Scale of Selective Mutism. The scale ranges from zero to ten with ten representing high levels of SM symptoms.

Junkins et al. (2021) measured participant adherence to antiretroviral medication for aids using the WISEPILL app and reported consistent number of

participants adhering to their AIDS treatment for between each group for all three evaluation points as reflected by table 1. The measures showed a mean number of adherent participants were 16 in the CBT group and 6 in the ISP group which remained between weeks 13 and 24 of the intervention.

Thase et al. (2020) determined from the Cost-Effectiveness Acceptability Curve that CCBT is 99.7% more likely to result in lower cost as compared to regular CBT and therefore would likely be the more acceptable intervention. They reported that participants in the regular CBT group would have had to spend 2,166 USD per month whereas participants in the online CBT group would have only had to spend 1,247 USD which suggests that CCBT is the more cost-effective option.

Heitzman-Powell et al. (2014) determined that the telehealth intervention had saved participating families from having to travel a total of 9,052 miles or 14567.78 kilometres which their participants found highly acceptable.

Hong et al. (2022) reported high satisfaction ratings from their participants with a mean post-treatment satisfaction rating of 29 out of 32 at post-treatment and 29 during the 4th month follow-up. Junkins et al. (2021) reported similar findings with participants average rating of 30.8 out of 32 as well as high satisfaction for each component of the study. Depression counselling received 97.2 points out of 100, HIV treatment adherence procedures received 96.6 points and telemedicine received 85.1 points. Furthermore, in depth interviews conducted at post-treatment were largely positive with only two of the 22 participants stating that face-to-face interventions were preferable to telehealth interventions.

Using a 10-item client satisfaction scale, Jolstedt et al. (2018) determined that the treatment was acceptable for the participants with children giving the treatment a

mean score of 40.50 and parents giving it a mean score of 38.89 out of 50. Of the 9 participating families, two did not think the treatment was successful and would not recommend it to others. Clinicians who conducted the interventions also rated the treatment highly, according to post-treatment reports.

        Chan et al. (2020) who developed their own acceptability measurement tool reported varying levels of satisfaction among the four participant groups. Participants in the level 4 group reported higher satisfaction ratings with a 24% "very satisfied" rating than the participants at other levels, particularly those at level one who reported a 10% "very satisfied" rating. Table 2 shows the individual "very good" or "excellent" rating given by participants for each component of the treatment. Furthermore, level four participants visited the website more often at 16 events of access in three months as compared to the two events of access reported by participants in level one. Heitzman-Powell et al. (2014) also used a researcher designed measurement tool to measure acceptability. The measure is divided into two elements which are importance and satisfaction ratings. The online tutorials received a mean importance rating of 4.62 and telemedicine coaching received a mean score of 4.64 out of 5. Online tutorials received a mean satisfaction score of 4.71 and 4.8 for telemedicine coaching.

**Technology**

Table 3 shows the technologies used by the studies being reviewed, types of telehealth as well as the type of intervention programme.

**Table 3** *Technologies and Intervention Programmes*

| Study | Technologies | Types of Telehealth used | Intervention Programme |
|---|---|---|---|
| **Chan et al., (2020)** | Text Messaging<br>Voice/Video Calls<br>Email<br>Fitbit<br>Web | Hybrid Telehealth<br>Synchronous (Videoconferencing)<br>Asynchronous (Email and Messaging)<br>Client Monitoring (Fitbit wearable monitor) | 1 year Programme (13 months) |
| **Heitzman et al., (2014)** | Video Conferencing (Skype/Facetime)<br>Learning Modules | Hybrid Telehealth<br>Synchronous (Videoconferencing)<br>Asynchronous (Email and Messaging) | 8 Learning Modules |
| **Hong et al., (2022)** | Video Conferencing (Zoom for Healthcare)<br>Bug-in-ear Technology | Hybrid Telehealth<br>Synchronous (Videoconferencing and Bug-in-ear technology)<br>Asynchronous (Module comments and review) | Multi-session Training (Lead-in, Synchronous, |
| **Jolstedt et al., (2018)** | Asynchronous Messaging<br>Learning Modules | Asynchronous (Messaging, Module comments and review) | 12 learning Modules |
| **Jones et al., (2015)** | Group Video Conferencing<br>Coping CAT Module | Hybrid Telehealth<br>Synchronous (Videoconferencing)<br>Asynchronous (Email and Messaging) | 20 Session Group Supervision Training (Clinicians)<br>12 session intervention (participants/parents) |
| **Junkins et al., (2021)** | Video Conferencing<br>WISEPILL Adherence App. | Hybrid Telehealth<br>Synchronous (Videoconferencing)<br>Asynchronous (Module comments and review)<br>Client Monitoring (Wisepill Adherence technology) | 10 – 12 weekly therapy sessions |
| **Thase et al., (2020)** | Video Conferencing<br>Learning Module | Hybrid Telehealth<br>Synchronous (Videoconferencing)<br>Asynchronous (Module comments and review) | 9 Session Modules |

The most common technology used by the studies was videoconferencing technology which was present in all but one study (Jolstedt et al., 2018). One study (Jones et al., 2015) used videoconferencing in a group setting with each participant attending via Zoom. The programmes used for videoconferencing were either Skype, Zoom for healthcare or Polycom software. Three studies (Heitzman-Powell et al., 2014; Jolstedt et al., 2018; Thase et al., 2020) delivered interventions with the use of computer-based learning modules.

Messaging via Short Message Service (SMS) and email were used by two studies (Chan et al., 2020; Jolstedt et al., (2018). Chan and colleagues also used a fitness tracker (Fitbit) and a web-portal. One study (Hong et al., 2022) used live Bug-in-ear technology in tandem with videoconferencing and Junkins et al. (2021) gathered participant treatment adherence data with a programme known as Wisepill.

Table 3 indicates that only one (Jolstedt et al., 2018) of the seven studies in this review had not utilised a Hybrid Telehealth system. The remaining six studies made use of a combination of synchronous and asynchronous method of delivering telehealth interventions. Furthermore, Chan et al. (2020) and Junkins et al. (2021) used an additional type of telehealth which was client monitoring telehealth with wearable technology and the adherence recording application.

Three studies, (Heitzman-Powell et al., 2014; Jolstedt et al., 2018; Thase et al., 2020) delivered interventions with learning modules that the participants needed to complete before being able to proceed. Chan et al. (2020) delivered interventions in a 13-month programme while Junkins et al. (2021) made use of a 10–12-week therapy programme. Hong et al. (2022) delivered a multi-session training programme over a span of three months with a post-treatment and fourth month follow-up evaluation. Jones et al. (2015) conducted a 20-session training course for participating clinicians and a 12-session intervention programme for the children using the Coping CAT programme.

Table 4 shows the challenges described by the researchers for each study included in this review.

