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van Boom, Storm. (2025). An Online Screening tool for Anxiety in the South African Population: A Systematic Review. [Master's dissertation, University of the Witwatersrand, Johannesburg]. WIReDSpace. https://hdl.handle.net/10539/48573

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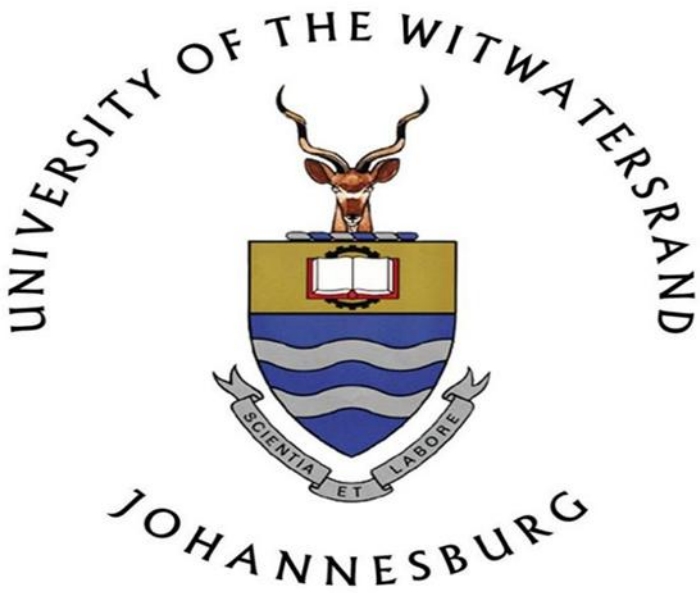

An Online Screening tool for Anxiety in the South African Population: A Systematic Review

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Declaration

A research project submitted in partial fulfillment of the requirements for the degree of MA by Coursework and Research Report in the field of Social and Psychological Research in the faculty of Humanities, University of the Witwatersrand, Johannesburg.

I declare that this research report is my own, unaided work. It has not been submitted before for any other degree or examination at this or any other university.

March 2025



Storm Muriel van Boom

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Acknowledgements

- To my supervisor Tasneem, for all of her knowledge, support, and patience throughout my postgraduate experience
- To the 2023 MASPR lecturers for their knowledge, time, and assistance
- To my mother and father, Hillary, and Royston, for all their support and encouragement in getting me where I am; and to my father for being my pillar of strength through the last few years
- To Adri, Heletje, and Riaan for their support and patience throughout this process
- To my fiancé Diaan, for his support and encouragement
- To my sisters, Roshana, and Maxine, for their patience and support
- To Mechael, Thalia, Nikita, and Tajme for their support and for keeping things light

Abstract

There has been an increase in Common Mental Disorders (CMDs), such as anxiety, over the past few years, especially following the outbreak of the Coronavirus (COVID-19) pandemic. This increase in CMDs has further implications regarding the shortage of mental health professionals and resources, as well as limited access to existing resources in Low-and Middle-Income Countries (LMICs). However, access to the internet has also increased in recent years, suggesting the availability of a platform to address mental health issues online, which is in alignment with the move to digitalizing health in South Africa. Therefore, this study aimed to identify what online screening tools for anxiety were available and appropriate for use in the South African general population through a systematic review. Twenty-two screening tools were identified, with the GAD-7 being the most commonly used tool amongst the included studies. The GAD-7 displayed appropriate psychometric properties when administered online, as well as when adapted, suggesting its applicability for use in the South African general population.

Keywords: digital health, GAD-7, online anxiety screening tools, psychometric properties, systematic review.

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Chapter One: Introduction and Rationale

Over the years, interest in mental health has increased, especially during the outbreak of the COVID-19 pandemic (Alibudbud, 2022; Hsu et al., 2019; Sharma-Misra et al., 2023). Similarly, efforts towards increasing the shift towards digitalizing healthcare systems, including mental health, have also increased over recent years, with South Africa moving towards this shift with the introduction of the National Digital Health Strategy for South Africa (National Department of Health [NDH], 2022). These increases, along with the increased prevalence of mental disorders such as anxiety worldwide, and amongst under-resourced countries, indicate that there is a need for the screening of mental disorders with tools that are accessible, affordable, trustworthy and contextually and culturally relevant. The provision of online mental health services is further important as such services has been associated with the potential of enhancing digital health through possibly enhancing mental health literacy and encouraging help-seeking behaviours amongst individuals with limited access (Sharma-Misra et al., 2023). Based on this, this study aimed to investigate the availability of psychometrically sound online anxiety screening tools that can potentially be adapted for use amongst the South African general population. In line with this aim, a systematic review methodology was conducted and yielded a variety of online articles via various databases and backwards citation that made use of online administrations of anxiety screening tools with proven reliability and/or validity.

The research report to follow will ensue in various chapters. Chapter one will introduce the study and outline the rationale; chapter two will discuss the literature review and theoretical framework; and chapter three will discuss the methodology, as well as some of the findings from the review. Furthermore, chapter four will discuss the results of the review as they pertain to the research questions. Lastly, chapter five will discuss the results,

strengths, weaknesses, and impact of the study, along with recommendations for future studies. Chapter five will also include the conclusion to the paper.

Rationale

Insufficient healthcare workers and resources capable of responding to mental health problems are common in LMICs (Bruckner et al., 2011; Edwards et al., 2023; Mughal et al., 2020; Nadkarni et al., 2015; World Health Organization[WHO], 2022). This lack of healthcare professionals within Africa is suggested by every 100 000 population only having 1.6 mental healthcare workers. This differs dramatically from every 100 000 population in Europe having 44.8 mental health workers (WHO, 2021). The .31 psychiatrists and .97 psychologists for every 100 000 South African public healthcare users further indicate the shortage of healthcare personnel in South Africa (Docrat et al., 2019). In addition to the shortage of mental health personnel, studies have also found an increase of mental health disorders, including that of anxiety, following the outbreak of the COVID-19 pandemic (Davy et al., 2021; Li et al., 2020; Moreno et al., 2020). This is evident in the increase of 301 million individuals around the world with anxiety-related disorders in 2019 to 374 million individuals living with anxiety in 2020, representing a 26% increase in anxiety-related disorders within the space of one year (WHO, 2022, p. 42). Thus, while there is a lack of healthcare personnel and resources, the rate of anxiety-related disorders continues to rise.

Although the COVID-19 pandemic undeniably had a negative influence on mental health, Moreno et al. (2020) have suggested that the pandemic can be used to encourage the reorganization of traditional healthcare approaches. This is especially true concerning the potential efficacy of screening for mental disorders via the internet, whereby screening tools allow increased access to healthcare information and monitoring of mental health (Hassem, 2022; Yom-Tov et al., 2023). In 2021 it was found that 77.5 % of South African households have at least one individual of whom has access to the internet, with mobile devices, such as

cellphones, providing access to 69.4% of households (Statistics South Africa, 2021). These statistics are suggestive of an increased availability of the internet to South Africans, which further suggests that South Africans would be able to access and benefit from an online screening tool for anxiety. Increased access is also important for the shift of South Africa towards digital health, which the NDH (2022) has stated will "provide opportunities to strengthen health systems", and "transform[ing] the way health services are provided" (p. 11), while also aligning with additional priorities of the health sector including "assist[ing] the country in dealing with the quadruple burden of disease, improving quality of care, improving maternal and child health, as well as support[ing] the health system transformation for NHI" (p. 11). Therefore, not only are online screening tools beneficial for enhancing mental health amongst South Africans, but also contributes to the transformation of the South African health sector as a whole.

With regards to there being a platform for online anxiety screening tools in South Africa, Mughal et al. (2020) stated in their systematic review that there was a shortage of validated screening tools for anxiety, as well as for other mental health disorders within LMICs. Furthermore, most of the anxiety screening tools identified in Mughal et al.'s (2020) study were not conducted on South African samples, with those that were, consisting of individuals with HIV, schizophrenia, or pregnant and antenatal women, with none conducted online (Andersen et al., 2011; Bantjes et al., 2019; Marsay et al., 2017; Myer et al., 2008; Seedat et al., 2007; Spies, Kader, et al., 2009; Spies, Stein, et al., 2009; van Heyningen et al., 2018). This relates to another systematic review which investigated the validity of screening tools for CMDs within LMICs finding only 24 validated screening tools for anxiety-related disorders, with 175 being validated for depression (Ali et al., 2016). The review by Ali et al. (2016) was similar to the review conducted by Mughal et al. (2020) in that the majority of the samples consisted of clinical samples such as clinic patients, individuals with HIV, trauma

survivors, and individuals with mental disorders. Furthermore, Ali et al. (2016) had also not reported if CMDs were measured online.

Screening tools need to be specific to South Africa, and the way South Africans understand mental disorders such as anxiety, as assessments that contain cultural or local idioms of distress may enhance the validity of such assessments amongst the respective culture or context (Cork et al., 2019). An idiom of distress appropriate for use in Africa, including South Africa, appears to be "thinking too much" (American Psychiatric Association [APA], 2013; Backe et al., 2021; Calitz et al., 2011; den Hertog et al., 2016). This idiom has been associated with experiencing somatic symptoms, such as body aches and headaches, as well as being associated with experiences of anxiety (Backe et al., 2021). Cork et al. (2019) have further stated that assessments and interventions that contain idioms of distress have the potential of enhancing communication between patients and practitioners, as well as reducing stigma. This is important in the South African context where mental health resources are scarce, and stigma is commonly experienced amongst those with mental illness, or amongst those who associate with individuals with mental disorders (Monnapula-Mazabane & Petersen, 2023). This highlights the importance of more information regarding psychometrically sound tools, such as valid screening tools for anxiety that are specifically suited to the South African general adult population, and within an online space. Thus, through the conduction of a systematic review, this study investigated the availability of online anxiety screening tools and their adaptability for use in the South African adult population.

In addition to the importance of an online anxiety screening tool for South Africa, the WHO has also emphasized mental health as a fundamental component in its Sustainable Developmental Goals (SDGs). The WHO (2022) has linked mental health to all 17 of its SDGs, including the third SDG (SDG 3) of Good health and Wellbeing, whereby mental

health is stated as being an “integral part of general health and wellbeing” (p. 96). The World Health Assembly (WHO, 2018) has also identified digital health as contributing to achieving the SDGs by supporting health systems in their health promotion and disease prevention strategies, as well as in improving the accessibility and affordability of mental health services. Furthermore, in South Africa’s shift to digital health, as stipulated in the National Digital Health Strategy for South Africa (NDH, 2022), digital health will contribute to South Africa meeting SDG 3 through electronic health records, which aim to improve patient management and access to medication, the linking of information systems, and the growth of health promotion amongst vulnerable groups. The results of this study will thus not only contribute to SDG 3 by promoting a tool capable of ongoing monitoring of mental health, but also contribute to the relationship between SDG 3 and the National Digital Health Strategy for South Africa by increasing patient management and the promotion of health amongst South Africans.

Chapter Two: Literature Review

This chapter discusses the literature pertinent to this study, while elaborating on its aim and research questions. The literature is discussed as it pertains to the current state of mental health in South Africa, the history and diagnosis of anxiety, and anxiety within the context of South Africa. The advantages and disadvantages of online screening tools, and its availability and usefulness in South Africa will also be discussed. Finally, the literature review also discusses the theoretical framework underpinning the study, its history, advantages and disadvantages, and its applicability to understanding anxiety.

The Current State of Mental Health in South Africa

Mental health has become of increasing importance within South Africa. This is evident by the country hosting its first conference (the South African Mental Health Conference (SAMHC)) centered on mental health in April of 2023 (Morar et al., 2024). The SAMHC addressed increasing prevalences of distress in recent years, where South Africa was found to be within the bottom four countries with the lowest mental wellness; while also being amongst the top five countries with the greatest distressed individuals, as found in a global survey measuring mental wellness trends (Morar et al., 2024; The Mental State of the World in 2022, 2023).

According to the WHO (2022), 80% of individuals with mental health disorders live within LMICs. The WHO (2022) further reported anxiety as being the most prevalent disorder in 2019, as well as in 2020, following the outbreak of the COVID-19 pandemic, which caused a period of increased psychological distress worldwide. The influence of the pandemic on mental health was further evident in a survey conducted by the South African Depression and Anxiety Group [SADAG] (2020), which found that 55% of the main challenges experienced by South Africans during the lockdown was anxiety and panic. Moreover, in a recent study, the rate of probable anxiety amongst populations across the nine

provinces of South Africa was found to be 17.8% (Craig et al., 2022). These statistics indicate the high prevalence rates of anxiety worldwide and in South Africa. This is concerning considering the limited information, and thus knowledge, about Generalised Anxiety Disorder (GAD) and other anxiety disorders, as was found in a systematic review by Edwards et al. (2023). Therefore, whilst more recent statistics on the prevalence of anxiety in South Africa is scarce, as well as there being limited knowledge about anxiety, available data still suggests the high rates of anxiety.

Based on these statistics, it is evident that addressing mental health disorders need to be of rising concern. This is especially true of anxiety-related disorders, whereby early detection has been associated with identifying and providing individuals in need with specialised care, further contributing towards the cost-effectiveness of treatment (van Krugten et al., 2021). Cost-effective treatment is further important for LMICs like South Africa, where re-admissions of mental health inpatients resulted in 18.2% of South Africa's expenditure on healthcare (Docrat et al., 2019). As mentioned in the rationale above, LMICs have limitations regarding their available healthcare workers and resources, making it challenging for LMICs to confront some of the issues surrounding mental healthcare and access (Bruckner et al., 2011; Edwards et al., 2023; Mughal et al., 2020; Nadkarni et al., 2015; WHO, 2022). Some of these limitations include the inaccurate provision of diagnoses and treatment; a lack of guidelines for responding to psychiatric-related emergencies; ongoing mental health stigma; limited research on the necessary interventions and policy needed to address mental health treatment gaps; and the isolation of health resources to physical conditions (Edwards et al., 2023; Nadkarni et al., 2015; Wainberg et al., 2017). Furthermore, best practices have been suggested to include personalising mental health services according to the health system, as well as introducing preventative strategies for mental disorders as opposed to relying solely on treatment (Wainberg et al., 2017). This suggests that in addition to providing effective

treatment, understanding healthcare systems and their nuances, such as their limitations, are further important when embarking on implementing accessible mental health services and resources.

Thus, considering the limitations within the field of mental health mentioned above, as well as the alarming numbers of mental disorders worldwide and in South Africa, the investigation of reliable and valid online screening tools that could counter some of these issues would be of great benefit to a LMIC like South Africa.

The History of Anxiety and Diagnosis

In their article discussing the role of anxiety in the history of psychiatric epidemiology, Murphy and Leighton (2009) suggest that "review[ing] past work as[is] a contribution to current and future thinking about the psychiatric phenomena of anxiety" (p. 1056). This suggests the importance of understanding prior understandings and experiences of anxiety in order to understand more current understandings, diagnoses, and experiences. Murphy and Leighton (2009) have also stated that the nosology of anxiety had evolved from symptoms emphasizing bodily states, to more recently, symptomology concerning cognitive experiences as well.

In relation to the statement made by Murphy and Leighton above regarding the association of anxiety as secondary symptomology, Crocq (2015) has also suggested that the first edition of The Diagnostic and Statistical Manual of Mental Disorders (DSM) often associated anxiety as a symptomology of psychoneurotic disorders, where anxiety could be directly felt, or unconsciously influenced by other 'mechanisms' such as depression. The occurrence of anxiety with other disorders has fed into the complications associated with diagnosing anxiety. One complication includes the difficulty in differentiating anxiety disorders with depression (Angst & Vollrath, 1991). This complication continues into contemporary practice with depressive disorders being frequently listed as a differential

diagnosis for some anxiety-disorders, including Social Anxiety Disorder (SAD), Agoraphobia, and GAD (APA, 2013).

Furthermore, within the second edition of the DSM, anxiety was categorised under 'Neuroses', while still associated as being directly felt and expressed, or unconsciously influenced by other experiences (Crocq, 2015). This relates to another diagnostic complication associated with anxiety as discussed by Angst and Vollrath (1991), which includes diagnostic stability. Diagnostic stability was stated to be an important factor for revisions of the DSM, due to difficulties in distinguishing transdiagnostic symptoms of different anxiety disorders within a categorical approach to diagnosis (Hovenkamp-Hermelink et al., 2016). This is an important factor to consider for construct validity, as complications in distinguishing symptoms across various anxiety disorders could be suggestive of the non-existence of separate anxiety disorders, but rather as one disorder with varying specifications (Hovenkamp-Hermelink et al., 2016). Angst and Vollrath (1991) have stated that diagnostic stability of anxiety over the years is low, with many individuals previously diagnosed with anxiety being later diagnosed as having pure depression, or a mix of anxiety and depression, with a diagnostic stability of 'pure anxiety' being low. In their study of diagnostic stability of anxiety disorders, Hovenkamp-Hermelink et al. (2016) further concluded that 'pure anxiety', which they defined as the presentation of one anxiety without other comorbid anxieties, were not stable overtime. This again relates to the description of anxiety stated above by Murphy and Leighton (2009), who noted that anxiety was often associated as a secondary symptom of other disorders such as depression. Hovenkamp-Hermelink et al. (2016) further concluded that individuals with chronic anxiety had less stability than those with non-chronic anxiety, with authors concluding that these results are indicative of the changing nature of anxiety. Therefore, anxiety remains an experience that is

in need of further investigation, especially as it involves factors such as diagnostic stability and differential diagnosis.

It was with the third edition of the DSM where anxiety had three subcategories, including phobic disorders, anxiety states, and post-traumatic stress disorders, with the 'anxiety states' being further divided into Panic Disorder (PD) , GAD, and Obsessive Compulsive Disorder (OCD) (Crocq, 2015). Crocq (2015) has also stated that the DSM-III-R prevented the diagnosis of an anxiety disorder if depression was diagnosed as a comorbid disorder. This links to earlier conceptions of anxiety as a secondary symptomology of other disorders as discussed by Crocq, and the complications associated thereof. In the fifth edition, the DSM-5 divided anxiety disorders into three spectrums, including anxiety, OCD, and trauma- and stressor- related disorders (Crocq, 2015). These organisations were based on groupings of anxiety disorders with shared "fear circuitry", and differed from the DSM-IV in the removal of OCD and PTSD from the anxiety chapter, the renaming of 'social phobia' to 'social anxiety disorder', and the allowance for the diagnosis of agoraphobia independent from a diagnosis of panic disorder (APA, 1994; Regier et al., 2013, p.94). Anxiety disorders are thus situated under a specific category based on the genetic and psychological characteristics associated with the disorder. This includes presentations of hoarding behaviour and compulsions being categorised under OCD, and disorders related to traumatic experiences under trauma- and stressor- related disorders.

Regarding contemporary understandings of anxiety, mental disorders are currently diagnosed using the DSM-V-TR (APA, 2022) and The International Classification of Diseases, 11th revision (ICD-11; WHO, 2018). According to the DSM-V-TR (APA, 2022), harmony between the DSM-V-TR and the ICD was deemed necessary to ensure a similarity of categorization of mental disorders. This symmetry can be seen in both the DSM-V-TR and the ICD-11 considering anxiety disorders to be characterized by excessive fear and anxiety

(APA, 2022; WHO, 2018). The DSM-V-TR (APA, 2022) differentiates between fear and anxiety by differentiating between the influence of time, whereby fear is a response to an "immediate" threat, whereas anxiety is a reaction to an "anticipated" and therefore "future" threat (p. 189). The DSM-V-TR (APA, 2022) further states that anxiety-related disorders need to last for six or more months, making them persistent, and exceed acceptable cultural reactions to stimuli, making them excessive. Similar to the ICD-11 (WHO, 2018), the DSM-V-TR (APA, 2022) states that anxiety and fear-related disorders result in the experience of distress and impairment that can have negative effects on one's family, personal, social, and occupational functioning. The DSM-V-TR (APA, 2022) chapter on anxiety provides diagnostic criterion for various anxiety-related disorders, including: separation anxiety disorder; selective mutism; SAD; GAD; PD; and agoraphobia, with the DSM-V-TR (APA, 2022) providing further criteria for other specified anxiety disorder; unspecified anxiety disorder; anxiety disorder due to another medical condition, and substance-induced anxiety disorder. The ICD-11 (WHO, 2018) provides diagnostic criterion for these same disorders, as well as for specific phobia; other-specified anxiety- and fear-related disorders; and anxiety- and fear-related disorders, unspecified.

For the purpose of this study, databases were searched for anxiety as it is referred to in a broad and more general sense, and which will include GAD, state and trait anxiety, and worry. The DSM-5 and DSM-V-TR (APA, 2013; APA, 2022) refer to GAD according to six criteria, which include: A) the presence of excessive worry that occurs for six or more months; B) the worry being beyond the individual's control; C) the worry being accompanied by three of more additional symptoms (such as restlessness, fatigue, poor concentration, irritability, muscle aches, and sleep disturbances); D) the worry causing significant impairment with problematic effects on various aspects of the individuals life, such as their social, personal, or work life; E) the worry not being related to the effects of medication; and

lastly, F) the worry not being the result of another mental disorder or condition. The ICD-11 (WH0, 2018) further states that GAD often involves worries pertaining to the occurrences of everyday life, including family, health, finance, school, and work.

The DSM-V-TR (APA, 2022) further adds that the more phenomena the individual worries excessively about, the more likely the individual is of meeting the criteria for GAD. In addition to the muscle tension that may be an accompanying symptom of GAD, other somatic symptoms might be experienced as well, including twitching, nausea, digestive issues, exaggerated startled responses, and shortness of breath, amongst others (APA, 2022). This study will also focus on tools relating to state and trait anxiety, where state anxiety refers to current feelings of worry or fear accompanying the activation of the autonomic nervous system, while trait anxiety refers to the predisposition an individual may have to having feelings of worry or anticipations of threat (Spielberger et al., 1970, as cited by Donzuso et al., 2014). These definitions of anxiety are important to the study as they reflect the broad depictions of anxiety as defined by the DSM-V-TR and ICD-11, where anxiety is defined as the anticipation of threat, or excessive worry.

With the latest revision of the DSM, the DSM-V-TR introduced few changes that directly affect the diagnosis of anxiety, as “text revision did not include conceptual changes to the criteria sets or to other DSM-5 constructs” (APA, 2022, p. xxi). Revisions to the DSM-5 included the addition of disorders, such as prolonged grief disorder, unspecified mood disorder, stimulant induced mild neurocognitive disorder, and free-standing symptom codes which allow practitioners to document the occurrence of injury with some suicidal intent or non-suicidal injury, independent of the presence of a psychiatric disorder (First et al., 2022). Further revisions include changes to the diagnostic criteria or clarification of specifiers for 70 disorders; and the introduction of new terminology, such as “antipsychotic medications” over

“neuroleptic medications”, and “experienced gender” over “desired gender” (First et al., 2022, p. 219). However, these are not specific to anxiety.

Further revisions include the creation of the Ethnoracial Equity and Inclusion Work Group to ensure that the DSM-V-TR includes considerations of racism and discrimination when looking at ethnoracial or culturally-specific presentations (First et al., 2022). The influence of the Ethnoracial Equity and Inclusion Work Group is evident in the DSM-V-TR section discussing GAD, where it is stated that “higher prevalence is associated with exposure to racism and ethnic discrimination and, for some ethnoracial groups, with being born in the United States” (APA, 2022, p. 253). This acknowledgement of the effects of racism and discrimination on the experience of GAD has not been explicitly stated within the DSM-5 (APA, 2013). While the explicit acknowledgement of the effects of racism and discrimination on GAD as it occurs within the United States have been introduced into the revised DSM-5, there is no acknowledgement of how anxiety may be experienced in South Africa, despite the acknowledgement of culturally specific presentations of various anxiety disorders relative to other countries, such as Japan, Korea, Vietnam, and Cambodia (APA, 2013). This lack of acknowledgement within the DSM’s latest edition further suggests the importance of adapting anxiety screening tools to the South African context, whereby tools need to be capable of measuring anxiety, while also recognising the influence of sociopolitical history and reality on experience.

Applicability of the DSM-V-TR in South Africa

With consideration of the DSM system of various anxiety-related disorders, and the importance of acknowledging the influence of sociopolitical history and reality on the experience of mental health and illness, it is important to discuss the applicability of this system in relation to South Africa. This is important because South Africa uses the DSM classification system to diagnose mental disorders (Schoeman et al., 2024). LMICS like

South Africa experience a variety of challenges regarding mental healthcare. These include a lack of infrastructure and human resources, poor mental health awareness, and differing explanatory models (Wainberg et al., 2017).

The DSM-5 was developed after 20 years of research by 400 professionals from multiple countries and academic centers across North America, where professionals were involved in field trials for the revision of the DSM-IV (Allgulander, 2013; APA, 2013). However, it is important to consider if these revisions were inclusive of, and therefore appropriate for application to the South African context and South African understandings of mental health and anxiety. As discussed earlier, while the DSM-V-TR has reviewed text in acknowledgement of the effect of racism and discrimination on mental disorders (First et al., 2022), this acknowledgement in terms of GAD has been specifically referred to within the context of the United States and is thus not entirely specific to South Africa. This is due to racism having different historical contexts in the two countries, as well as the two countries experiencing racism differently. For example, a study found that South African Black individuals experience racism in terms of racial differences in socioeconomic status (SES) compared to White individuals more than Americans do, whilst Black Americans experience more psychological effects of racism, such as lowered self-esteem, than Black South Africans do (Williams et al., 2012). These differences are important for understanding experiences of anxiety, as GAD includes worrying about various aspects of daily living, including work, family, and social life (APA, 2022). Thus, the anxiety surrounding the specific aspect of daily living may differ between the two countries, for which the revised DSM-5 does not specifically account for.

Moreover, information regarding how different cultures in Africa and South Africa view and define symptoms of mental health and illness, including that of anxiety, is scarce (Atwoli et al., 2022; Benjamin et al., 2022; Mkhwanazi & Gibbs, 2021). However, general

perceptions of mental health amongst South Africans are suggested to be highly influenced by culture. A study finding low prevalence rates of SAD were suggested to indicate the reduced ability of the DSM criteria in identifying the influence of culture on mental health (Hofmann et al., 2010). However, *taijin kyofusho* is stated within the DSM-V-TR as being a culturally-specific presentation of social anxiety amongst Korean and Japanese individuals, characterized by individuals meeting criteria for SAD, but experiencing the fear of offending others, as opposed to being embarrassed by others (APA, 2013; Hofmann et al., 2010; Regier et al., 2013). This culturally-specific presentation of SAD is related to the collectivist nature and interdependent self-construal's practiced by various Asian cultures, whereby the influence of an individual's behaviour on their society as a whole is considered of high importance (Hofmann et al., 2010; Hofmann & Hinton, 2014). Acknowledging the influence of how mental health and disorder is understood by collectivist societies is further important for the South African context, as various cultures can be defined as being collectivist, based on the emphasis on interdependent relationships (Daniels & Isaacs, 2023; Engelbrecht & Kasiram, 2012; Ujewe, 2018).

Cultures within the regions of Africa and Asia may be defined as being collectivist in nature. However, only the culturally-specific presentations of SAD as characteristic of some Asian cultures are integrated into the DSM-V-TR, with the DSM-V-TR not acknowledging South African culturally-specific presentations, or the more widespread African worldview of Ubuntu (APA, 2022). The exclusion of Ubuntu from the DSM-V-TR is problematic, as practices of Ubuntu may prove beneficial to the field of mental health by reducing the challenges surrounding mental illness, such as lack of support and stigma (Engelbrecht & Kasiram, 2012). This exclusion further reinstates the DSM-V-TR as being limited in its ability to provide culturally-specific guidelines to mental health professionals when diagnosing South African and African individuals with various mental disorders.

The lack of cultural specificity is evident in a study finding that the Zulu culture and language conceptualises individuals as either “mad or non-mad” (Daniels & Isaacs, 2023, p.49), which suggests a binary approach to mental illness within the Zulu culture, as opposed to a dimensional approach. This conflicts with the DSM-5 asserting “…dimensional approaches to mental disorders” and associating such an approach with “increase[ing] the validity of a diagnosis” (APA, 2013, p. 5). This suggests an incoherency between how the DSM approaches mental disorders, and the way mental illness is understood within the Zulu culture, which further suggests a possible inaccuracy in how the DSM makes valid diagnoses of mental disorders. Similarly, a study conducted with Sesotho-speaking individuals diagnosed with anxiety disorders found that presentations of anxiety or distress differed to that as is commonly seen in western cultures (Calitz et al., 2011). These presentations included perceptual disturbances, such as visual and auditory hallucinations, including hearing voices and seeing unsettling images (Calitz et al., 2011). Calitz et al. (2011) stated that such presentations are not a common presentation of anxiety amongst western cultures, as such symptoms would be indicative of psychotic disorders, and not anxiety. However, these symptoms were not declared to be of a psychotic nature amongst participants, but rather of anxiety (Calitz et al., 2011). This highlights the differing presentations of anxiety in western cultures versus in more collectivist cultures.

Differing presentations of anxiety as is seen in western cultures is also seen with Brain Fag Syndrome (BFS) and Kufungisisa. BFS is a culture-bound syndrome common in West Africa most commonly experienced by youth in academia and associated with various symptoms, including pain, itchiness, irritation of the eyes, poor concentration and difficulties learning (Aina & Morakinyo, 2011; Calitz et al., 2011;). The DSM-5 (APA, 2013) further asserts that BFS is associated with “thinking too much”, which the DSM-5 has stated as being a common idiom of distress within many countries in Africa, East Asia, Latin America, and

the Caribbean. As mentioned above, “thinking too much” has also been associated with experiences of anxiety (Backe et al., 2021). Similarly, Aina and Morakinyo (2011) have stated that BFS has commonly been associated as a type of depressive or anxiety disorder, often treated by cognitive-behavioural therapy and antidepressants. It is arguable that the DSM-5 (APA, 2013) does acknowledge that various cultures may experience, and express anxiety differently based on somatic or cognitive symptomology. This is suggested by ‘*Kufungisisa*’, a Shona cultural idiom of distress within Zimbabwe associated with anxiety symptoms of excessive worry, irritability, and depression, and translated to also mean “thinking too much”, being included within the appendix of the DSM-5, along with BFS (APA, 2013). However, specific expressions or idioms capable of identifying culturally specific symptomology, whether somatic or cognitive, are not incorporated within the diagnostic criteria of any anxiety disorders. This contributes to the challenges associated with diagnosing anxiety, whereby anxiety has many differential diagnoses for each anxiety disorder, with these differential diagnoses often overlapping.