**Table 4** *Challenges and Proposed Solutions*

| Study | Challenges | Suggested Solutions |
|---|---|---|
| **Chan et al., (2020)** | Technical difficulties (accessing web portal). Lower user knowledge with technology Non-inclusive population Non personalised study materials | Improved inclusion criteria Better on-boarding process considering participant computer literacy Materials personalisation and improvement Inclusion of other wearable technology participants are familiar with |
| **Heitzman et al., (2014)** | Technical Difficulties Limited access and knowledge of telehealth technology Small Sample size Set-up of households and communication issues (Distractions etc...) | Use of more accessible equipment such as cellphones Using technology participants are familiar with Using more common and easy to access videoconferencing software Indicate specific work area of the house for telehealth intervention when available |
| **Hong et al., (2022)** | Technical difficulties Challenges in delivering specific treatment during group sessions particularly reinforcement. Pandemic restrictions forced families to stay indoors limiting children exposure Small Sample size | Initiate better communication strategies during group sessions Including more variable contingency management systems Manage schedules to promote more individualised care Study to be redone when restrictions are lifted to test effectivity of treatment in other settings |
| **Jolstedt et al., (2018)** | Technical difficulties Missing data from clinicians, parents, and children Clinicians did not know how to deal with families' failure to return research data Clients' failure to reach target module | Aid with Data collection Further training for clinicians in dealing with challenging families Manage modules to encourage target attainment Understanding which participants need more support based on module completion rates and understanding factors underlying adherence |
| **Jones et al., (2015)** | Technical difficulties High levels of non-completion may cause bias Therapist intervention skills not directly observed. | May be related to clinician confidence and preparedness. Additional telehealth training may be indicated Direct intervention observation component included in future studies |
| **Junkins et al., (2021)** | Technical Difficulties Small Sample size Limitations with internet access and available technology | Participants were provided with a nearby venue to access available technology for intervention. Set better paraments and inclusion criteria for outcome measures and participant selection |
| **Thase et al., (2020)** | Technical Difficulties Participating therapists already highly trained in CBT may have skewed outcomes | Optimised inclusion criteria to avoid bias. Eliminate face-to-face components to focus more on telehealth outcomes |

The most common limitation encountered by the researchers were technical difficulties followed by limitations with access to required technology and reliable access to the internet. All the studies experienced some form of technical difficulty either at the user or service provider end. Some of the technical difficulties included failure to access necessary services like the web-portal (Chan et al., 2020), issues with communication via videoconferencing (Hong et al., 2022) and problems with the Wisepill App (Junkins et al., 2021). Additionally, studies (Chan et al., 2020; Heitzman-Powell et al., 2014) reported limited user knowledge of the technology such as how to access the web-portal and unfamiliarity with Polycom.

All seven studies shared limitations regarding the generalisability of their studies as reported by the researchers of each study. Three studies (Heitzman-Powell et al., 2014; Hong et al., 2022; Junkins et al., 2021) cited small sample size as the reason for the poor generalisability. Two studies (Jolsttedt et al., 2018; Jones et al., 2015) reported missing data and poor completion rates as the likely cause. One study (Chan et al., 2020) reported highly specific participant characteristics and one study (Thase et al., 2020) stated that participant skill level may have caused biases that led to poor generalisability.

One other notable limitation reported by Heitzman-Powell et al. (2014) is the difficulty of delivering behavioural services to participants' households due to the poor set-up which led to inadequate communication. Hong et al. (2022) also included communication difficulties as a limitation brought about by the challenging nature of delivering group therapy via videoconferencing.

**Suggested Solutions**

Table 4 outlines the possible solutions to the limitations and challenges described by the researchers in each study.

The researchers were unable to suggest specific solutions to technical problems, however they stated that this issue is expected and was often well accounted for by setting up technicians that would be able to respond to the issues when needed. Heitzman-Powell et al. (2014) and Junkins et al. (2021) set up a controlled clinic setting closer to the participant's homes with the required equipment and technical support available to overcome these challenges.

To overcome the challenges with limited knowledge with technology, Heitzman-Powell et al. (2014) suggested using more common software, especially

software the participant is more familiar with. They also suggested the use of smartphones with the required software whenever possible for participant ease of use. Chan et al. (2020) suggested improvements with the on-boarding process including better instructions for participants.

Regarding difficulties with communication, Heitzman-Powell et al. (2014) suggested setting up specific areas in the house devoid of distractions for conducting interventions whenever possible. Hong et al. (2022) suggested the review of better strategies for group communication over videoconferencing. They also promoted better scheduling to accommodate all participants at their most convenient time.

Lastly, to remedy the issue of generalisation, (Chan et al., 2020; Junkins et al., 2021; Thase et al., 2020) suggested optimising the inclusion criteria to reach a more diverse population. Other suggestions included a better onboarding and participant selection process.

## Discussion

The aim of this systematic review was to determine the feasibility and acceptability of implementing ABA interventions to people in rural areas via telehealth. The specific research questions were: a) What behavioural interventions are currently being adapted to be delivered via telehealth to people in rural areas? b) What type and method of telehealth delivery is most common? c) How effectively are these interventions being applied? d) What elements make them effective? e) What are the challenges of delivering behavioural interventions via telehealth technologies to rural areas? f) What solutions have the studies presented to overcome these challenges? The systematic search identified seven studies that qualified for this review.

**What Behavioural interventions are currently being adapted to be delivered via telehealth to people in rural areas?**

The analysis of the studies in this review showed that the behavioural strategies and interventions currently adapted for delivery to rural areas via telehealth are Cognitive Behavioural Therapy, Reinforcement or Contingency Management and Intensive Group Behavioural Therapy. One study also reported findings on the application of a behavioural training programme.

The most common behavioural therapy currently being adapted for telehealth for use in rural areas is CBT which was implemented by four of the seven studies in this review (Jolstedt et al., 2018; Jones et al., 2015; Junkins et al., 2021; Tahse et al., 2020). This is consistent with current literature, which suggests that CBT is one of the most used types of psychotherapy and behavioural treatment. A quick search of any database on articles pertaining to behavioural interventions in rural areas would yield mostly CBT results. This is likely due to several benefits derived from CBT as a behavioural intervention detailed by David et al. (2018), who claims CBT is the gold standard for psychotherapies because of three main reasons. Firstly, CBT is more heavily researched than other treatments currently available and boasts a large body of supporting evidence for its efficacy. Secondly, other treatment strategies have not provided sufficient evidence for superiority over CBT particularly for depression and anxiety and lastly, the theoretical models underpinning CBT, particularly the behavioural components are well researched and supported by evidence. Meanwhile, Tolin et al. (2010) reported in a meta-analysis that CBT is comparable to other interventions for most disorders but was the superior treatment option for anxiety and depression. This is supported by the studies in this review where CBT was primarily

employed by researchers to explore the effect of telehealth delivered interventions on depression and anxiety of participants in rural areas. The CBT strategies employed are often part of programmes like the Coping CAT which is highly regarded and evidenced based (Beidas et al., 2010; Mukund and Jena, 2022). Furthermore, the four studies in this review implementing CBT to rural areas suggested that CBT is well suited for online delivery. Online CBT can be delivered in the form of computer-based modules that could be evaluated either synchronously by videoconferencing or asynchronously from feedback or direct messaging. Meanwhile, other researchers reported that telehealth delivered CBT was equally as effective as its face-to-face counterpart (Kumar et al., 2017; Ruwaard et al., 2011).

Contingency management was the second most common behavioural strategy employed in the studies reviewed. There is a range of evidence for the successful implementation of contingency management in the reduction of smoking behaviours with the help of Mobile Telehealth applications (Dallery et al., 2021). Contingency management is an effective method of reducing harmful behaviours or promoting behaviours beneficial to the client. Often contingency management is used as a component of a behavioural intervention or training package as in the case of OASIS training by Heitzman-Powell et al. (2014) and the parent training component of the intervention by Hong et al. (2022).