The importance of consideration of cultural experiences of distress, including predominantly somatic symptoms; idioms of distress regarding GAD; and diagnostic validity is evident in a study measuring the construct validity of the face-to-face and Sesotho administered seven items of the GAD (GAD-7) amongst a sample of Tuberculosis patients in Free State, South Africa. In this study it was found that the commonly used one factor (general anxiety) model of the GAD-7 was surpassed by a two-factor (somatic and cognitive) model amongst the sample of Free State patients (Kigozi, 2021). Furthermore, the two-factor model was further improved when allowing two items (“‘Not being able to stop or control worrying” and “Worrying too much about different things”) to covary (Kigozi, 2021, p. 3). Similarly, in a psychometric study conducted amongst adult women in Soweto, researchers found adequate fit for a two-factor model of depression and anxiety with somatic and

cognitive subtypes which they attributed to the high likeliness of the population in reporting symptoms of mental disorders as they pertain to physical and mental discomfort (Hart et al., 2025). Similarly, Calitz et al. (2011) found that the experiences of anxiety expressed by Sesotho individuals were similar to those reported in other African cultures, and included the experience of excessive worry and irritability, as well as physical symptoms such as headaches, sweating, and insomnia. Therefore, the results of these studies suggest the importance of not only considering somatic and cognitive experiences of distress, but how these experiences (along with language) might influence the structure of diagnostic tools, and their usage in specific samples.

In addition to the importance of collectivist and somatic and cognitive symptomology defined above, Daniels and Isaacs (2023) found that conceptualizations of mental illness amongst Zulu individuals were possibly influenced by the geographical locations of participants, whereby individuals within rural areas would hold more traditional views of mental illness, associated with spiritual beliefs, as opposed to individuals living in urban areas. This relates to the contribution of cultural expressions in understanding anxiety as discussed by Calitz et al. (2011), where Sotho speaking participants experiencing anxiety expressed their anxiety through cultural expressions directly translated to mean “talking with the heart” as an expression of excessive worry; “thinking deeply” to express mental exhaustion; “hot head” to express mental confusion; and “feeling dirty” to relate experiences of depersonalisation and derealisation (p. 445). From this, Calitz et al (2011) suggested the importance of classification systems of mental disorders being more inclusive of the varying cultural expressions of anxiety. However, this nuance is not reflected within the DSM-5 criterions of anxiety-related disorders. Therefore, despite the inclusion of 400 individuals throughout 39 countries in the revision of the DSM-IV into the DSM-5, it is important to question the contribution of South African, (and broader African), professionals in these

revisions (Burns & Alonso-Betancourt, 2013). Based on the importance of cultural specificity in diagnosing mental illness as discussed above, the absence of South African contribution to the creation of the DSM-5 poses various challenges for the validity of the main diagnostic system used in South Africa.

In addition to the importance of cultural understandings of mental disorders discussed above, it is further important to consider the sociohistorical contexts of individuals before issuing diagnoses of mental disorders. Where the DSM-5 (APA, 2013) appears to acknowledge the importance of culture in mental illness through its Cultural Formulation Interview used to assess the cultural contexts of individuals, criticism exists regarding the extent to which the DSM-5 is sensitive to the sociopolitical histories of postcolonial settings, such as South Africa. Such criticism suggests a malpractice of applying the DSM-5 to populations without careful consideration of the impacts of the longstanding legacies of colonialism, and the political, social, and economic marginalization and disadvantage of such populations (Kriegler, 2015). The implications of the legacy of colonialism and apartheid is evident in the findings of a study investigating the influence of social and historical context on mental health, where Black South Africans were found to experience more exposure to traumatic events, life stressors, and psychological distress in comparison with other racial groups (Harriman et al., 2022). Harriman et al. (2022) related these findings to the long-lasting effects of colonialism and apartheid, whereby Black South Africans were more likely to experience discrimination-related stress, while being less likely of receiving adequate access and treatment to mental healthcare, both pre- and post-apartheid. Thus, the experience of psychological distress and possible mental illness in South Africa is likely to be influenced by the effects of the country's sociopolitical history.

The effects of the sociopolitical history include the ongoing experiences of poverty, social inequality, and unemployment that post-apartheid South Africa is challenged with

experiencing (Tshishonga, 2019). As discussed earlier, Mkhwanazi and Gibbs (2021) found that experiences of food poverty and unemployment were risk factors for GAD amongst a sample of residents in an informal settlement in South Africa. Mkhwanazi and Gibbs (2021) further attributed the ongoing experiences of poverty and unemployment to the legacy of apartheid. The findings of this study thus highlight the role that sociopolitical history in South Africa plays in the experience of mental distress and disorder. Therefore, the application of a diagnostic system or screening tool for the adult South African population will need to consider these effects and their impacts on diagnosing individuals with mental disorders, including that of anxiety-related disorders.

Anxiety Screening Tools in South Africa

There are various anxiety screening tools that have been used in South Africa. These include the Beck Anxiety Inventory (BAI); GAD; Hospital Anxiety and Depression Scale-Anxiety (HADS-A); Patient Health Questionnaire-4 (PHQ-4); the Kessler six (K6) and 10 (K10); the Hamilton Anxiety Rating Scale (HAM-A); the Edinburgh Postnatal Depression Scale (EPDS); the State-Trait Anxiety Inventory (STAI); the Depression, Anxiety and Stress Scale (DASS-21) and the E-mwtool-3 (Basaraba et al., 2023; Hill, 2022; Mughal et al., 2020). Of these tools, many measure both anxiety and depression within the same tool, including the PHQ-4, the K6 and 10, the DASS-21, and the E-mwtool-3. This may prove problematic in differentiating between symptoms of anxiety and depression. Furthermore, majority of these tools (HADS-A, K6, K10, and the STAI) are based on DSM-IV criteria (Mughal et al., 2020). This is important when considering that the change from the DSM-IV to the DSM-V-TR regarding anxiety included the removal of OCD and PTSD related disorders from the chapter on anxiety, the renaming of ‘social phobia’ to ‘social anxiety’, and the diagnoses of agoraphobia separately from panic disorder (APA, 1994; APA, 2022). This

suggests that these tools are based on an outdated diagnostic criteria, with the DSM currently being in its revised fifth edition (APA, 2022).

In Mughal et al.'s (2020) systematic review looking at validated screening tools within LMICs, the most commonly used tool for anxiety in South Africa was the GAD and the K-10. The studies referencing the tools within Mughal et al.'s review were all administered via face-to-face interviews, and amongst pregnant women (Spies et al., 2009; van Heyningen et al., 2018). However, despite not being administered to a general population, nor via an online platform, the tools did display acceptable to good reliability ($\alpha > .8$ for K-10, and $\alpha > .7$ for the GAD-2) (van Heyningen et al., 2018). Mughal et al. (2020) also reported the validity of the tools from the studies, where the K-10 obtained 76% sensitivity and 70% specificity; and the GAD-2 obtained a sensitivity of 64% and specificity of 74% (van Heyningen et al., 2018). Similarly, both the K-10 and GAD-2 were validated in the South African population, while also translated to participants in their language of choice from a selection of English or Afrikaans (Spies et al., 2009; van Heyningen et al., 2018). Despite the translation and administration of the K-10 in Afrikaans, the K-10 was stated as having agreeable validity in diagnosing anxiety disorders amongst pregnant women (Spies et al., 2009). This suggests that tools can be adapted and still remain psychometrically sound.

A common version of the GAD is the GAD-7. The GAD-7 is a measure of general anxiety disorder and has been shown to demonstrate excellent psychometric properties. The GAD-7 was established by Spitzer et al. (2006) who used the DSM-IV symptom criteria to establish a questionnaire to measure anxiety amongst a patient sample from 15 primary health clinics. In their study, Spitzer et al. (2006) concluded that the GAD-7 was a reliable and valid measure of anxiety, where the GAD-7 demonstrated excellent internal consistency reliability (Cronbach $\alpha = .92$) and test-retest reliability (intraclass correlation = 0.83); as well as good convergent validity indicated by its strong correlations with other measures of anxiety (such

as the Beck Anxiety Inventory (BAI) (r = 0.72) and the anxiety subscale of the Symptom Checklist-90 (r = 0.74)) in its initial study. Furthermore, the GAD-7 has also demonstrated its factorial validity, with its seven item version, as opposed to its 15 item version, demonstrating suitable fit as a measure of anxiety (Spitzer et al., 2006).

In a more recent study, audio assisted self-interviews in the form of questionnaires were administered to a sample of adults from informal settlements in South Africa and included the GAD-7 (Mkhwanazi & Gibbs, 2021). Questionnaires were translated and back translated from English to isiZulu and isiXhosa, with the GAD-7 yielding a Cronbach's alpha of .87, with the study not indicating if any of the items needed to be changed (Mkhwanazi & Gibbs, 2021). The Cronbach's alpha of Mkhwanazi and Gibbs'(2021) study being >.8 after being translated to two different languages from English with no mention of item adaptation demonstrates the reliability of the tool and its applicability for use amongst South Africans. The consistency and validity of this measure, whilst being validated or translated to participants in their language of choice, demonstrates the usefulness of the tool amongst South Africans. However, most of the samples from these studies consisted of clinical samples made up of adult HIV and Schizophrenic patients and pregnant and antenatal women, with only two studies containing samples appearing to be from the general population. This suggests the need for more screening tools that are applicable for the general population, while also administered online.

An Online Space for Mental Health

In addition to the acceptable psychometric properties of the tools used amongst South Africans, there is space for tools to be conducted online. In their systematic review, Gama and Laher (2024) investigated the efficacy of mental health apps and found that such apps were increasing in numbers and provide the opportunity for enhanced access to affordable mental healthcare amongst LMICs. Gama and Laher (2024) further stated the usefulness of

mental health apps for providing mental healthcare in under-resourced areas. This point was also emphasised in the 'WHO/International Telecommunication Union (ITU) National eHealth Strategy Toolkit', which South Africa has consulted for their quest in improving healthcare systems through the incorporation of digital technology (NDH, 2022). Furthermore, as part of the National Digital Health Strategy for South Africa (NDH, 2022) the department of health intends on building the architecture necessary for digital technology to improve health systems in South Africa, which includes basing the strategy as a person-centred initiative that seeks to make health records electronic, while also making healthcare accessible through the creation of digital health apps for healthcare providers as well as other beneficiaries. The shift of South Africa towards digital health, along with the increased access to the internet amongst South African's, suggests that not only is there a space for online screening tools for anxiety amongst South Africans, but that the digitalisation of health in general is the future of South African mental health and healthcare systems.

Connecting to the internet to conduct a test is defined as 'online testing' (TreDoux, 2013). There is a difference between screening and case finding, with screening including the provision of a diagnostic test to a whole population possibly at risk, and case finding including providing diagnostic tests to individuals with the highest risk of a condition (Plummer et al., 2016). Understandings of these differences and the extent to which they can be deciphered by online screening tools are important for the development of an accurate screening tool, where there have been various arguments against such tools (Plummer et al., 2016).

Online screening tools can offer a variety of benefits. Ideally, screening tools should be brief, accurate, have an understandable scoring system, and have been tested in a variety of study populations (Herr et al., 2014). In a systematic review investigating the accuracy of a self-report screening tool for anxiety, it was found that the GAD-7 had the best accuracy as a

screening tool for case findings (Herr et al., 2014). This suggests that the self-reporting of the GAD-7 provides a useful resource to screen individuals likely to present with GAD. Furthermore, the self-report format commonly used in online screening possibly increases the likeliness of individuals answering questions more honestly due to the anonymity associated with online screening (Donker et al., 2011). This could suggest the usefulness of online screening tools as a means to measure case findings, as individuals with anxiety might feel more at ease to express their experiences if anonymity is assured.

Furthermore, online screening tools have the potential of providing psychometrically sound ways of measuring mental disorders. In a study measuring anxiety and depression amongst patients with cystic fibrosis using the HADS, it was found that there was no statistical differences between online and paper-based administrations of the HADS (Cronly et al., 2018). Where these are results from one study conducted amongst a patient sample, the results are still indicative that online screening tools have the potential of providing the same results as paper-based administrations, thus indicating somewhat trustworthy psychometric properties. In Cronly et al.'s (2018) study, the HADS obtained a Cronbach alpha of 0.84 for the online sample and 0.89 for the paper-based sample for the anxiety subscale, with P=0.073, indicating a non-significant difference between the two administrations. Similarly, the similarity between administrations of online and paper-based anxiety tests was observed by Donker et al. (2011), who despite noticing higher mean results between the paper-based and online-based administrations of anxiety tests, including the GAD-7, GAD-2, and GAD-I, found that there were no significant differences between the responses from both subsets of administration with the authors stating the validity and reliability of the online administrations of the tests.

An additional benefit of online screening includes the possibility of online administrations of tests yielding more and faster responses. This is related to screening for

mental disorders via the internet having the ability to screen large populations of people, as well as it being cost effective, and accessible for patients and practitioners (Buchanan, 2002; Cronly et al., 2018). The fast and far-reaching administration of screening tests is further vital as the detection of anxiety is often low within primary care settings, with this being associated with the costly and time consuming nature of administering anxiety tests (Donker et al., 2011; Zimmerman and Mattia, 2001). This further suggests the importance of a digital approach to healthcare, which could possibly alleviate long waiting times to access mental health screening. This is important considering that, as stated above, detection of anxiety is often low within primary care settings, and further associated with being costly and time consuming (Donker et al., 2011; Zimmerman and Mattia, 2001). A cost effective approach to mental health is thus useful in LMICs such as South Africa, where resources are often lacking in providing accessible and affordable mental healthcare to majority of the population (Docrat et al., 2019). Thus, the ability of a tool to not only be able to screen large amounts of the population, but in a manner that is accessible and affordable, is an important consideration for healthcare systems.

Furthermore, online screening tools offer the additional benefit of filtering out misinformation. This is indicated by 50.9% of individuals using the MACSCREEN anxiety screening tool being found to be more likely of seeking treatment after using the screening tool (Ameringen et al., 2015). These results are important as they challenge the issue of the increased likeliness of misinformation when searching for mental health information via the internet, which can further lead to individuals inaccurately diagnosing themselves with mental disorders (Ameringen et al., 2015; Yom-Tov et al., 2023). Ameringen et al. (2015) further suggests that online screening tools could also be advantageous in providing users with a means of continuously monitoring their mental health status, especially when users of such screening tools have previously consulted healthcare professionals. Such a service

provided by screening tools further encourage users or potential users to initiate or maintain treatment-seeking practices. This benefit is suggested in a study finding that individuals with previous experiences of disintegrating mental health were less likely of clicking on a link directing users to seek external help (Choi et al., 2018). Choi et al. (2018) attributed this finding to users seeking to monitor their symptoms, and not so much treat their symptoms. Therefore, screening tools have the capacity to motivate users to employ positive treatment seeking behaviors, as well as offer the potential and benefit of allowing users to monitor their symptoms. As was stated above, this will allow beneficiaries of healthcare systems to become more actively engaged in their experiences of mental health and healthcare.