**What types and methods of telehealth delivery are most used?**

Six of the seven studies in this review utilised hybrid telehealth, which is a combination of two or more types of telehealth. This includes the utility of videoconferencing programmes like Skype, Polycom and Zoom for healthcare in conjunction with asynchronous modules and in one case Bug-in-ear technology, used

by one study (Hong et al., 2022). The combining of two or more types of telehealth allows the intervention to provide a wider range of treatment for clients. Junkins et al. (2021) and Chan et al., (2020) both used the more common synchronous and asynchronous telehealth types but also used wearable patient monitoring technologies as well as mobile health apps. Most of the studies available today pertaining to telehealth regularly combine several telehealth approaches to achieve the best results.

Synchronous telehealth, which is by far the most common type of telehealth used by the studies, is touted as a highly effective alternative to face-to-face interventions (Harris et al., 2022). Harris and colleagues stated that there are three main advantages of using synchronous telehealth technology which is likely why it is the preferred type of telehealth. Firstly, participants find it more comfortable receiving treatment from the safety of their own homes, precluding the need for travelling. This is particularly important for clients with severe symptoms or conditions like autism with accompanying aggressive behaviour. Secondly, synchronous telehealth allows participants to avoid illness which they could be exposed to in transit or at clinics. This is a significant point especially during this pandemic. They also stated that the level of communication between care provider and client is at a similar level or even better than face-to-face interventions.

Asynchronous telehealth was used by all the studies in this review. All the studies used modules which the participants are instructed to complete, critiqued by a therapist and returned to the participants with feedback. One study (Jolstedt et al., (2018) used this method exclusively and did not have a synchronous component or other telehealth types. Chan et al. (2020) employed emails as well as text messages in addition to module feedback, while Thase et al. (2020) had therapists observing and responding to video recordings. While asynchronous telehealth is used mainly in

medical practice, particularly during consultation (Mahnke et al., 2011), it has become standard practice in telehealth delivery of behavioural interventions.

Lastly, other telehealth technologies used by the studies in this review included patient monitoring technology in the form of fitness/activity trackers. Both therapists and participants in a 2021 study stated that the fitness trackers they had been using provided an added value to their treatment (Ummels, Beekman, Braun, and Beurskens, 2021). Another technology is the Wisepill medication adherence monitoring application utilised by Junkins et al. (2021). Wisepill is an mHealth application that guides its users into adhering more closely to treatment regimen by prompting participants via text messages and alerts to record their medication intake. Mobile health has made it possible for behavioural services to be fully self-administered or with minimal intervention from therapists. Used in conjunction with other types of telehealth, Wisepill mHealth enabled Junkins and colleagues to determine whether behavioural interventions targeting adherence to treatment were effective.

**How effectively are these interventions being applied?**

To determine the successful implementation of behavioural interventions, there are three major elements to consider. They are study completion and adherence rates, feasibility and effectivity outcomes, and acceptability outcomes. All the studies in this review reported the outcomes of their investigation of the delivery of behavioural interventions to people in rural areas via telehealth. They determined that not only was this method of service delivery effective and feasible, but it was also found acceptable by the target population. This coincides with several other studies dedicated to determining the implementation of behavioural interventions to a similar

target population like the study by Stewart et al. (2017). They determined that trauma-focused CBT could be successfully delivered via telehealth to people from rural areas.

Adherence and completion rates generally refer to the number of participants who were able to follow the parameters of the interventions and remain in the programme from the on-boarding process to post-treatment evaluation. According to Harley et al. (2018), completion rates often predict the overall efficacy of an intervention. Improvements brought about by therapy are often more prominent among completers than non-completers. They are the most fundamental of user metrics when measuring interventions (Sauro & Lewis, 2012). Two studies (Heitzman-Powell et al., 2014; Hong et al., 2022) reported having reached 100% completion rates among their participants. The study by Hong and colleagues incorporated Bug-in-ear technology to provide instantaneous feedback to participants, while Heitzman-Powell and team provided immediate feedback during training via teleconferencing. According to Wojtowicz et al. (2013), the type and level of communication between participants and therapists can increase the likelihood of treatment completion which is why these studies that instituted immediate feedback received high completion rates. Better communication between the involved parties facilitates better treatment outcomes. Additionally, it is useful to note that in the case of Jolstedt et al. (2018), therapists had no direct contact with the participants and gave feedback only through asynchronous telehealth in the form of comments on module performance. This lack of direct interaction with a therapist likely contributed to the poor completion rates reported by the study. Meanwhile, in the case of Jones and colleagues, the poor completion and adherence rates are attributed to the skills of the participating clinicians who were unable to secure complete client adherence due to therapists' lack of experience. Studies suggest that therapist competence is a

significant factor when it comes to determining the successful outcome of an intervention (Fairburn & Cooper, 2011; Strunk et al., 2010). Furthermore, the study by Chan et al. (2020) reported that participants who received a greater level of therapist interaction, also had higher completion rates and visited the assigned web portal without prompting an average of 8 times more often than those in the lower levels. This finding further supports the notion that therapist involvement positively impacts treatment adherence and promotes higher completion rates.

The importance of reliable measurement tools particularly in providing behavioural interventions cannot be understated (Aldridge et al., 2017; Parsons et al., 2019). The studies in this review utilised highly valid and reliable measurement tools to determine the efficacy of their interventions, the most common of which were Clinical Global Impression (CGI) and Children's Global Assessment Skills (CGAS). Both tools were designed to determine a participant's level of functioning and determine whether there has been an improvement after treatment was initiated. The Children's Behaviour Checklist (CBCL) was also used, particularly in studies related to anxiety and depression with the target population being children in rural areas. The two studies that featured the CGI and the CGAS measurement tools established an increase in the level of functioning in participants before and after the intervention. According to the CGI and CGAS results, most participants from both studies could be classified as "treatment responders" and had minimal to moderate improvements in functioning. This suggests that the telehealth delivered interventions were able to significantly and positively affect the level of functioning of participants who received the treatment.

The data derived from the measurement tools for depression and anxiety, particularly the ones comparing telehealth with face-to-face interventions, provides further

evidence that telehealth is not inferior to in person behavioural therapies as a method of providing CBT to participants in rural areas. Other studies such as Li et al. (2021) and Scogin et al. (2018) support these findings in their research which also pertain to the effectiveness of telehealth delivered CBT for treating symptoms of depression.

For the studies where parents and caregivers were trained to provide ABA interventions, the researchers reported that there were significant increases in both knowledge and skills between pre- and post-testing. These outcomes were derived from tests scores as well as observation via conducted synchronously webcam. Heitzman-Powell et al. (2014) reported a mean increase of 39.13% in ABA knowledge and 41.23% between the two testing points. Hong et al. (2022) made similar claims regarding their participants as well as lower levels of burden that often comes hand in hand with training. The researchers attributed this skill and knowledge increase as well as the overall decrease in burden to the use of Bug-in-ear technology. This further indicates that immediate feedback is an important factor in the efficacy of telehealth interventions, especially for training purposes. The current literature is consistent with these findings and may provide evidence for the efficacy of telehealth as a method of delivering behavioural training to parents, particularly in rural areas (Holzman et al., 2023; Merrill et al., 2023; Tsami et al., 2019)

Cost-effectiveness was also measured by two of the seven studies, which showed that participants were saved from having to travel long distances for the duration of the intervention. Furthermore, participants from rural areas were also able to save an estimated sum of 919 USD for treatment received via telehealth as compared to face-to-face treatment. These findings pertaining to cost effectiveness have been researched thoroughly and supported by several different studies (Egede et al., 2018; Gentili et al., 2022).

The studies reviewed presented evidence of acceptability derived from the satisfaction surveys and interviews conducted by the researchers. Those that used client satisfaction questionnaires reported that participants rated the interventions as highly acceptable (Hong et al., 2022; Junkins et al., 2021). The participants also spoke positively of their experience during the closing interviews with some stating that the intervention as preferable to face to face interactions because being in a separate area from the therapist allowed for more comfortable interactions. However, some participants expressed a preference for traditional delivery of behavioural intervention citing the need for personal interaction as the reason. This means that, although telehealth is growing more popular, there is still room for traditional methods. This is where synchronous telehealth can come into a significant role. Two studies developed their own satisfaction surveys also derived from the CSQ. These surveys yielded similar results with the CSQs. The researchers stated that the participants found the telehealth method of service delivery to be convenient and efficient. Heitzman-Powell and team also noted the travel distance potentially saved by participants which were a total of 14 thousand kilometres between the 9 families over the span of the intervention which was another factor contributing to the high satisfaction ratings. These findings align with those from current studies that implemented behavioural interventions and training over telehealth (Loveys et al., 2023; Patterson et al., 2021; Tsami et al., 2023).

Earlier it was stated that Chan et al. (2020) randomly assigned participants into four groups of varying levels of therapist support. Participants who were assigned to level four, those who received more support from therapists, gave the intervention higher satisfaction rating as compared to participants who received less support. Although the components of the intervention were generally rated positively, most of

the positive ratings were from participants in level four. Those same participants were also more likely to visit the website dedicated to the intervention which was also monitored by the researchers. The outcome of the client satisfaction assessment suggested that the level of therapist presence influences how acceptable participants perceived the intervention. A systematic review by Kruse et al. (2017) found that improved communication enabled by telehealth between provider and client is a factor for increased client satisfaction.

**What elements make them effective?**

This review has noted four elements that contributed to the successful and acceptable delivery of behavioural interventions via telehealth to people living in rural areas. First and most significantly is the level of therapist involvement and support in the intervention. The greater the involvement of therapists in the delivery of interventions, the higher the likelihood of participants adhering to the treatment, engaging with the programmes, completing the assigned tasks, and submitting requirements. Researchers in studies that had minimal therapist supervision encountered difficulties with data gathering and compliance that affected the validity. Furthermore, participants who received high levels of therapy support regarded the intervention more positively than those who did not as evidenced by the study by Chan and colleagues. Chang et al. (2023) stated in their study that telehealth and the technologies that come with it are merely tools for delivering interventions. The real catalyst for positive outcome is the consistent and supportive engagement between client and therapist.  Lastly, Ingersoll et al. (2016) and Tolin et al. (2007) found that participants who received more support from therapists during telehealth interventions reported marginally higher rates of improvement than those who received less or no support, which supports the findings of this study.

Secondly, the convenience of receiving behavioural treatment via telehealth positively impacts the efficacy of the interventions in the study. One of the major limitations of traditional behavioural services is that it requires participants to visit therapists regularly which means frequent long trips on a weekly and even daily basis. This is difficult for participants who exhibit challenging behaviours, those with anxiety and specifically, those who live in rural areas. With telehealth, this need for travel is largely eliminated (Orlando et al., 2019). Instead, participants can receive treatment from the comfort of their own homes. Patterson et al., (2021) includes ease of travel as one of the factors that contribute to the efficacy and high satisfaction received by telehealth. Participants are also able to engage in treatment at their own pace, a freedom that is often absent from traditional means of providing behavioural services. This promotes self-sufficiency in participants as noted by Jolstedt et al. (2018). Additionally, parents and caregivers can include training sessions into their schedules without making sacrifices with their jobs. In the study by Heitzman-Powell et al. (2014), the convenience of being able to adapt treatment to daily schedules encouraged not just one carer but two. The implication of this outcome suggests that telehealth treatment could be used to involve multiple carers in one household thanks in part to its convenience . This means that the carers and family members of a client who uses telehealth and receives treatment at home, may be more likely to participate in treatment. As a result, they would likely be more knowledgeable of the client's condition and behavioural strategies and may be generally bettered equipped at helping the client. This also means that everyone involved in the participant's care is on the same page about approaches introduced in the training. The convenience afforded by telehealth behavioural therapy is a component that greatly contributes to

its efficacy and overall acceptability and could encourage participants in rural areas to seek treatment when they need it (Edwards et al., 2018).

Thirdly, the cost-effectiveness of telehealth makes it a good treatment method for people in rural areas. As shown by the studies in this review and supported by current literature (Egede et al., 2018; Gentili et al., 2022) telehealth delivered behavioural interventions are less expensive compared to traditional behavioural services. Historically, people who live in rural areas are of lower socioeconomic status when compared to most urban residents  (Dercon, 2009; Ravallion et al., 2007), thus, an affordable treatment option likely appeals to people and makes receiving treatment more considerable. The study by Thase et al. (2020) presented data supporting the claims that telehealth is a cheaper option than traditional behavioural interventions. In this same study, participants expressed preference and high levels of satisfaction for telehealth because of its affordability. Furthermore, Heitzman-Powell and team were able to determine that families also saved money by reducing the need for long distance travels. Parents and caregivers who otherwise need to work are still able to participate in training and provide care without having to make financial sacrifices. The flexibility provided by telehealth allows therapists and parents to schedule appropriate times for interventions. This decreased burden makes telehealth an effective and acceptable treatment.

Lastly, for participants who were experiencing symptoms of mood disorders or in the case of selective mutism or autism, the comfort of receiving treatment in a safe space is an element of the efficacy of telehealth as a method of delivery for behavioural interventions. Among the seven studies, four were directed towards mood disorders and two were for selective mutism and autism. Mood disorders such as anxiety and depression can lead to the inability or unwillingness to seek help,

especially if it involves having to deal with an unfamiliar therapist. Being able to receive treatment without the need for face-to-face interaction can be helpful for these people. Participants in a study by Castro et al. (2022) expressed satisfaction with the comfort provided by telehealth delivered ABA. They stated in the article that being able to receive treatment in one's bedroom, particularly in days when symptoms of depression were most severe, allowed the participant to continue receiving treatment. The women in the study by Junkins et al. (2021) expressed in an interview how comfortable it was to express themselves when they were not directly under the scrutiny of a therapist. Although a small number expressed a preference for traditional means of receiving care, the African American women from the rural south of the United States rated the telehealth intervention highly. Telehealth delivered interventions have also opened the way for people to participate in group therapies which have been found to be effective by Hong and colleagues (2022) who implemented group behavioural treatment to children with selective mutism whose symptoms stem from anxiety. The comfort of a client is a significant consideration when providing care, especially regarding behavioural treatment. A comfortable, familiar environment can facilitate the effective delivery of interventions which can later be generalised to other places. Telehealth allows for the delivery of this service anywhere but especially to areas that clients may find most comfortable. This adds another element which could allow the treatment to be more ideal (Banbury et al., 2018).

**What are the challenges of delivering ABA interventions via telehealth technologies to rural areas?**

The researchers involved in the studies selected for this review were met with several challenges during the entirety of the programme.