In relation to accessing mental healthcare, it was found that rural areas of the United States had increased access to mental health services, in addition to reduced apprehension about privacy stemming from fear of stigma when using online screening tools (Yom-Tov et al., 2023). The reduced apprehension is significant considering the negative effect of stigma in reducing mental healthcare resources that are already in short supply (WHO, 2022). This influence of stigma was present in a study investigating the caregiver and service user experience of South Africans with mental illnesses, with findings indicating limited access and mental health literacy as a result of stigma, along with poor social, psychological, and financial experiences amongst individuals with mental illnesses (Monnapula-Mazabane & Petersen, 2023). Stigma further contributes to delays in treatment-seeking behaviors (Onyeukwu & Donahue, 2024; Wainberg et al., 2017). Moreover, Yom-Tov et al. (2023) identified a rise in the use of screening tools amongst individuals living within rural and remote areas to search for mental health related information. Yom-Tov et al. (2013) also found that almost half of online users identified as belonging to a previously marginalized community. These findings are supported by Hassem and Laher (2022) stating that online screening tools are more cost effective, thus making them more accessible to rural areas.

Similarly, the WHO (2022) states that access to mobile devices will become easier than access to in-person mental healthcare facilities due to technology becoming increasingly available throughout many countries. Furthermore, online testing provides additional benefits by computerized testing having less of the errors frequently seen with pencil-and-paper tests, along with users with varying computer literacy skills still being able to access online screening, depending on the nature of the online tests (TreDoux, 2013). Therefore, online screening tools offer solutions to combat the mental health gaps present in lower income areas, as well as amongst individuals belonging to previously marginalized populations who may have reduced access to in-person mental healthcare services and facilities.

Regarding LMICs like South Africa, there is a shortage of tools available to screen for anxiety-related disorders (Ali et al., 2016; Mughal et al., 2020). However, the anxiety subscale of the HADS was suggested by Ali et al. (2016) as being the most appropriate tool to screen for anxiety. Ali et al. (2016) based this recommendation on the HADS-A being found to have strong validity (Ali et al., 2016). However, this finding arose from the inclusion of only eight studies that used the tool. Furthermore, Ali et al's. (2016) systematic review did not explicitly state if any of the anxiety tools were administered online, with the studies that did measure anxiety using a majority of clinical samples. Ali et al. (2016) also stated that of the 153 studies that met the inclusion criteria for their systematic review investigating the validity of screening tools for CMD in LMICs, the targeting of the general population as a sample was only found in 20 of the studies, with South African samples only being found within seven studies. This lack of screening tools for the general population is also reflected in a systematic review conducted by Mughal et al. (2020) where the use of the general population as a target population was only seen in seven of the 59 studies included in the systematic review. This indicates the necessity of further investigating the availability of valid online anxiety screening tools for use amongst general populations in LMICs like South

Africa. This is important for establishing the population validity of such tools. These systematic review findings thus suggest not only a platform for online screening tools but also increasing need for such tools.

Some of the arguments against screening include associated harms, such as stigma, the effects of false positives, such as unnecessary diagnosis and treatment, and the effect thereof on already struggling healthcare systems. Further limitations of internet use for screening includes poor usage amongst older adults, as well as decreased computer literacy amongst older adults (Cronly et al., 2018; Houston et al., 2001). This limitation is concerning when acknowledging increasing numbers of older adults across the globe, with the world population of individuals above the age of 60 expected to increase from one billion in 2020 to 2.1 billion in 2050 (Obeng et al., 2022; WHO, 2022). However, pointing devices such as computer mouses could combat these limitations by providing older generations or populations with less experience with computer technology with a means of completing online screening tools, thus allowing such populations to also access and reap the benefits of online screening (Jarva et al., 2022). Furthermore, a study investigating the likeliness of older adults changing their perceptions to digital technology found that older adults were likely to have positive perceptions of adapting to digital technology if the digital technology was likely to lead to improved health, such as reduced anxiety and depression, monitoring and awareness surrounding physical activity, and improving fitness (Cho & Cho, 2023). Therefore, while limitations exist regarding the accessibility of online screening tools amongst older adults, there is evidence to suggest that older adults are willing to adapt to digital technology if it contributes to improved mental and physical health.

Another limitation of online administered testing includes the limited ability to control testing environments, possibly contributing to reduced generalisability (Donker et al., 2011). Such limited control was experienced by Cronly et al. (2018), who in their study

administering the HADS to a sample of Cystic Fibrosis patients in an online and paper format experienced the challenge of duplicate responses, where some individuals responded both online and via paper. Furthermore, a study found that 71% of online screening users were likely to experience suicidal intent following a referral to consult in-person health services (Jacobson et al., 2022). As worrying as this finding is, Jacobson et al. (2022) stated that similar findings were not found in previous studies or literature. Similarly, Hassem and Laher (2022) state that panic can be prevented by keeping feedback from screening to a minimum. Therefore, controlling the way feedback is provided can reduce the concerns surrounding the potential risk of screening tool results causing panic and inducing suicidal ideation. This further suggests that the negative outcomes of online screening tools can be minimised.

However, an additional challenge experienced by Donker et al. (2011) included findings of similar responses from both online and paper-based administrations of various anxiety screening tools, with the authors also stating that they found higher cutoff scores and sensitivity for the online sample when compared to the paper-and-pencil sample, with lower specificity. This was suggested to be influenced by the nature of online responses to tests, where participants might feel less exposed, and thus more likely to provide sensitive information, resulting in higher mean results (Buchanan, 2002; Donker et al., 2011). However, to combat the occurrence of higher mean results, Donker et al. (2011) suggested higher cut-off scores for online administrations. Donker et al. (2011) also suggested a multi-step process of diagnosing anxiety, with the first step including the provision of an online screening tool, followed by a ‘confirmatory’ diagnosis for higher risk participants by interview or longer questionnaires. Furthermore, psychologists can encrypt texts and visuals, as well as use password protected devices to safely store patient data away from unauthorized viewers to reduce concerns surrounding breaches to consent, privacy, and confidentiality (TreDoux, 2013).

Thus, while there are challenges associated with online screening tools, these challenges can be mitigated by ensuring that online screening tools are adapted to be suitable for the environment whereby screening takes place; including making the interface of online screening tools accessible to older populations; and being cognisant of sensitivity cut-offs, issues arising from lack of control over the testing environment, ethical considerations, and confirmatory diagnoses. Therefore, despite these challenges, online screening tools that are accessible, valid, and reliable have the potential of positively influencing treatment practices amongst individuals looking for information about their mental health.

Therefore, the concerns and limitations surrounding online screening tools cannot be denied. However, it is important to address these concerns, as screening tools that are reliable and valid may increase the access to and engagement with mental health services, as well as increase the limited knowledge about mental health. The potential advantages of online screening tools thus need to transcend the disadvantages. This is especially true when considering the shortage of validated screening tools for anxiety amongst the general population of LMICs like South Africa. Therefore, this study aimed to examine the availability of online anxiety screening tools and their potential adaptability for use within the general adult population of South Africa. More specifically, this study was a systematic review conducted to answer the following research questions:

1. What online screening tools are available to screen anxiety?
2. Are these tools reliable and valid? and
3. Can these tools be used or adapted for use in the South African adult population?

Theoretical Framework

Based on this study emphasising an online approach to mental health due to consideration of the importance of an online screening tool for anxiety, a “Biopsychosocial-Digital approach” to health was selected as an appropriate theoretical framework. A digital

approach to health has been stated as contributing to "provide[ing] opportunities to strengthen health systems" within the National Digital Health Strategy for South Africa (NDH, 2022, p. 11). Some of the advantages associated with such an approach include the increased and improved access to healthcare; less pressure on current healthcare systems; the increased creation of information about digital healthcare; and the increase and enhancement of personalized approaches to healthcare (Ahmadvand et al., 2018; U.S. Food and Drug Administration, 2020). Furthermore, these potential advantages are in alignment with society seeking the renovation of healthcare systems into systems that encourage "digitally-engaged patients" by providing healthcare that is more personalized, affordable, and inclusive. A *digitally-engaged patient* refers to patients as individuals who seek more independence and agency in their receipt of healthcare (Ahmadvand et al., 2018). Digitally-engaged patients relate to the WHO's summons for more person-centered approaches to mental health, as such approaches will contribute to individuals feeling in control of their personhood as well as allowing individuals to be actively involved in their healthcare (WHO, 2022). This approach is also reflected as a key principle that underpins South Africa's National Digital Health Strategy for South Africa, where the inclusion of a person-centred focus within the shift to digitalised health has been stated as potentially contributing to improved health interventions when patients are more actively involved in the healthcare they receive (NDH, 2022).

Ahmadvand et al. (2018) have suggested expanding paradigms to counter issues (such as professionals being untrained in digital approaches to health) experienced within a digital health space. In relation to this, the Biopsychosocial-Digital (BPS-D) approach amplifies the Biopsychosocial (BPS) model developed by George L. Engel (1978) by introducing technology as a fourth tier. Engel's BPS model arose out of his criticism towards the presiding biomedical model of his time for being "…disease-orientated, not patient-oriented" (p.171) due to the lack of acknowledgement on the importance of the interacting influences

of the psychological and the social on the physical health of individuals. Stemming from this critique, Engel (1978) highlighted the importance of healthcare systems becoming more inclusive and aware of the interaction between the biological, social, and psychological on the holistic health and treatment of individuals through the use of a biopsychosocial approach.

Where literature on the BPS-D model and its relationship to anxiety is scarce, anxiety can be understood through each factor in the expanded BPS-D model. In terms of the biological tier, anxiety can be experienced physically, through physiological states of the body. This includes the common somatic experiences associated with anxiety, including fatigue, muscle tension, and unsatisfying sleep (APA, 2022). This tier is important for understanding anxiety amongst South Africans, where expressions of anxiety are largely related to somatic discomfort (Kigozi, 2021). Furthermore, anxiety has been understood as possibly resulting from brain pathology and genetic influence, as has been suggested based on the influence of DNA mutations, genetic polymorphism, and mitochondrial DNA in the occurrence of anxiety (Lacerda-Pinheiro et al., 2014). The DSM-V-TR (APA, 2022) has also stated that genetics accounts for a third of the risk of experiencing GAD. Therefore, the symptoms and possible causes of anxiety can be understood from a biological perspective.

Regarding the psychological tier, anxiety is associated with psychological symptoms, including irritability, restlessness, and poor concentration (APA, 2022). Similarly, experience to psychological trauma has been associated with increased vulnerability to mental disorders, such as anxiety (Laugharne et al., 2010). This is suggested in a study by Craig et al. (2022) finding that South African individuals with high scores indicative of Adverse Childhood Experiences (ACEs) had a higher chance of having probable anxiety and depression. Therefore, the psychological tier of the BPS-D model contributes to understanding anxiety.

Social factors also influence the experience of anxiety. The DSM-V-TR (APA, 2022) has stated that the environment individuals occur within may contribute to anxiety, with certain parenting styles, such as overprotection and overcontrol, being associated with GAD. Similarly, a study found that isolation experienced during the pandemic was associated with increased prevalence of GAD amongst adults (Wu et al., 2021). Furthermore, the WHO (2022) also stated that social factors, such as gender, socioeconomic status, race, and sexual orientation largely influence mental health. This statement by the WHO is reiterated by Fisher (2021) stating that the social and sociopolitical environments of individuals can influence the production of information about health, such as epidemiology. The emphasis of social experience on disorder is especially important for South Africa. As discussed in the literature review chapter above, stressful social situations may influence experiences of mental distress. This was suggested by Mkhwanazi and Gibbs (2021) who stated that food poverty was associated with the increased risk of GAD.

Lastly, the digital addition to the BPS model may prove useful in providing increased accessibility to treatment interventions for anxiety. The provision of interventions in an online space that was designed in a user-friendly and captivating format was suggested as a useful means to hold the engagement of individuals in anxiety online interventions (Garrido et al., 2019). Furthermore, Garrido et al. (2019) stated that the anonymity and privacy associated with digital intervention may serve as an appealing factor of digital intervention. This may prove beneficial in providing access to mental health services despite the threat of stigma. The addition of a digital aspect is further useful when considering the limited availability of mental health resources in South Africa, as well as the continuing stigma towards mental disorders. Therefore, the BPS-D model is capable of providing a holistic view of anxiety, which is inclusive of biological, social, and psychological factors, with the digital factor providing a means of effective treatment.

In addition to the BPS-D model providing a holistic view of anxiety, the addition of a digital approach to Engel's traditional BPS model can be implemented through assessing the advantages such an addition may provide, as well as assessing and reducing the disadvantages of the traditional model (Ahmadvand et al., 2018). The addition of a digital approach to the BPS model would involve the provision of electronic health resources to patients; the availability to online information; the use of mobile devices to monitor health; and telecommunication and telemedicine (Ahmadvand et al., 2018). Such additions would encourage active participation in healthcare, which would thus align with the concept of the "digitally-engaged patient" and the benefits thereof. Furthermore, adding a digital dimension to the BPS model would address the criticisms and limitations regarding Engel's model, as well as enhance the capturing of biological, social, and psychological information, which would prevent the dichotomization of each of the three tiers of the traditional model (Ahmadvand et al., 2018). Based on the critiques towards the traditional model for being limited in addressing culturally-specific or non-biological explanations for experiences, and thus potentially partaking in biological reductionism that dismisses the subjectivity of humans, a paradigm shift is a welcomed addition (Ahmadvand et al., 2018; Benning, 2015).

Moreover, this critique can be addressed by extending the model to include a digital approach through consideration of the expansion of the "biological self." This expansion is based on individuals having increased access to biological and medical information, which further provides individuals with the opportunity to actively engage in the creation of information concerning themselves, as well as providing patients with new platforms of understanding their biological personhoods (Ahmadvand et al., 2018). In a study examining healthcare professional's opinions of an electronic mental wellness app, one professional indicated that the app was useful in helping the professional "decide with the patient…areas the treatment will focus on", which authors suggested was an indication of a changing

dynamic, whereby patients were involved in the treatment they would receive, and not merely told what treatment to receive (Wainberg et al., 2021, p. 23). This aligns with the biopsychosocial-digital approach which emphasizes the importance of patient involvement in their receipt of healthcare. This involvement by patients in the creation of knowledge and access to treatment concerning their own health, made possible by the increasing access to biological information and understanding, will contribute to challenging the vulnerability of the traditional BPS model in engaging in biological reductionist accounts of illness.

An additional criticism towards the traditional BPS model includes the belief that the BPS model does not have clear guidelines or methodology for physicians to enact on empathetic practice and social and psychological considerations towards treatment (Benning, 2015). This limitation of the BPS model is problematic as consideration of the social and psychological factors that influence health can influence treatment. This is suggested by Wainberg et al. (2017) who discuss an effective mental health policy implemented in Chile including the multidisciplinary approach to healthcare, whereby general practitioners and psychologists collaborated with each other following the diagnosis of conditions such as diabetes, hypertension, and depression. This suggests the acknowledgement of a relationship between physical and mental health, and the possibility of conjoining care for these two related spheres of health. Furthermore, the lack of clear guidelines to ensure empathetic practice that incorporates psychological and social influences can be addressed through the potential of digital approaches in allowing increasing support for decision-making amongst patients available through apps (Ahmadvand et al., 2018). This, again, is in alignment with the creation of a “digitally-engaged” patient.