The first and most common issue that they faced were technical issues likely stemming from the equipment used or the lack of reliable internet providers in rural areas. This challenge is shared by almost all studies that use telehealth, especially when it is implemented in remote areas (Banbury et al., 2018). Castro et al. (2022) notes this as one of the most significant weaknesses of telehealth as a service. Internet availability is a significant factor in the success or failure of telehealth service delivery. People who live in rural areas often have no or less reliable access to internet and this issue was reported in almost all the studies in this review (Quinton et al., 2021; Whitacre et al., 2020). This issue has a range of effects including disrupted or poor video and audio communication, inaccessible intervention materials and failure in submission of research data. Additional issues include the performance of the equipment used for the research which have some similar effects. Technical problems are often unavoidable in any research that utilise hardware and software, but an additional level of difficulty is experienced when services are delivered remotely. Normally technicians would be on hand to assist in trouble shooting any technical problems that may arise. With telehealth, although technicians can provide instructions remotely, some of the more technical problems can be beyond the capabilities of participants, specifically those of advanced age. This was encountered by Chan et al. (2020) when participants were unable to access some of the necessary software to participate in the interventions due to an error with the website portal that was not remedied until later. This incident was unsatisfactory for the participants which may have led to lower satisfaction ratings.

Another issue is the limited knowledge of participants regarding some of the software and hardware used for the interventions. Although technology has become more ubiquitous and computer literacy is on the rise, some people of advanced age

and those who live in rural areas remain unapprised (Aljassim & Ostini, 2020). Additionally, current literature suggests that low telehealth literacy continues to by one of the major factors obstructing the widespread use of telehealth and for lower satisfaction towards telehealth  (Banbury et al., 2018; Rush et al., 2021). Heitzman-Powell et al. (2014) introduced an application called Polycom which required some previous knowledge. Some of their participants found it difficult to use this technology and a different arrangement had to be developed to overcome this limitation. The unfamiliarity of the technology and the method of service delivery hindered the submission of data in the study by Jones et al. (2015) which affected the outcome of the study. This issue necessitates the implementation of pre-training of participants which is not so easily done remotely as the participants would have to use the same technologies to receive the training for the technologies.

A third issue regards the poor generalisability of the studies. Most of the studies in this review cite small sample size as the reason for the poor generalisability which is a common feature of single case and quasi-experimental research designs. Other studies, however, report different factors for poor generalisability. Chan et al. (2020) stated that, although the criteria for participant selection was 18 and above, the mean age of participants in their study was 70 years old. These participants were also predominantly white, highly educated individuals from financially well-off demographics which renders the study non-generalisable to other races and socioeconomic backgrounds as well as ages. Jolstedt et al. (2018) reported that data was only available for 15 out of the 17 participants due to failures in submission and lower completion of the modules. Jones et al. (2015) also reported a similar issue with poor completion rates and data submission. These factors affected the generalisability

of each study which the researchers mentioned as significant consideration for future studies in rural telehealth.

Lastly, although there are benefits to receiving therapy in a safe and comfortable home space, it comes with challenges of its own. In some cases, particularly when children were involved, an area of the home reserved for treatment was not established. As a result, distractions were present during interventions which may have affected their effectiveness. In these cases, the familiarity and comfort of the treatment space worked against the client and the therapist. Additionally, the presence of other family members not participating in the treatment also became distracting to participants. Some teenage clients, in a review conducted by Castro et al. (2022), expressed distress about the fact that they are in the same area with their parents. They felt unable to freely relay their concerns with therapists or participate with treatment because of perceived lack of privacy.

Other challenges mentioned in the literature includes "Zoom Fatigue" or the feeling of burnout brought about by having to conduct activities online (Fauville et al., 2021). This was common particularly during the height of the COVID pandemic where schools, work, and other activities aside from telehealth were conducted via teleconferencing. Although not as prevalent when the restrictions were lifted and people were free to resume regular activities, it is still a consideration especially for younger clients, as some schools have taken to hybrid mediums of education which includes the internet.

**What solutions have the studies presented to overcome these challenges?**

The researchers highlighted several solutions to the challenges noted in the previous section. The first one regarding technical issues includes the provision of

equipment that is maintained by the service providers. This equipment is observed for faults before being lent to participants and is therefore less prone to technical issues. Equipment can also be simplified to perform only the functions specified by the service providers to reduce the risk of confusion and strain on the equipment. Standby equipment should also be available should the ones provided malfunction. Junkins et al. (2021) and Heitzman-Powell et al. (2014) determined that providing a treatment hub for participants that is easy for participants to access already furnished with the required technologies is another solution to this problem (Martin-Khan et al., 2015). These designated hubs are still far from the city but are regularly maintained by service providers to ensure that technical issues are at a minimum and are staffed should problems arise (Williams, 2021). These areas also have optimal and controlled access to the internet which is a bonus especially considering that the internet connectivity problems would likely be the telehealth issue most difficult to overcome. Fortunately, countries have pushed forward initiatives to improve internet access for everyone including people in rural areas (Ministry of economic development, 2009). Even today, large swathes of places that had poor to nonexistent internet in the first ten years of the millennium are now catching up with the rest of the world.

The issue of technical skill and knowledge could be resolved by implementing a pretreatment training programme for participants. Chan et al. (2020) established this with their participants, however it was not strictly implemented which resulted in some participants not knowing what to do when met with unexpected challenges. Studies often introduce pretreatment training procedures on how the interventions would be taking place and how to perform intervention related tasks, however, the introduction and pretraining on how to use the technologies as well as simple troubleshooting steps could be beneficial. Furthermore, a step-by step troubleshooting

guide could be made available to participants in the event of a technical issue that the

service provider could not immediately respond to. Again, the solution provided by

Junkins et al. (2021) and Heitzman-Powell et al. (2014) of providing a service hub can

be applicable to this issue. Steiner et al., (2020) wrote an article outlining the

usefulness of using telehealth hubs and Te Whatu Ora (n.d.) in New Zealand are

initiating the creation of such hubs within and between remote communities. These

service areas could be optimised to determine and remedy any technical problems that

may arise to promote the seamless delivery of behavioural services. This solution may

necessitate local travel for people in rural areas, less than the distance they would

have travelled otherwise. Hong et al. (2022) also suggested using technologies that

participants are more familiar with and already use. These technologies could be

adapted to meet the standards of privacy and ethics required by regulators. In the last

few years videoconferencing has gone from being an inaccessible technology used

mainly in business, military application, and academia to a more readily available tool

for the masses. The applications currently available are also easier to use and can be

operated by participants who do not have explicit computer skills. The researchers

suggested the use of these more readily available technologies that participants are

already familiar with to facilitate better reception of treatment.

The issue of generalisation, Chan et al. (2020) and Thase et al. (2020)

suggested, could be overcome by defining the inclusion criteria for participant

selection more clearly. They also suggested that the onboarding process be improved

for future research to include a more diverse set of participants that could cover the

target population more widely. This aligns with the findings of Polit et al., (2010)

which highlights several suggestions on improving generalisability and transferability

which includes successful collection and understanding of available data. Better

incentives for participation could be utilised as well to encourage participants who would otherwise be uninterested in participating. Some participants are willing to receive the treatment as part of a study, however a few may find this less agreeable and may need financial encouragement. Jolstedt et al. (2018) and Jones et al. (2015) both experienced issues of generalisation brought about by poor completion and data submission rates. Jones and team determined that this was likely due to the limited knowledge and confidence on the part of the participating clinicians. They noted that some clinicians did not know how to encourage participating parents to submit the desired data when the parents were unable to or did not submit promptly. All participants should be briefed on the importance of submitting data and clinicians in particular should be given extra training to encourage and influence participants to perform their assigned responsibilities. Meanwhile, Jolstedt et al. (2018) noted that therapist participation and encouragement is a significant factor in increasing adherence and intervention completion. Although the intervention had been effective for most of the participants in their study, several were unable to submit vital data which adversely affected the generalisation and overall validity of the study. An increase in therapist encouragement and reminders could possibly mitigate or even eliminate this problem in future studies, and in the practical application of telehealth, an issue that is not as likely to occur for synchronous telehealth interventions.