Similarly, Martinez-Nicolas et al. (2023) suggested the use of the Emw-Tool as a pre-diagnostic evaluation followed by confirmatory diagnoses conducted by healthcare professionals. This recommendation made by Matinez-Nicholas et al. (2023) relates to the

above criticism made by Benning (2015) regarding the need for clear guidelines and methodology that will allow for increased decision-making support, which is lacking in the traditional BPS model, whereby online screening tools can serve as a "pre-diagnostic" evaluation. Furthermore, The PRIDE study has also indicated the importance of training healthcare professionals about the value of digital approaches to screening and treating mental health, as well as how to use the application to yield results. This suggests the usefulness of online screening tools in assisting not only potential patients, but also the healthcare professionals who help those with mental disorders. The Emw-Tool was also administered in short and in full online during the outbreak of the COVID-19 pandemic, which contributed to the maintenance of the provision of mental healthcare during a health crisis (Wainberg et al., 2021). Similarly, Martinez-Nicholas et al. (2023) have stated the usefulness of online apps to create awareness of mental health risk, and the importance thereof post-COVID, where mental distress was increasingly experienced, world-wide (Davy et al., 2021; Li et al., 2020; Moreno et al., 2020). This is suggestive of the possible sustainability of online healthcare applications. Wainberg (2017) further states that in order for mental health to be fulfilled comprehensively, as opposed to merely addressing one or two disorders, digital technologies need to be used as supporting tools for implementation strategies directed towards comprehensive treatment. Therefore, the addition of a digital dimension to the BPS model can provide more comprehensive guidelines for healthcare practice and treatment, while also providing much-needed awareness on mental health following COVID-19.

Thus, the inclusion of a digital approach to the BPS model would increase patient support by allowing and encouraging patients to become involved in their healthcare; whilst also allowing healthcare practitioners to become more equipped with treating mental health disorders comprehensively, in a manner that involves the patient. Based on the potentials of

the BPS-D approach in enhancing healthcare, despite limited research on the digital approach due to it being relatively new, as well as in its ability to address the limitations of Engel's prevailing model, such a model was an appropriate choice to serve as the theoretical framework for examining online screening tools in a diverse country like South Africa. This framework is further appropriate when considering South Africa's plans of digitalizing healthcare, with the hopes that a digital approach to health will "assist the country in dealing with the quadruple burden of disease, improving quality of care, improving maternal and child health, as well as support the health system transformation" (NDH, 2022, p. 11).

Chapter Three: Methodology

The following chapter will discuss the research design of this study, as well as the procedure, instruments, and analysis that was used during the conduction of the systematic review. This chapter will also briefly discuss some of the findings from the systematic review, specifically as they pertain to some of the descriptive findings from the included studies.

Research Design

This study was completed using a qualitative systematic review methodology. A systematic review includes using a calculated approach to search for and obtain data, with the accumulated data undergoing a process of appraisal to assess the quality of data. The appraised data is then synthesized and used to address specific research questions in a rigorous manner (Grant & Booth, 2009; Uman, 2011). Systematic reviews are thus especially useful in answering the research questions of this study which relied on the integrating of information, specifically the psychometric properties of anxiety screening tools, and the assessment of such tools for their application in the South African context. Grant and Booth (2009) have further stated that qualitative systematic reviews involve the creation of themes and constructs from the amalgamated and analysed information available within studies. This systematic review used Content Analysis (CA) to analyse data and can thus be defined as a qualitative systematic review.

Some of the advantages of using systematic reviews include their insistence on transparency and replicability (Siddaway et al., 2019). Transparency and replicability are important for the conduction of subsequent studies interested in adapting online anxiety screening tools for use amongst other target populations in South Africa, besides that of the general adult population. Some limitations of systematic reviews include only having one reviewer, and mistakes made regarding studies selected for inclusion, both of which may lead to bias (Uttley et al., 2023). Additional limitations could include poor explanation of the

methods followed, preventing replication of the study, as well as mistakes in the extraction of data, which might affect the findings and implications of the study (Uttley et al., 2023). The strengths and weaknesses experienced during this study have been discussed at the end of the paper.

Procedure and Instruments

With the intention of conducting as rigorous a review as possible, this study followed Uman's (2011) eight steps for conducting a systematic review, or meta-analysis; as well as the following of the 27 items of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009). The PRISMA guideline is attached below (see appendix A). Additional guidelines for conducting systematic reviews include the registering of systematic reviews with reputable registers where the details of systematic review protocols can be published to ensure the transparency of the review process, as well as to reduce the likeliness of systematic reviews being duplicated (Allers et al., 2018). This systematic review and its detailed procedure were registered on PROSPERO with identification number CRD42023465595 (see appendix B). The review and details thereof have undergone changes to the criteria and date of completion since its registration, with these changes being visible at the following link: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42023465595. The eight steps of Uman's guidelines and relevant findings are detailed below.

Step 1 and 2: Review Questions and Criteria

Uman's (2011) first step included formulating the review question, which was outlined in chapter one, with the second step including the defining of the inclusion and exclusion criteria. Inclusion and exclusion criteria within systematic reviews refer to certain information that needs to be present or absent within a study, in order for the study to be included in the systematic review (Laher & Hassem, 2020). These criterions are important as

they produce distinct guidelines that indicate which articles to include or exclude from systematic reviews, allowing research questions to be answered without bias (Siddaway et al., 2019). Inclusion and exclusion criteria also contribute to the replicability of a study (Siddaway et al., 2019). The inclusion and exclusion criteria used for this systematic review appear in Table 1.

Table 1

Inclusion and Exclusion Criteria

Inclusion Criteria	**Exclusion Criteria**
Qualitative and quantitative studies (this is to account for the possibility of limited articles available on the topic)	Studies with samples below the age of 18 (this is to abide by the ethical concern of informed consent of included studies)
Articles written in English (this is due to the reviewers only being proficient in English)	Studies based on tools that screen for a variety of disorders without mentioning the separate psychometric properties of each disorder (as this could distort the extracting of data pertaining to the reliability and validity of the tools to screen anxiety specifically)
Studies based on tools developed specifically to screen for general anxiety screening tools administered online	Studies based on clinical populations previously diagnosed with any mental or physical disorders (as such articles deviate from the research aim of seeking anxiety screening tools applicable for the general population)
Studies with samples 18 and over (this is to abide by ethical considerations regarding consent)	Grey literature
Studies which mention psychometric properties of screening tools that are used online to measure general anxiety	
Articles published between 1970 and 2024	

Step 3: Search Strategy and Location of Studies

Uman's (2011) third step included developing search strategies. The first part of the strategy included locating databases from which studies could be retrieved. Six databases were selected where various search terms were entered into databases so to yield related articles for inclusion in the analysis. These databases included Sabinet; PubMed; PsycInfo; Proquest Psychology Journals; ScienceDirect and EBSCOHost. These databases were

selected based on their relevance to the topic of psychology and mental health, as well as providing access to national and international journals.

The second part of the strategy included the entering of search terms into each database. A broad range of search terms were entered into each database with the intention of increasing access to articles likely to answer the research questions. Search terms included phrases relating to the phenomena of interest (anxiety), the type of information required (psychometric properties), and the instruments of concern (online screening tools). The search terms entered into the databases included: “online anxiety screening tools”; “internet anxiety screening tools”; “web-based anxiety screening tools”; “web-based anxiety assessments”; “screening for anxiety on the internet”; “online screening for persistent worry”; “using the internet to screen for unexplained fear/worry”; “anxiety and online screening tools”; “psychometric properties of online anxiety screening tools”; “anxiety OR anxiety-related screening tools”; “internet anxiety screening tools or web-based anxiety screening tools or using the internet to screen for anxiety or online screening for persistent worry or using the internet to screen for unexplained fear/worry/anxiety or web-based anxiety screening tools or using the internet to screen for anxiety or online screening for persistent worry or using the internet to screen for unexplained fear, worry, or anxiety”.

Furthermore, Siddaway et al. (2019) suggest using AND/OR Boolean functions to increase the obtaining of applicable search results. This refers to specificity, which emphasizes reducing the likelihood of obtaining unrelated studies (Uman, 2011). Therefore, search terms also included the use of AND/OR Boolean functions in a range of search terms, such as “anxiety AND online screening tools”, as well as in a search term combining the phrases of all the search terms together, “internet anxiety screening tools or web-based anxiety screening tools or using the internet to screen for anxiety or online screening for persistent worry or using the internet to screen for unexplained fear/worry/anxiety or web-

based anxiety screening tools or using the internet to screen for anxiety or online screening for persistent worry or using the internet to screen for unexplained fear, worry, or anxiety". Articles obtained via the searches were stored in the referencing software, Zotero, to keep track of the articles. The importing of articles for each search term across all databases were halted once saturation was reached. In relation to this systematic review, the searching of databases was halted when saturation was achieved, which was indicated through the presence of repeated articles that were already saved into the referencing management software, or when search results were unrelated to the search terms.

As discussed above, six databases were searched using a variety of search terms with Boolean functions. The formatting used to present the database information for each database (including search date, search terms, and number of articles yielded from each database) is presented using the Science Direct database as an example (see appendix C). The page number where searches stopped was also included for each search term and database. Searches for a search term were discontinued when it appeared that saturation had been reached, which was indicated by recurring articles, or the appearance of articles unrelated to the search terms. Additional information recorded from the search process included any difficulties obtaining articles, upon which article numbers were recorded and returned to. Furthermore, a common occurrence when searching for articles within the PsychInfo database was the alert that entered search terms did not yield any results, after which the database would search for keywords within articles to present articles.

Step 4: Selection of Studies

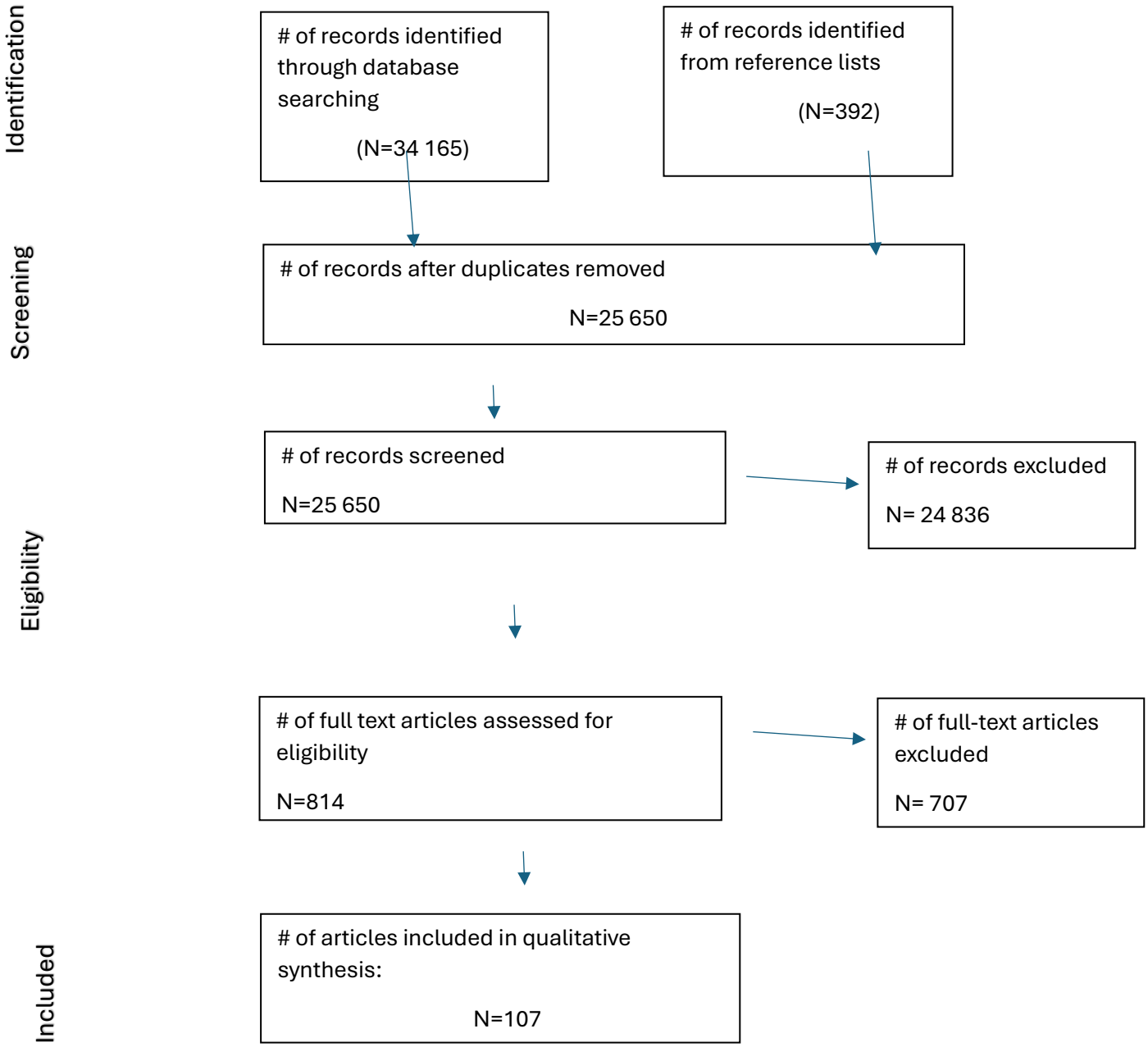
Uman's (2011) fourth step includes the selection of studies. Following the obtaining of related studies during the search and selection process, two reviewers reviewed potential studies to ensure inter-rater reliability. Articles were reviewed blindly by the primary researcher and author of this research report, Storm van Boom; as well as the supervisor of

the research report, Dr. Tasneem Hassem. When the two reviewers could not reach a consensus on whether to include or exclude a study, the two reviewers discussed the conflicted article, and reached a final, unblinded decision, on whether or not to include the study. Articles were screened using the online systematic review software Rayyan (Ouzzani et al., 2016). Furthermore, the fourth step states that the details of studies need to be retained. The retainment of detailed study records was assured by entering and storing study details on Zotero.

Of the six databases searched from 25 July 2023 to 6 November 2024, 34 165 articles were yielded, along with 392 articles that were obtained from the reference lists of included articles. After the removal of duplicates, the total amount of articles yielded amounted to 25 650. Following the screening of articles, a total of 107 articles were selected for inclusion in the systematic review. The breakdown of articles is presented in figure 1.

Figure 1

PRISMA Table



Step 5: Data Extraction

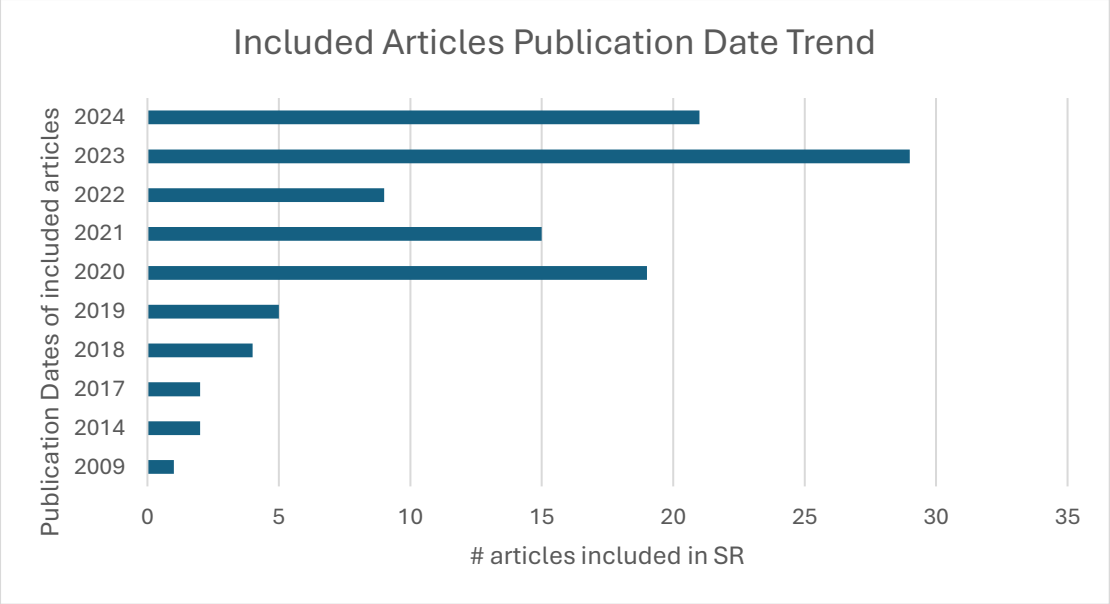
The fifth step includes the extraction of data. This was done by extracting the information relevant to the research questions and placing this information into detailed tables consisting of the sampling strategies conducted by studies, the methodology used by included studies, and details of the study participants. Part of this step included chain citing, which refers to searching the reference lists of included or relevant studies, in the attempt to retrieve all related articles, thus achieving a balance of sensitivity and specificity (Laher & Hassem, 2020; Uman, 2011).

5.1 Descriptive Information from Included Studies

5.1.1. Publication Dates. For the 107 articles selected for final inclusion, publication dates ranged from 2009 to 2024 (see figure 2). Of the included studies, less than six articles per year were published from the years 2009 to 2019 with the number of included articles published after 2019 more than tripling from 5 in 2019 to 19 in 2020. Majority (86.92%) of the included articles were published between 2020 and 2024, with articles published in 2023 and 2024 amounting to almost half (46.73%) of all the included articles. The year 2023 yielded the most (29) included articles, followed by 2024 (21).

Figure 2

Publication Trends of Included Articles



The data extracted from the included articles are presented in table 2. Most of the articles (52.34%) did not specifically report what sampling techniques their studies made use of (1, 2, 4, 6-9, 11-13, 16, 17, 20, 23, 27, 29 - 33, 36, 37, 41, 43, 47, 49, 50, 52, 54, 55, 57, 61, 62, 64, 65, 73, 76-78, 80-84, 90-92, 96, 94, 97, 99, 100, 105-107). Of the included articles, 20.56% reported using a convenience sampling technique (28, 34, 38-40, 45, 46, 48, 53, 56, 58, 66, 69, 74, 75, 79, 86, 88, 95, 96, 98, 103); 13.08% reported using a snowball technique (5, 10, 25, 26, 42, 44, 48, 67, 68, 70, 71, 87, 89, 93); 4.67% reported using quota sampling (15, 51, 72, 85, 102); 3.74% used voluntary (19, 22, 24, 63); and less than 2% combined used stratified and purposeful sampling (3, 35). Some articles used a mixed sampling technique. Quota and stratified sampling were used by 2.80% of articles (14, 18, 104); convenience and snowball was used by 1.87% of articles (48, 98); stratified and snowball by 0.93% (59), as well as by 0.93% of articles reporting the use of stratified and cluster sampling (60).

Table 2

Descriptive Information from Included Studies

Article Details					**Sample**						
No.	**Title**	**Authors**	**Method-ology**	**Sampling Strategy**	**Size**	**Range**	**Mean**	**% Female**	**% Male**	**% Non-Binary**	**CASP Score**
1	Optimism, mindfulness, and resilience as potential protective factors for the mental health consequences of fear of the Coronavirus.	Vos et al. (2021)	Quant.	NR	546	18-65	29.81	44.69	54.94	0.37	7
2	Validation, reliability, and specificity of CliniCom™ Psychiatric Assessment Software	Handal et al. (2018)	Quant.	NR	273	19-50	NR	NR	NR	NR	7.5
3	Is social media use for networking positive or negative? offline social capital and internet addiction as mediators for the relationship between social media use and mental health	Glaser (2018)	Quant.	Stratified	1157	NR	49.54	56	NR	NR	8.5
4	Optimizing process-based therapy: A Boruta-driven approach to identifying key clinical outcomes in a Swedish validation of the process-based assessment tool (PBAT)	Larsson and Sundstrom (2024)	Quant.	NR	427	18+	48	53.70	46.06	0.23	8.5
5	Validation of the Acceptance and Action Questionnaire-II in the general Spanish population.	Menéndez-Aller et al. (2023)	Quant.	Snowball	964	18-84	43.43	52.8	NR	NR	8.5

6	Intolerance of uncertainty, appraisals, coping, and anxiety: The case of the 2009 H1N1 pandemic	Taha et al. (2014)	Quant.	NR	1027	18-67	32.37	72.83	27.17	NR	8.5
7	Development and initial validation of a short form of the Memories of Home and Family Scale	Redican et al. (2023)	Quant.	NR	1406	18-89	48.8	50.0	49.8	0.2	9
8	Elevated cognitive failures in trait anxiety	Goodhew and Edwards (2024)	Quant.	NR	532	NR	38.22	44.9	53.1	1.1	9
9	Enabling brief assessments of alexithymia: psychometric properties of the Russian version of the Perth Alexithymia Questionnaire-Short Form (PAQ-S) and its correlates with ill-being and well-being	Larionow et al. (2024)	Quant.	NR	203	18-74	23.58	74.38	25.62	NR	9
10	Factor structure and psychometric properties of the Body Perception Questionnaire Short Form (BPQ-SF)	Najari et al. (2024)	Quant.	Snowball	748	18-77	31.74	57	43	NR	9
11	Goal disengagement and goal reengagement: Associations with depression, anxiety, and satisfaction with life	Verschuren and Douilliez (2024)	Quant.	NR	175	NR	35.49	68	NR	NR	9
12	The effect of ego-resiliency and COVID-19- related stress on mental health among the Japanese population	Kubo et al. (2021)	Quant.	NR	222	19-87	46.71	43.7	56.3	NR	9
13	Instagram: Friend or foe? The application's association with psychological well-being.	Mackson et al. (2019)	Quant.	NR	204	18-48	25.16	NR	NR	NR	9
14	COVID-19-related anxiety predicts somatic symptoms in the UK population.	Shevlin et al. (2020)	Quant.	Stratified Quota	2,025	NR	45.446	51.9	NR	NR	9

15	Association of social media use with mental health conditions of nonpatients during the COVID-19 outbreak: Insights from a national survey study	Zhong et al. (2020)	Quant.	Quota	2185	NR	33.43	54.6	45.6	NR	9
16	Mental health risk factors during the COVID-19 pandemic in the Polish population	Larionow and Mudło-Głagolska (2022)	Quant.	NR	926	18-60	35.15	78.51	NR	NR	9
17	Establishing a common metric for self-reported anxiety: Linking the MASQ, PANAS, and GAD-7 to PROMIS anxiety	Schalet et al. (2014)	Quant.	NR	MASQ (N = 743), GAD-7 (N = 748), and PANAS (N = 1120)	NR	MASQ-GA=51; GAD-7=47; PANAS and PROMIS Anxiety=46	NR	MASQ-GA=48; GAD-7=44; PANAS and PROMIS Anxiety=47	NR	9
18	A symptom-based definition of resilience in times of pandemics: patterns of psychological responses over time and their predictors	Valiente et al. (2021)	Quant.	Stratified Quota	1628	18-75	45.75	47.1	52.8	0.1	9.5
19	Association between coping resources and mental health during the COVID-19 pandemic: a cross-sectional study in the Czech Republic.	Šípová et al. (2023)	Quant.	Voluntary	476	19-80	39	60	NR	NR	9.5
20	Inhibition on irrelevant negative information alleviates the mediating role of psychological distress in the association between trait rumination and symptoms of depression and anxiety	Putra et al. (2023)	Quant.	NR	237	NR	21.57	80.1	19.9	NR	9.5

21	Measuring decentering -Development and validation of the French version of the Experiences Questionnaire (EQ-F)	Gamaiunova et al. (2024)	Quant.	NR	Study 1 (320); Study 2 (99)	S1: NR; S2:18-40	S1:Sample 1-29.29; Sample 2-28; Sample 3-47.12; Sample 4-28.36; S2: 28.36	90, 52; 66.66; 79.31; 67.5	9.47; 21.83;20.68; 32.5	NR	9.5
22	Psychological states of Bangladeshi people four months after the COVID-19 pandemic: An online survey	Zubayera et al. (2020)	Quant.	Voluntary	1146	18 to 61	26.38	40.8	59.2	NR	9.5
23	Psychometric properties of the Greek version of FCV-19S.	Tsipropoulou et al. (2021)	Quant.	NR	2970	NR	NR	72.49	24.47	NR	9.5
24	The Cleveland Adaptive Psychopathology Inventory: preliminary validity and reliability of a multi-scale personality and psychopathology questionnaire	Poreh and Levin (2019)	Quant.	Voluntary	1646;	18-86;	44.53;	76.1;	NR	NR	9.5
25	The psychological impact of {COVID}-19 in {Italy}: {Worry} leads to protective behavior, but at the cost of anxiety	Prete et al. (2020)	Quant.	Snowball	618	19-80	38.55	71.36	28.64	NR	9.5
26	Validation of the Arabic version of the cyberchondria severity scale 12 items (CSS-12-Ar) among a sample of Lebanese adults	Hallit et al. (2023)	Quant.	Snowball	449	NR	24.34	70.6	29.4	NR	9.5
27	Validation study of the Korean version of the COVID-19 Anxiety Scale (CAS-7) and psychometric comparison of different rating scales	Keun Park et al. (2023)	Quant.	NR	400	18-60	44.7	NR	(51	NR	9.5

28	Relationships among repetitive negative thinking types, change in employment, and mental health	Pössel et al. (2024)	Quant.	Convenience	cross-sectional: 1,627; longitudinal study: 475	cross-sectional: 18-87; longitudinal study: 19-80	NR	sample 1: 72.7%; sample 2: woman (82.3%)	sample 1: 19.2%; sample 2: ; 15.6% men	sample 1: 0.5%; sample 2: 0.6%	9.5
29	Affective forecasting in individuals with trait anxiety: increased anticipated unpleasantness and the underlying psychological mechanism.	Wang et al. (2024)	Quant.	NR	130	NR	19.20; 19.15	76.15	23.84	NR	9.5
30	Six addiction components of problematic social media use in relation to depression, anxiety, and stress symptoms: A latent profile analysis and network analysis	Peng and Liao (2023)	Quant.	NR	10668	NR	33	57	(43	NR	9.5
31	Don’t worry, it won’t be fine. Contributions of worry and anxious arousal to startle responses and event-related potentials in threat anticipation	Carsten et al. (2023)	Quant.	NR	1,603	18-65	29.06	72.5	27.5	NR	9.5
32	Rasch model analysis of the Depression, Anxiety and Stress Scales (DASS)	Shea et al. (2009)	Quant.	NR	420	NR	NR	66.19	33.80	NR	9.5
33	COVID-19 pandemic and lockdown measures impact on mental health among the general population in Italy	Rossi et al. (2020)	Quant.	NR	18147	NR	38	79.5	20.5	NR	9.5
34	exploring lifestyle habits, physical activity, anxiety and basic psychological needs in a sample of Portuguese adults during COVID-19	Antunes et al. (2020)	Quant.	Convenience	1404	18-89	36.4	69.6	30.3	NR	9.5

35	The patient health questionnaire–4: factor structure, measurement invariance, latent profile analysis of anxiety and depressive symptoms and screening results in Polish adults.	Larionow and Mudło-Głagolska (2023)	Quant.	Purposeful	2557	18-78	27.18	67.65	31.71	0.62	10
36	Assessing psychological flexibility: The psychometric properties of the Czech translation of the compact questionnaire	Ptáček and Jelínek (2024)	Quant.	NR	299	18-70	29.27	69.9	29.1	1.0	10
37	Beliefs about sleep: links with ruminations, nightmare, and anxiety	Faccini et al. (2023)	Quant.	NR	429	NR	41.76 (Group 1); 41.08 (Group 2)	21.07	78.93	NR	10
38	Conceptualising social media addiction: a longitudinal network analysis of social media addiction symptoms and their relationships with psychological distress in a community sample of adults	Tullett-Prado et al. (2023)	Quant.	Convenience	462	18-64	30.8	29%	69.3%	1.9%	10
39	Development of social distancing phobia scale and its association with anxiety and perceived stress	Gunlu (2021)	Quant.	Convenience	1260 (Study 1=444; Study 2=1,495, Study 3=321)	18-55	Study 1 (27.36); Study 2 (32.36); Study 3 (29.23)	Study 1 (59.9); Study 2 (54.9); Study 3 (53.3)	Study 1 (40.1); Study 2 (45.1); Study 3 (46.7)	NR	10
40	Early psychosocial predictors of mental health among Indians during coronavirus disease 2019 outbreak	Ahmad et al. (2020)	Quant.	Convenience	392	18-71	30.3	47	NR	NR	10

41	Effectiveness of an online short-term audio-based mindfulness program on negative emotions during the COVID-19 pandemic: Latent growth curve analyses of anxiety and moderated mediation effects of anxiety between mindfulness and negative affect.	Kang et al. (2023)	Quant.	NR	100	NR	Intervention (37.9); Control (36.02)	Intervention (52); Control (54)	Intervention (48); Control (46)	NR	10
42	Handwashing adherence during the COVID-19 pandemic: A longitudinal study based on protection motivation theory	Szczukaa et al. (2023)	Quant.	Snowball	1256	NR	37.1	80.2	19.1	0.7	10
43	Intolerance of uncertainty, anxiety sensitivity, and health anxiety during the COVID-19 pandemic: Exploring temporal relationships using cross-lag analysis	Bredemeier et al. (2023)	Quant.	NR	301	18–65	42.9	42.9	NR	NR	10
44	Mapping of the network connection between sleep quality symptoms, depression, generalized anxiety, and burnout in the general population of Peru and El Salvador	Yupanqui-Lorenzo et al. (2024)	Quant.	Snowball	1012	NR	26.5	65.1	34.9	NR	10
45	Mental health screening for COVID-19: a proposed cutoff score for the Greek version of the Fear of COVID-19 Scale (FCV-19S	Nikopoulou et al. (2022)	Quant.	Convenience	538	18-75	Women’s age (Mage =42.70; men’s(Mage= 43.38	77.9	22.1	NR	10
46	Psychological health, sleep quality, and coping styles to stress facing the COVID-19 in Wuhan, China	Fu et al. (2020)	Quant.	Convenience	1242	NR	NR	69.73	30.27	NR	10
47	The relationship between individuals' sources of information, perceptions, and anxiety regarding the COVID-19 pandemic in Turkey.	Aksan (2023)	Quant.	NR	482	NR	NR	67.7	32.3	NR	10