Regarding the issue of unsuitable areas of the home for therapy, Hong et al. (2022) suggested the assessment and selection of a small but comfortable dedicated area for treatment within the home. Additionally, the American Institute on Aging (2020) advises telehealth clients to establish quiet and clutter free areas in the home for consultations beforehand. Videoconferencing could be preceded by an email or call reminder a few minutes before the actual session to alert participants to ensure an

appropriate space. Working closely with carers or parents to establish the best time for treatment is also a good idea. At certain times during the day, carers and parents are too busy to set up effective areas for treatment so it is beneficial to find the time that suits all parties. Hong et al. (2022) suggested the adjustment of treatment time or "dose" which is the amount of time therapy is conducted. Longer treatment times invite distraction, take up participant and family member time and eventually lead to a decrease in participant engagement. The efficient utility and management of time on the part of the therapists ensures that the client's time is not wasted (Ostrovsky et al., 2022). Lastly, the provision of a relatively close telehealth hub is again another solution to this problem. A nearby hub could be preset to the specifications of the treatment or training and could be established between communities in rural areas to be used by multiple groups of people. This solution however requires a certain level of infrastructure as well as an investment in equipment that may not be feasible without the aid of large institutions or the government.

**Limitations**

In the process of conducting this review, the researcher was met with several challenges and encountered several limitations.

Firstly, the limited number of studies that qualified for this study limits the conclusions that could be derived. This also suggests that there is a need for further research into the effectiveness and acceptability of delivering behavioural services via telehealth to rural populations. The specificity of the inclusion criteria likely left the researcher with a small number of articles available for review. This had inadvertently led to a restrictive review that is reduced in scope. Secondly, as each study took different approaches and used different types of the same technologies, the

effectiveness of any single behavioural intervention or technology cannot be definitively ascertained. Thirdly, this review was hindered by the fact that the timeframe of the studies had been before and after the COVID pandemic. Lastly, it is possible that telehealth studies targeting remote areas have only just started being published and would only grow in number in the coming years. Future studies would be able to make use of these new resources that had not been available at the beginning of this review.  Additionally, any attempts at replicating this review must be conducted sooner rather than later due to the increased likelihood that the technologies discussed may be replaced. Another approach that may also be considered for future study includes contrasting the changes in telehealth service delivery at different points before, during and after the COVID 19 pandemic.

**Suggestion for future research**

The field of telehealth delivered behavioural health services has become heavily saturated in the last three years owing to the COVID pandemic. This only bodes well as the evidence mounts supporting its efficacy, acceptability and helps it improve even more to better serve the people who need it most. As such, this review has illuminated several points of interest that may guide researchers in future telehealth studies not just for behavioural interventions but for telehealth as whole.

First and foremost, the concept of community telehealth hubs must be explored. A community telehealth hub has the potential to be the most efficient solution to the most common problems faced when implementing telehealth in rural areas before the problems of accessibility and technical skills are addressed. It provides an appropriate environment with good internet access, up to date technologies and personnel who can respond to any issues that may arise. These hubs

could be opened between several remote communities or within communities themselves, in small rural health units, community centres or in the case of Aotearoa New Zealand, in schools or in Maraes. Currently there are few articles discussing this as an option for implementing telehealth in rural areas, however, several studies in this review have considered and suggested them as possible solutions. Studies could be focused on the successful implementation of such hubs and the outcomes could mean better access to behavioural support for people in rural areas.

Secondly, further research could focus on determining the full extent of the impact of therapist involvement in behavioural telehealth services. One of the findings of this review was that the level of therapist, clinician or coach support increases the likelihood of the successful implementation of interventions. It reduces the likelihood of clients dropping out and not adhering to data submission guidelines and increases overall client satisfaction ratings. Future research could determine whether the type of therapist communication has any bearing on the parameters previously mentioned. It would be interesting to see if participants prefer videoconferencing or will instant messaging, chat applications or audio calls be sufficient. It is also important to note that though older generations and people from different demographic backgrounds and cultures may prefer more formal interactions, later generations may also have other preferences. This knowledge makes telehealth more adaptable and increases its success in rural areas.

## Conclusion

Telehealth is a versatile technology designed to deliver services to people not just within large metropolises but beyond, regardless of distance. The studies in this review and cited in the literature proved that behavioural services could indeed be

delivered by this means. Furthermore, people who live in rural areas can benefit from this service if it is adapted to best accommodate their needs. Not only is telehealth found highly effective for delivery to people in rural areas by the studies in this review, but participants also found them to be a very acceptable way of receiving treatment and were very satisfied with the interventions in general. The review has found that individual behavioural strategies such as contingency management as well as packaged programmes such as Cognitive Behavioural Therapies can be well adapted to be delivered via telehealth. Not only can they be applied directly to participants in the form of one-on-one sessions, but they could also be delivered in the form of group therapy. Behavioural strategies can also be used to support positive changes in lifestyle behaviour and to train parents and carers in providing interventions to the people they support.

The review noted four elements of telehealth delivered behavioural interventions that make them more effective. These elements are level of therapist involvement, convenience, cost-effectiveness, and comfort. The level of therapist involvement in the care of people who live in rural areas had a significant effect on the participants' engagement and completion rates. This means that, although telehealth promotes independence, therapists should still be on hand to provide support, encouragement, feedback, and reminders especially regarding the submission of research data or treatment outcomes. The remote nature of telehealth in addition to the isolation of rural areas adversely affects participants' level of engagement and this is where therapists and clinicians come in. The studies in this review which employed little to no therapist direct contact with participants suffered with poor generalisability and low overall validity due to low completion rates and missing data. Therapist involvement may not eliminate this issue, but it is possible to reduce the effect it has

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on the outcome of the intervention. The convenience of being able to receive treatment when you need it and in a schedule that best suits the client is a factor of telehealth that increases its effectiveness. Additionally, telehealth can save people in rural areas from having to make long trips to get the help they need as well as provide a more cost-effective alternative to regular treatment. Furthermore, telehealth allows for even participants with significant and debilitating challenging behaviours and symptoms of mood disorders to receive treatment from the comfort of their own home. This precludes the need to meet with a therapist face to face and allows clients to receive treatment in their own terms.

This review suggests that the best way to make use of telehealth to deliver behavioural services to people in rural areas is by utilising more than one form of telehealth. Synchronous telehealth via videoconferencing was most used by the studies in this review but a combination of multiple forms such as asynchronous, patient monitoring and even mobile telehealth may be the most effective method of delivering interventions and even training. Limiting the service to simply providing feedback to complete modules can lead to reduced levels of engagement, low completion rates and even poor data submission.

Lastly, we learned of the many difficulties people from rural areas experience when receiving behavioural treatment via telehealth. Technical issues remain the most common difficulty experienced by participants, which includes equipment issues and especially internet inaccessibility. In some cases, participants also have limited familiarity with the technology or programmes used for treatment, particularly participants of advanced age. The review suggests, based on the current available literature, that the best solution for this issue is to establish service centres close between rural communities that are easy to access and are well maintained by

therapists and technicians. This ensures that a knowledgeable person is on hand to help in cases of technical difficulties, and even educate and guide clients for optimal treatment success. The hub also allows for a quiet and controlled area for treatment that the client's home may not be best suited for due to the number of distractions, numerous sources of disruption and issues with privacy especially between adults. This problem, however, can be overcome simply by defining a schedule that allows participants to make themselves ready to receive treatment and providing gentle reminders before the start of a session so participants can prepare.

People in rural areas continue to experience a disparity in the level of service they are provided, especially when it comes to the need for highly specialised treatments like behavioural interventions. Telehealth has the potential to address the disparities that exist between rural and urban and allow for the same level of care to be delivered to everyone who needs it. This review has highlighted some of the ways telehealth can be made more effective, the challenges involved in its use and the ways these challenges can be overcome. Eventually, technology and accessibility will reach a point of seamlessness and convenience that would allow even those who live in the most rural of communities to receive behavioural treatment as if they were living in the largest cities. Until such time, it is the responsibility of behavioural researchers and scientists to optimise and adapt the technologies we have now, for the benefit of everyone equally.

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# Appendices

## Appendix A

Inter-Observer Agreement Form.

Level 1: Article title assessment.

Name of Observer: _Georgina Scott_  Date of Observation: _25 08 2022_

Number of Articles Included: ____49____  Number of articles excluded: _3_

Number of Agreed upon articles: _____  IOA Agreement Percentage: _____

**Inclusion Criteria**: Articles eligible for this level of assessment specifically include the words, "internet", "internet-based", "web-based", "online", "remote", "remote delivery", "telehealth", "telemental health", "tele-psychiatry", or "telerehabilitation" on their title.

**Exclusion Criteria**: Titles that *only* include the words "telephone", "cell phone", "smartphone", "computer", "applications", "eHealth", "wearable technology", "virtual", "digital", or "video treatment"; without including any of the words in the inclusion criteria.

**Instructions**: Please place a (/) mark on articles that meet the inclusion criteria and an (x) mark on articles that do not.

| ARTICLE NUMBER | ARTICLE TITLE | MEETS CRITERIA |
|---|---|---|
| 1 | Developing and implementing a web-based psychotherapy program to address mental health challenges among patients receiving oncologic and palliative care: Protocol for an open-label randomized controlled trial | / |
| 2 | A Web-Based Group Cognitive Behavioral Therapy Intervention for Symptoms of Anxiety and Depression Among University Students: Open-Label, Pragmatic Trial | / |
| 4 | Remote assessments and behavioral interventions in post-bariatric surgery patients | / |
| 5 | Provision of Care by "Real World" Telemental Health Providers | / |
| 6 | Telehealth-delivered group smoking cessation for rural and urban participants: feasibility and cessation rates | / |
| 7 | Delivering Transdiagnostic Treatment Over Telehealth During the COVID-19 Pandemic: Application of the Unified Protocol | / |
| 8 | Feasibility and Acceptability of a Remotely Delivered, Web-Based Behavioral Intervention for Men With Prostate Cancer: Four-Arm Randomized Controlled Pilot Trial | / |
| 9 | A secondary analysis of the role of geography in engagement and outcomes in a clinical trial of an efficacious Internet intervention for insomnia | / |
| 10 | Telemedicine Cognitive Behavioral Therapy for Anxiety After Stroke: Proof-of-Concept Randomized Controlled Trial | / |

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Inter-Observer Agreement Form.

| ARTICLE NUMBER | ARTICLE TITLE | MEETS CRITERIA |
|---|---|---|
| 11 | Internet-based treatment for older adults with depression and co-morbid cardiovascular disease: protocol for a randomised, double-blind, placebo controlled trial | / |
| 12 | Affirm online: Utilising an affirmative cognitive–behavioural digital intervention to improve mental health, access, and engagement among LGBTQA+ youth and young adults | / |
| 13 | Making Internet-delivered cognitive behaviour therapy scalable for cancer survivors: a randomized non-inferiority trial of self-guided and technician-guided therapy | / |
| 14 | Feasibility and Efficacy of the Addition of Heart Rate Variability Biofeedback to a Remote Digital Health Intervention for Depression | × |
| 15 | Development and evaluation of a remote training strategy for the implementation of mental health evidence-based practices in rural schools: pilot study protocol Remotely Delivered Interventions to Support Women With Symptoms of Anxiety in Pregnancy: Mixed Methods Systematic Review and Meta-analysis | / |
| 16 | Predicting treatment failure in regular care internet-delivered cognitive behavior therapy for depression and anxiety using only weekly symptom measures | / |
| 17 | Pragmatic Adaptations of Telehealth-Delivered Caregiver Coaching for Children with Autism in the Context of COVID-19: Perspectives from the United States and South Africa | / |
| 18 | Bringing Chronic-Pain Care to Rural Veterans: A Telehealth Pilot Program Description | / |
| 19 | The ANU WellBeing study: a protocol for a quasi-factorial randomised controlled trial of the effectiveness of an Internet support group and an automated Internet intervention for depression | / |
| 20 | Internet-Based Cognitive Behavioral Therapy via Videoconference for Patients With Bulimia Nervosa and Binge-Eating Disorder: Pilot Prospective Single-Arm Feasibility Trial | / |
| 21 | Formative Evaluation of an ABA Outreach Training Program for Parents of Children With Autism in Remote Areas | / |
| 22 | Therapist-supported online remote behavioural intervention for tics in children and adolescents in England (ORBIT): a multicentre, parallel group, single-blind, randomised controlled trial | / |
| 23 | Remote Intensive Group Behavioral Treatment for Families of Children with Selective Mutism | / |
| 24 | Parent Engagement With a Telehealth-Based Parent-Mediated Intervention Program for Children With Autism Spectrum Disorders: Predictors of Program Use and Parent Outcomes | / |
| 25 | Implementation of internet-delivered CBT for children with anxiety disorders in a rural area: A feasibility trial | / |
| 26 | Guidelines for establishing a telemental health program to provide evidence-based therapy for trauma-exposed children and families | / |
| 27 | Translating Cognitive Behavioral Therapy for Anxious Youth to Rural-Community Settings via Tele-Psychiatry | / |
| 28 | Feasibility, acceptability, and preliminary impact of telemedicine-administered cognitive behavioral therapy for adherence and depression among African American women living with HIV in the rural South | / |
| 29 | Internet-Based Cognitive Behavioral Therapy With Real-Time Therapist Support via Videoconference for Patients With Obsessive-Compulsive Disorder, Panic Disorder, and Social Anxiety Disorder: Pilot Single-Arm Trial | / |
| 30 | Fidelity of delivery and contextual factors influencing children's level of engagement: Process evaluation of the online remote behavioral intervention for tics trial | / |

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Inter-Observer Agreement Form.