48	The relationship between interoceptive emotional awareness, neuroticism, and depression, anxiety, and stress	Grimble et al. (2024)	Quant.	Convenience And Snowball	838	18-60	29.54	53.81	45.94	NR	10
49	The role of self-esteem and emotion regulation in the associations between childhood trauma and mental health in adulthood: a moderated mediation model	Li et al. (2023)	Quant.	NR	6057	NR	NR	39.99	60.01	NR	10
50	The universality of anxiety experiences between Germany, Indonesia, and the US: A measurement invariance analysis	Jaya et al. (2024)	Quant.	NR	2350	NR	32.53	37.8	NR	NR	10
51	Trait and situation-specific intolerance of uncertainty predict affective symptoms during the COVID-19 pandemic	Broos et al. (2024)	Quant.	Quota	2152	18-94	47.09	64	NR	NR	10
52	Validation of Korean version of the Anger Discomfort Scale	Kim and Stead (2024)	Quant.	NR	765	S1 (18-77); S2 (18-61)	29.43	NR	NR	NR	10
53	Validation of the Chinese version of the Perseverative Thinking Questionnaire	Yao et al. (2023)	Quant.	Convenience	1000	18-50	NR	S1 (55.67); S2 (61.50)	NR	NR	10
54	Validation of the Chinese version of the Sleep Regularity Questionnaire (SRQ) and analysis of influencing factors	Yan et al. (2024)	Quant.	NR	3642	NR	NR	76.5	23.5	NR	10
55	Validity of the PROMIS depression and anxiety common metrics in an online sample of Australian adults	Sunderland et al. (2018)	Quant.	NR	3175	NR	NR	79.6	20.4	NR	10
56	Worry about {COVID}-19 contagion and general anxiety: {Moderation} and mediation effects of cognitive emotion regulation	Muñoz - Navarro et al. (2021)	Quant.	Convenience	1753	18-60	NR	76.8	22.9	0.3	10

57	Risk of depression, anxiety, and stress among the Saudi general population during the COVID-19 pandemic	Alsaif et al. (2022)	Quant.	NR	754	18-64	36	45.9	54.1	NR	10
58	Psychometric properties of a Spanish version of the Fear of COVID-19 Scale in general population of Lima, Peru.	Huarcaya-Victoria et al. (2022)	Quant.	Convenience	832	NR	38.37	65.6	34.4	NR	10
59	COVID-19 related depression and anxiety among quarantined respondents.	Tang et al. (2021)	Quant.	Stratified And Snowball	1160	18-50	NR	60	40	NR	10
60	Perception of health conditions and test availability as predictors of adults' mental health during the COVID-19 pandemic: A survey study of adults in Malaysia	Dai et al. (2020)	Quant.	Stratified And Cluster	669	20-71	NR	51.57	48.43	NR	10
61	Can the Depression Anxiety Stress Scales Short be shorter? factor structure and measurement invariance of DASS-21 and DASS-9 in a Greek, non-clinical sample	Kyriazos et al. (2018)	Quant.	NR	2272	18+	35.54	63%	NR	NR	10
62	Generalized anxiety and depressive symptoms in various age groups during the COVID-19 lockdown in Poland. Specific predictors and differences in symptoms severity	Gambina et al. (2021)	Quant.	NR	1115	18-85	44.64	50.5	49.5	NR	10
63	Adjustment disorder, traumatic stress, depression and anxiety in Poland during an early phase of the COVID-19 pandemic	Dragan et al. (2021)	Quant.	Voluntary	1742	18–78	31.23	77	22	1%	10.5
64	Clarifying the link between anxiety and conspiracy beliefs: A cross-sectional study on the role of coping with stressors	Krüppel et al. (2023)	Quant.	NR	589 (S1); 177 (S2)	18-82 (S1); 19 to 77 (S2)	32.91 (S1); 39.17 (S2)	77 (S1); 66 (S2)	NR	NR	10.5

65	COVID-19 fear and anxiety as mediators in the relationship between repetitive negative thinking and psychopathology: A community-based study during the 2nd confinement in Portugal	Peixoto and Cunha (2024)	Quant.	NR	336	18 -68	35.02	83.3	15.5	1.2	10.5
66	Cross-cultural validation and measurement invariance of the Perth Alexithymia Questionnaire (PAQ): A study in Iran and the USA	Mazidi et al. (2023)	Quant.	Convenience	926 (Iran) ; 242 (United States)	18–65 (Iran); 20–73 (US)	32.52 (Iran); 40.69 (US)	61.98 (Iran); 40.08 (US)	NR	NR	10.5
67	Dimensionality and reliability of the online version of the Patient Health Questionnaire-4 in a large Colombian sample: results from the PSY-COVID study	Sanabria-Mazo et al. (2024)	Quant.	Snowball Method	18,061	18-55	NR	75	25	NR	10.5
68	Emotion regulation frequency and self-efficacy: Differential associations with affective symptoms	Ramos-Cejudo et al. (2024)	Quant.	Snowball	study 1 (431); Study 2 (132)	18-70	Study 1 (25.5); study 2 (33.79)	Study 1 (75); Study 2 (75)	Study 1 (25);	NR	10.5
69	Fear, anxiety and depression among Bosnia and Herzegovina citizens during the third wave of COVID-19	Šljivo and Kulenović (2023)	Quant.	Convenience	1096	18-87	35.84	81.3	NR	NR	10.5
70	Phubbing among Lebanese young adults: Scale validation and association with mental health (depression, anxiety, and stress): Research and Reviews	Bitar et al. (2023)	Quant.	Snowball	study 1 (203); study 2 (461)	18-29	study 1 (21.63); study 2 (22.25)	study 1 (73.4); study 2 (70.9)	study 1 (26.6); study 2 (29.1)	NR	10.5
71	Psychometric evaluation of the Arabic version of the Fear of COVID-19 Scale	Alyami et al. (2021)	Quant.	Snowball	639		34.75	42.1	57.9	NR	10.5

72	Psychometric evaluation of the Swedish version of the Types of Positive Affect Scale	Lehmivaara et al. (2024)	Quant.	Quota Sampling	440	18-84	46.09	48.9	NR	NR	10.5
73	Psychometric properties of the Generalised Anxiety Disorder Dimensional Scale in an Australian sample	Groves et al. (2023)	Quant.	NR	293	18-73	28.31	72.7	NR	NR	10.5
74	Psychometric properties of the Italian Tendency to Avoid Physical Activity and Sport Scale relationship to weight stigma and body esteem	Soraci et al. (2024)	Quant.	Convenience	235	NR	35.17	57.4	42.6	NR	10.5
75	Psychometric validation of the Indonesian Version of the Fear of COVID-19 Scale: Personality traits predict the fear of covid-19	Nazari et al. (2023)	Quant.	Convenience	728	18-60	26.56	54.8	45.2	NR	10.5
76	The factor structure and measurement invariance of the PHQ-4 and the prevalence of depression and anxiety in a Southeast Asian context amid the COVID-19 pandemic.	Mendoza et al. (2022)	Quant.	NR	4,524	18-73	27.16	74.76	25.24	NR	10.5
77	The psychometric properties of the Turkish version of the Pre-sleep Arousal Scale	Türkarslan et al. (2024)	Quant.	NR	651	NR	28.09	65.28	34.72	NR	10.5
78	The Self-Compassion Scale: Validation and psychometric properties within the exploratory structural equation modeling framework	Rakhimov et al. (2023)	Quant.	NR	486	18-85	39.1	59.1	40.3	0.4	10.5
79	Using a bifactor exploratory structural equation modeling framework to examine the factor structure of the Depression Anxiety and Stress Scales-21: Research and Reviews	Koğa and Koğar (2023)	Quant.	Convenience	521	18-50	26.58	45.3	54.7	NR	10.5

80	Validation and psychometric evaluation of the Italian version of the Fear of COVID-19 Scale	Soraci et al. (2022)	Quant.	NR	249	18-76	34.50	92	8	NR	10.5
81	A nationwide survey of psychological distress among Italian people during the COVID-19 pandemic: Immediate psychological responses and associated factors.	Mazza et al. (2020)	Quant.	NR	2766	18-90	32.94	71.6	28.4	NR	10.5
82	Stress, anxiety, and depression levels in the initial stage of the COVID-19 outbreak in a population sample in the northern Spain,	Ozamiz-Etxebarria et al. (2020)	Quant.	NR	976	18-61	NR	81.1	18.9	NR	10.5
83	The effect of age, gender, income, work, and physical activity on mental health during coronavirus disease (COVID-19) lockdown in Austria.	Pieha et al. (2020)	Quant.	NR	1005	NR	NR	52.7	47.3	NR	10.5
84	Longitudinal predictors of depression, anxiety, and alcohol use following COVID-19-related stress	Venanzi et al. (2021)	Quant.	NR	200	18-25	21.87	62.0	36.0%	1.6	10.5
85	Anxiety, depression, traumatic stress and COVID-19-related anxiety in the UK general population during the COVID-19 pandemic	Shevlin et al. (2020)	Quant.	Quota	2025	18-83	45.44	51.7	48.0	0.3	10.5
86	The Italian COVID-19 Anxiety Syndrome Scale: Investigation of the COVID-19 anxiety syndrome and its association with psychological symptoms in an Italian population	Mansueto et al. (2022)	Quant.	Convenience	755 (combined)	18+	study 1 (31.71); study 2 (36.76)	study 1 (67); study 2 (75)	study 1(33%); study 2 (25%)	NR	10.5

87	Individual, social and national coping resources and their relationships with mental health and anxiety: A comparative study in Israel, Italy, Spain, and the Netherlands during the Coronavirus pandemic	Mana et al. (2021)	Quant.	Snowball	2675 (combined)	18-88	Israel = 38.61; Dutch = 44.71; Italian= 41.67; Spanish = 48.32	NR	Israel 48.9 %; Dutch 29.3 %; Italians 36.6 %; Spanish 23.9 %	NR	10.5
88	Incremental validity of coronaphobia: Coronavirus anxiety explains depression, generalized anxiety, and death anxiety	Lee et al. (2020)	Quant.	Convenience	453	18-65	NR	47.46	52.31	0.22	10.5
89	Intolerance of COVID-19-related uncertainty and depressive and anxiety symptoms during the pandemic: A longitudinal study in Argentina	del-Vallea et al. (2022)	Quant.	Snowball	1230	18-77	41.62	81.7	17.6	0.7	10.5
90	Fear of COVID-19 and positivity: Mediating role of intolerance of uncertainty, depression, anxiety, and stress	Bakioğlu et al. (2021)	Quant.	NR	960	18-76	29.74	69.1	30.9	NR	10.5
91	Mindfulness and symptoms of depression and anxiety: The underlying roles of awareness, acceptance, impulse control, and emotion regulation	Cheung and Ng (2019)	Quant.	NR	sample 3 (813); sample 4 (894)	18-88	sample 3 (M= 34.74); sample 4 (M= 29.16)	sample 3 =71; sample 4= 67.4	NR	NR	10.5
92	The hierarchical factor structure of the Spanish version of Depression Anxiety and Stress Scale -21	Ruiz et al. (2017)	Quant.	NR	333	18-26	19.96	71.47	28.52	NR	10.5
93	COVID-19 pandemic and mental health in Lebanon: A cross-sectional study	El Othman et al. (2021)	Quant	Snowball	386	NR	31.32	75.9	24.1	NR	10.5
94	An assessment of the psychometric properties and psychological correlates of the Greek COVID-19 Anxiety Syndrome Scale	Seydavi et al. (2023)	Quant.	NR	912	18–73;	32.35	78.8	20.0	1.2	11

95	Fundamental fears in Greece (i): The psychometric properties of the Greek adaptation of the Anxiety Sensitivity Index-3	Makrygiorgos et al. (2023)	Quant.	Convenience	611	18–74	32.75	52	48	NR	11
96	Investigating the structure of the CESD-R and DASS-21 across adults with low and high levels of autistic traits.	McKernan and Russo (2023)	Quant.	Convenience	434	NR	35.4	34.7	NR	NR	11
97	Psychometric properties of the Polish version of the Perth Emotional Reactivity Scale	Larionow et al. (2023)	Quant.	NR	491	18-84	24.78	71.07	28.92	NR	11
98	Testing the metacognitive model of rumination and depression in non-clinical populations: New data about PBRS and NBRS scales.	Cano-López et al. (2020)	Quant.	Convenience And Snowball	427	18-70	25.64	74.5	24.8	NR	11
99	Psychological impact of COVID-19 in the Sweden Population: Depression, anxiety, and insomnia and their associations to risk and vulnerability factors	McCracken et al. (2020)	Quant.	NR	1212	18-88	36.1	73.8	26.2	NR	11
100	Psychological adjustment in Spain during the COVID-19 pandemic: Positive and negative mental health outcomes in the general population	Valiente et al. (2021)	Quant.	NR	1,951	18-75	45.16	47.1	NR	NR	11
101	Social media use and anxiety in emerging adults	Anna Vannuccia et al. (2017)	Quant.	NR	563	18-22	20.	50.2	NR	NR	11
102	Measurement invariance of the Patient Health Questionnaire (PHQ-9) and Generalized Anxiety Disorder scale (GAD-7) across four European countries during the COVID-19 pandemic	Shevlin et al. (2022)	Quant.	Quota	6,054 (combined)	18+	UK=45.44; Ireland=44.97; Spain= 45.17 ; Italy= 49.94	UK=51.7; Ireland= 51.5; Spain= 47.0; Italy=51.2%	UK=48.0; Ireland=48.2; Spain= 52.7; Italy=48.8	UK=0.3; Ireland=0.3; Spain=0.3; Italy=NR	11

103	Health anxiety and mental health outcome during COVID-19 lockdown in Italy: The mediating and moderating roles of psychological flexibility	Landi et al. (2020)	Quant.	Convenience	944	18-81	38.8	75.3	NR	NR	11
104	Anxiety and depression in the Republic of Ireland during the COVID-19 pandemic	Hyland et al. (2020)	Quant.	Stratified Quota	1041	18-88	44.97	51.5	48.2	0.3	11
105	Confirmatory factor analysis and exploratory structural equation modelling of the factor structure of the Depression Anxiety and Stress Scales-21	Gomez et al. (2019)	Quant.	NR	738	18-72	25.29	49.3	50.7	NR	11
106	Depression and Anxiety in Hong Kong during COVID-19	Choi et al. (2020)	Quant.	NR	500	18+	47.26	54.8	45.20	NR	11
107	Psychometric properties of 7- and 30-Day Versions of the PROMIS Emotional Distress Item Banks in an Australian adult sample	Batterham et al. (2019)	Quant.	NR	3,175	18-66	NR	80	20	NR	11

Furthermore, the included articles had sample sizes that ranged from 99 to 18 147 participants, with the ages of participants ranging from 18 to 94. The mean ages of the participants across the articles ranged from 19.15 to 51. Regarding gender, 80 articles reported a majority female sample (3-6, 9-11, 14-16, 19-21, 23-36, 39, 41, 42, 44-48, 53-56, 58-70, 73-78, 80-87, 89-94, 97-99, 102, 103, 104, 106, 107). Twenty one articles (1, 4, 7, 8, 18, 28, 35, 36, 38, 42, 56, 63, 65, 78, 84, 85, 88, 89, 94, 102, 104) also mentioned the proportion of their samples that reported being non-binary or not reporting their gender, with the proportion of non-binary participants amounting to less than 2% of the article samples. However, articles that reported on gender as a belonging to the non-binary or 'other' category were in the minority.