| ARTICLE NUMBER | ARTICLE TITLE | MEETS CRITERIA |
|---|---|---|
| 31 | Therapist Training on Cognitive Behavior Therapy for Anxiety Disorders Using Internet-Based Technologies | ✓ |
| 32 | Psychotherapy by Telephone or Internet in Austria and Germany Which CBT Psychotherapists Rate It more Comparable to Face-to-Face Psychotherapy in Personal Contact and Have more Positive Actual Experiences Compared to Previous Expectations? | ✗ |
| 33 | Clinical and Cost Effectiveness of Online Cognitive Behavioral Therapy in Children With Functional Abdominal Pain Disorders | ✓ |
| 34 | Telemental Health For Youth With Chronic Illnesses: Systematic Review | ✓ |
| 35 | Telehealth behavior therapy for the management of type 1 diabetes in adolescents | ✓ |
| 36 | Telehealth and Autism: Treating Challenging Behavior at Lower Cost | ✓ |
| 37 | Effect of Internet-Based vs Face-to-Face Cognitive Behavioral Therapy for Adults With Obsessive-Compulsive Disorder: A Randomized Clinical Trial | ✓ |
| 38 | The predictive value of patient, therapist, and in-session ratings of motivational factors early in remote cognitive behavioural therapy for severe health anxiety | ✓ |
| 39 | Internet-Based Cognitive Behavioral Therapy With Real-Time Therapist Support via Videoconference for Patients With Obsessive-Compulsive Disorder, Panic Disorder, and Social Anxiety Disorder: Pilot Single-Arm Trial | ✓ |
| 40 | Development and Initial Evaluation of Web-Based Cognitive Behavioral Therapy for Insomnia "Nitecapp" in Rural Dementia Caregivers: A Mixed-Methods Study | ✓ |
| 41 | Computer-based treatment of poststroke language disorders: a non-inferiority study of telerehabilitation compared to in-person service delivery | ✓ |
| 42 | Internet Cognitive Behavioral Therapy for Women With Postnatal Depression: A Randomized Controlled Trial of MumMoodBooster | ✓ |
| 43 | Cognitive processing therapy for posttraumatic stress disorder delivered to rural veterans via telemental health: a randomized noninferiority clinical trial | ✓ |
| 44 | Telemedicine: a cost-reducing means of delivering psychotherapy to rural combat veterans with PTSD | ✓ |
| 45 | The complex association of barriers and interest in internet-delivered cognitive behavior therapy for depression and anxiety: informing e-health policies through exploratory path analysis | ✗ |
| 46 | Binge-eating disorder treatment goes online - feasibility, usability, and treatment outcome of an Internet-based treatment for binge-eating disorder: study protocol for a three-arm randomized controlled trial including an immediate treatment, a waitlist, and a placebo control group | ✓ |
| 47 | Transdiagnostic versus disorder-specific internet-delivered cognitive behaviour therapy for anxiety and depression in primary care | ✓ |
| 48 | The No Worries Trial: Efficacy of Online Dialectical Behaviour Therapy Skills Training for Chronic Pain (iDBT-Pain) Using a Single Case Experimental Design | ✓ |
| 49 | Developing a cognitive behavioral therapy for hypersomnia using telehealth: A feasibility study | ✓ |
| 50 | An Adjunctive Internet-Based Intervention to Enhance Treatment for Depression in Adults: RCT. | ✓ |

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Inter-Observer Agreement Form.

| ARTICLE NUMBER | ARTICLE TITLE | MEETS CRITERIA |
|---|---|---|
| 51 | A web-based self-management program for recent combat veterans with PTSD and substance misuse: program development and veteran feedback | ✓ |
| 52 | Web-based therapist-assisted cognitive behavioral treatment of panic symptoms: a randomized controlled trial with a three-year follow-up | ✓ |
| 53 | Telehealth Increases Access to Brief Behavioral Interventions in an Orofacial Pain Clinic During the COVID-19 Pandemic: A Retrospective Study | ✓ |

Observer signature: _____

# Appendix B

Level 2: Article Abstract Assessment.

Name of Observer: _____          Date of Observation: _____

Number of Articles Included: _____          Number of articles excluded: _____

Number of Agreed upon articles: _____          IOA Agreement Percentage: _____

**Inclusion Criteria**: Articles eligible for this level of assessment specifically include the words, "behaviour", "behavioural therapy", "behavioural intervention", "behaviour intervention" or "Cognitive-Behavioural Therapy" (CBT)

**Exclusion Criteria**: Articles are disqualified if they do not include the words in the inclusion criteria or if it *only* includes the word "cognitive" or "cognitive therapy".

**Instructions:** Please place a (/) mark on articles that meet the inclusion criteria and an (x) mark on articles that do not. This portion will require you to follow the link.

| ARTICLE NUMBER | ARTICLE TITLE | MEETS CRITERIA |
|---|---|---|
| 1 | https://doi.org/10.2196/30735 | |
| 2 | https://doi.org/10.2196/27400 | |
| 4 | https://doi.org/10.1186/s12877-016-0396-x | |
| 5 | https://doi.org/10.3389/fpsyg.2021.653652 | |
| 6 | https://doi.org/10.1136/bmjopen-2017-018345 | |
| 7 | https://doi.org/10.1016/j.janxdis.2016.06.002 | |
| 8 | https://doi.org/10.5664/jcsm.8750 | |
| 9 | https://doi.org/10.2196/26814 | |
| 10 | https://doi.org/10.1016/j.cbpra.2014.03.005 | |
| 11 | https://doi.org/10.1016/j.janxdis.2010.01.010 | |
| 12 | https://doi.org/10.1093/pm/pnab295 | |
| 13 | https://doi.org/10.2196/14754 | |

Observer signature: _____

| ARTICLE NUMBER | ARTICLE TITLE | MEETS CRITERIA |
|---|---|---|
| 14 | https://doi.org/10.1016/j.cgh.2017.10.004 | |
| 15 | https://doi.org/10.2196/34792 | |
| 16 | https://doi.org/10.1007/s10864-020-09376-4 | |
| 17 | https://doi.org/10.1111/papt.12341 | |
| 18 | https://doi.org/10.1080/23311908.2019.1637623 | |
| 19 | https://doi.org/10.1037/int0000225 | |
| 20 | https://doi.org/10.1186/s12888-020-02506-2 | |
| 21 | https://doi.org/10.1159/000508143 | |
| 22 | https://doi.org/10.1186/s13063-022-06520-5 | |
| 23 | https://doi.org/10.1007/s10826-017-0671-2 | |
| 24 | https://doi.org/10.3402/ejpt.v7.31019 | |
| 25 | https://doi.org/10.1186/1471-244X-13-296 | |
| 26 | https://doi.org/10.1016/j.jocrd.2013.07.002 | |
| 27 | https://doi.org/10.1352/1944-7558-123.6.574 | |

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Appendix C

What Works Clearinghouse Study Eligibility Review.

| Article Number | Type of Study | Baseline Equivalence | Outcome Measure | Assignment to conditions. | Composition al Change | Attrition Rate | WCC Rating |
|---|---|---|---|---|---|---|---|
| 1. | RCT | Meets WCC Standard | Meets WCC Standard | Meets WCC Standard | Meets WCC Standard | High Attrition rate | Meets WCC Standard without reservation. |
| 2. | QED | Meets WCC Standard | Meets WCC Standard | Meets WCC Standard | Not Applicable | Low Attrition rate | Meets WCC Standard without reservation. |
| 3. | QED | Meets WCC Standard | Meets WCC Standard | Meets WCC Standard | Not Applicable | Low Attrition rate | Meets WCC Standard without reservation. |
| 4. | QED | Meet WCC Standard | Meets WCC Standard | Meets WCC Standard | Not Applicable | Low Attrition rate | Meets WCC Standard without reservation. |
| 5. | QED | Meet WCC Standard | Meets WCC Standard | Meets WCC Standard | Not Applicable | Low Attrition rate | Meets WCC Standard without reservation. |
| 6. | RCT | Meets WCC Standard | Meets WCC Standard | Meets WCC Standard | Meets WCC Standard | Low Attrition rate | Meets WCC Standard without reservation. |
| 7. | RCT | Meets WCC Standard | Meets WCC Standard | Meets WCC Standard | Meets WCC Standard | Low Attrition rate | Meets WCC Standard without reservation. |