Step 6: Quality Assessment

Uman's sixth step involved assessing the quality of included articles. It was proposed that the Critical Appraisal Skills Programme (CASP) (CASP Checklists, n.d.) would be used for assessing qualitative studies; while quantitative studies were to be assessed using the CASP, as adapted by Laher and Hassem (2020). Considering that the articles included in the systematic review only consisted of quantitative studies, appraisals were conducted using Laher and Hassem's (2020) adapted CASP (appendix D). Based on the adapted CASP, studies were to be scored out of 11, with a score of 0-3 being considered weak; 4-7 moderate, and 8-11 being considered strong.

Following the screening and selection of articles, all of the included articles were assessed for quality using the CASP, as adapted by Hassem and Laher (2020). All of the articles received CASP scores between 7 and 11 (see table 2). 101 (94.39%) of the articles received CASP scores between 9 and 11 (articles 7-107), with 29.70% of these articles receiving a score of 10.5 (articles 63-93); 26.73% receiving a score of 10 (articles 35-62);

16.83% receiving a score of 9.5 (articles 18-34); 13.86% a score of 11 (articles 94-107); and 10.89% a score of 9 (articles 7-17). Based on these scores, the majority (94.3%) of the articles obtained scores that were moderate or strong.

Further regarding the CASP, inconsistencies amongst the ethical data reported were present amongst some of the articles (2, 15, 25, 27). One of the criterions stated by the CASP requires reviewers to indicate if enough information regarding how the studies were explained to participants was described by studies; as well as if informed consent was obtained from participants (Hassem & Laher, 2020). Regarding the former criterion, none of the studies described how the studies were explained to prospective participants. Similarly, two studies stated that informed consent was not required for participation in the online studies (Handal et al., 2018; Keun Park et al., 2023). Another study reported that "A written informed consent was considered obtained from each participant when submitting the online form" (Hallit et al., 2023, p. 6). One study did not acknowledge consent at all (Zhong et al., 2020).

Step 7: Data Analysis and Interpretation

Analysing and interpreting results made up the seventh step of Uman's (2011) eight step guideline. CA was used to analyse the results, with CA referring to the analysis of textual, verbal, or visual information (Cole, 1988; Elo & Kyngäs, 2008). This analytical method was suitable for this study which was aimed at investigating the psychometric properties of online anxiety screening tools, thus being textual in nature. Furthermore, CA is also used to analyze both qualitative and quantitative data (Elo & Kyngäs, 2008; Graneheim et al., 2017). As mentioned above, only quantitative studies were included, thus making CA an appropriate analytical method. Furthermore, CA is useful for collecting the information needed from a source in order to answer a research question, thus making it systematic in its describing of phenomena (Cole, 1988; Elo & Kyngäs, 2008). The three research questions

that guided the systematic review were used as a guideline to sort through the information available in the studies regarding the psychometric properties of the tools, and descriptive and demographic information pertaining to the studies and their participants.

More specifically, the CA was implemented through use of a three-phase, inductive approach. An inductive approach involves categorizing available information as it is presented in a data source, resulting in the making of generalizations (Elo & Kyngäs, 2008; Graneheim et al., 2017). This approach was necessary for this study which was concerned with the shortage of available literature and studies based on the psychometric properties of online anxiety screening tools. The first phase involved selecting units of analyses in order to prepare the data for analysis (Elo & Kyngäs, 2008). Units of analysis refer to measurable content and can include the analysis of words, phrases, or sections of text (Cole, 1988). The descriptions of screening instruments and samples, as well as the sections discussing the psychometric properties of reliability and validity within studies were thus selected as the units of analyses for this study. The second phase involved grouping data according to codes and categories (Elo & Kyngäs, 2008). This was done by grouping codes into relevant categories, and then describing these categories based on their relation to the research questions.

All articles selected for analysis were coded and categorized, with the generation of four overall categories, including: psychometric properties (which included data pertaining to the various screening tools reported in articles, the diagnostic criteria screening tools were based on, reliability, validity, and cutoff scores); adaptation (which included the number of articles that reported on adaptations, as well as the type of adaptation conducted); study designs (which included the uses of measuring anxiety within studies, the number of studies conducted that were related to COVID-19), and sampling strategies and samples (which

included codes related to sampling strategies, sample size, and percentages of male and female participants).

Step 8: Dissemination of Findings

The last phase of the inductive three-phase approach to analysis included reporting the analysis process that was conducted, as well as the results that were obtained (Elo & Kyngäs, 2008). Part of this phase was conducted in this methods section, while also detailed in the results section below. Similarly, Uman's (2011) final step includes the distribution of findings. This step will be administered through the eventual publication of the study.

Ethical Considerations

This systematic review obtained a variety of articles from various publicly available journals and databases present on the internet. Considering that the study used articles from databases accessible online, contact with human participants was not made and was thus classified as 'no risk' based on the University of the Witwatersrand's (n.d.) non-medical Human Research Ethics Committee (HREC). Based on this classification, this study qualified for the application of an Ethics Waiver, with the Ethics certificate (protocol number: MASPR/23/10W) having been granted and unconditionally approved by the School of Human and Community Development Ethics Committee under the non-medical HREC (see appendix E).

Chapter Four: Results

This chapter intends to discuss the key findings of the study as they pertain to the research questions discussed above.

Article Descriptions in Relation to Anxiety Screening Tools

From the analysis of data (see table 2) it is evident that all of the studies were quantitative and conducted online. However, despite all of the studies being conducted online, only two articles (32 and 67) provided a brief acknowledgement and comparison of the administration of tools online, versus via paper-and-pencil. Shea et al. (2009) stated that items of the DASS-21 were invariant across both online and paper-and-pencil based administration. Furthermore, Sanabria-Mazo et al. (2024) briefly compared computer and pencil-and-paper versions of the PHQ-4 by stating that paper-and-pencil versions of the PHQ-4 had been validated amongst clinical and non-clinical samples, whilst theirs was the first to validate the dimensionality and reliability of an online administration of the PHQ-4 amongst a general sample of Colombian adults.

Throughout the articles, the anxiety screening tools were used for various analyses. Majority of the articles (67.30%) used anxiety screening tools to measure the association of anxiety with other measures (1,3, 5, 6-9, 11-13, 15, 16, 18, 19, 20, 25, 28, 29, 30, 31, 34, 37, 38-40, 41-43, 45, 46, 48, 49, 51,53, 54, 56-60, 62, 63-66, 68-70, 73, 74, 76, 77, 81-85, 87-91, 93, 97-100, 102, 103, 105). Some of these included the association of anxiety with optimism and resilience; cognitive failure; alexithymia, and goal engagement and disengagement, amongst others (Goodhew & Edwards, 2024; Larionow et al., 2024; Verschuren & Douilliez, 2024; and Vos et al., 2021). Psychometric studies were conducted in 16.82 % of the articles (2, 17, 24, 27, 32, 35, 50, 55, 61, 67, 73, 78 79, 91, 95, 101, 104, 106) with 15 of these studies pertaining to anxiety screening tools (2, 17, 24, 32, 35, 50, 55, 61, 67, 73, 79, 91, 101, 104, 106). Studies using anxiety screening tools to validate other measures through the

conduction of correlations were conducted by 14.02% of the articles (4, 10, 21, 23, 26, 36, 52, 58, 71, 72, 75, 80, 93, 94, 96). Anxiety tools were used to validate measures of Fear of COVID-19 amongst various populations, including Peru, Greece, Saudi Arabia, Indonesia, and Italy (Alyami et al., 2021; Huarcaya-Victoria et al., 2022; Nazari et al., 2023; Soraci et al., 2022; Tsipropoulou et al., 2021). Additional measures were also validated by the anxiety tools, including body perception, cyberchondria, and anger discomfort (Hallit et al., 2023; Kim & Stead, 2024; Najari et al., 2024). The occurrence of anxiety following the outbreak of COVID-19 was investigated in 18.69% of the included studies (15, 16, 18, 22, 33, 46, 59, 62, 63, 69, 81-83, 85, 93, 98, 99, 103, 105). Further relating to COVID-19, 50.47% of the articles were based on studies centered around the outbreak of the pandemic (1, 12, 14, 15, 16, 18, 19, 22, 23, 25, 27, 30, 33, 34, 39-43, 45-47, 51, 56-60, 62, 63, 65, 67, 69, 71, 75, 80-89, 91, 93, 94, 99, 100, 102-104, 106), while the other 49.53% was not COVID-related (2-11, 13, 17, 20, 21, 24, 26, 28, 29, 31, 32, 35, 36-38, 44, 48, 49, 50, 52-55, 61, 64, 66, 68, 70, 72-74, 76-79, 90, 92, 95-98, 101, 105, 107).

Countries in which Tools were Tested

The countries that studies were conducted in were stated by 96.26% of the articles. The remaining 3.74% did not report the countries studies were conducted in; or were not specific as to which countries samples were taken from. In their study, Bredemeier et al. (2023) stated that 89.3% of their sample were from European countries, 6.7% from the United States, and 4% from other countries. The other countries the 4% of the sample were from were not reported (Bredemeier et al., 2023). Studies within the included articles made use of anxiety screening tools across 42 countries and six continents (see table 2). These continents included North America, South America, Europe, Asia, Oceania, and Africa. Europe was the continent where most (71.70%) of the samples were taken from; followed by Asia (19.81%). The rest of the continents (Africa, North America, South America, and

Oceania) accounted for less than 17% of the samples. However, despite North America being amongst the continents with together less than 17% of the article samples, the country wherefrom the most samples were taken was the United States, which accounted for 11.76% of the article samples. The United States was followed by China and Spain (10.78% each), and then Italy (9.8%). Of the studies that mentioned the countries the samples originated from, only one article reported having a sample from The Gambia, in West Africa.

Availability Of Online Screening Tools

Twenty two anxiety screening tools were identified across the included articles (see table 3). The most commonly used tool was the GAD-7. The GAD-7 was used by 44 articles (3, 6, 11, 14, 17-19, 23, 27, 33, 39, 40, 42, 45, 46, 47, 49, 50, 53, 55, 56, 58, 59, 60, 62, 63, 69, 73, 75 76, 83-87, 92, 94, 99,100,102, 103,104, 106, 107). The GAD-7 was followed by the 21 items of the DASS-21, which was used by 28 of the articles (1, 10, 12, 15, 16, 20, 21, 22, 30, 32, 36, 38, 48, 53, 57, 61, 65, 66, 74, 77, 79, 81, 82, 90, 91, 95, 96, 105). The third most commonly used tool was the STAI used by 9 of the articles (7, 8, 13, 25, 29, 34, 52, 64, 89). Of the nine articles that used the STAI, four studies used the full STAI (8, 25, 34, 64) which measures both state and trait anxiety; three studies used the ‘trait’ subscale of the STAI (13, 29, 52), and 2 studies used the ‘state’ subscale of the STAI (7, 89). The remaining 19 screening tools were used by less than 33% of the articles (2, 4, 5, 9, 17, 24, 26, 28, 31, 35, 37, 41, 43, 44, 51, 53, 54, 55, 61, 67, 68, 70, 71, 72, 73, 76 , 78, 80, 88, 93, 96, 97, 98, 101, 107).

Table 3

Psychometric Properties of Included Studies

Article No.	Title	Authors	Country	Anxiety screening Tool	Reliability	Validity	Translation
3	Is social media use for networking positive or negative? Offline social capital and internet addiction as mediators for the relationship between social media use and mental health	Glaser et al.	New Zealand	GAD-7	α =.94	NR	NA
6	Intolerance of uncertainty, appraisals, coping, and anxiety: The case of the 2009 H1N1 pandemic	Taha et al.	Canada	GAD-7	α =0.95	The study referred to other studies where the validity and consistency of the GAD-7 was stated as being 'good'. The current study also indicated convergent and discriminant validity of the GAD-7 with the measure of MHFS	NA
11	Goal disengagement and goal reengagement: Associations with depression, anxiety, and satisfaction with life	Verschuren and Douilliez	Belgium, France, Switzerland	GAD-7	α = .88; ω=.89	NR	French
14	COVID-19-related anxiety predicts somatic symptoms in the UK population.	Shevlin et al.	United Kingdom	GAD-7	a = .94	The study stated that the GAD-7 has been proven a valid and reliable measure amongst community samples.	NA

17	Establishing a common metric for self-reported anxiety: Linking the MASQ, PANAS, and GAD-7 to PROMIS Anxiety	Schalet et al.	United States	GAD-7	Internal consistency was high amongst individual scales (.89 to .98); as well as for the combined scales (.98).	Combining of the measures resulted in the finding of a general overall construct of anxiety. PROMIS and the GAD-7 (27 items) were CFI = 0.972, TLI = 0.970, and RMSEA = 0.077..	NA
18	A symptom-based definition of resilience in times of pandemics: Patterns of psychological responses over time and their predictors	Valiente et al.	Spain	GAD-7	Cronbach's α T1= 0.927; T2= 0.932; Test retest= 0.86	NR	NA
19	Association between coping resources and mental health during the COVID-19 pandemic: A cross-sectional study in the Czech Republic.	Šípová et al.	Czech Republic	GAD-7	α = .87	NR	NA
23	Psychometric properties of the Greek version of FCV-19S.	Tsipropouloui et al.	Greece	GAD-7	α=.79	NR	NA
27	Validation study of the Korean version of the COVID-19 Anxiety Scale (CAS-7) and psychometric comparison of different rating scales	Park et al.	South Korea	GAD-7	α =0.948	NR	Korean
33	COVID-19 pandemic and lockdown measures impact on mental health among the general population in Italy	Rossi et al.	Italy	GAD-7	a=0.91	NR	Italian
39	Development of social distancing phobia scale and its association with anxiety and perceived stress	Gunlu	Turkey	GAD-7	α =0.91	NR	Turkish
40	Early psychosocial predictors of mental health among Indians during coronavirus disease 2019 outbreak	Ahmad et al.	India	GAD-7	α =0.87	The article referred to other articles where the GAD-7 was proven valid amongst a general population, indicating	NA

42	Handwashing adherence during the COVID-19 pandemic: A longitudinal study based on protection motivation theory	Szczukaa et al.	Australia, Canada, China, France, the Gambia, Germany, Israel, Italy, Malaysia, Poland, Portugal, Romania, Singapore, and Switzerland	GAD-7	α = 0.89	NR	country specific
45	Mental health screening for COVID-19: A proposed cutoff score for the Greek version of the Fear of COVID-19 Scale (FCV-19S	Nikopoulou et al.	Greece	GAD-7	0.79	NR	NA
46	Psychological health, sleep quality, and coping styles to stress facing the COVID-19 in Wuhan, China	Fu et al.	China	GAD-7	α =0.901	NR	Chinese
47	The relationship between individuals' sources of information, perceptions, and anxiety regarding the COVID-19 pandemic in Turkey.	Aksan	Turkey	GAD-7	α =.91	the sensitivity was 89%, while the specificity was 82% when the cut-off score was 10.	Turkish
49	The role of self-esteem and emotion regulation in the associations between childhood trauma and mental health in adulthood: A moderated mediation model	Li et al.	China	GAD-7	α = 0.937	NR	NA
50	The universality of anxiety experiences between Germany, Indonesia, and the US: A measurement invariance analysis	Jaya et al.	United States, Germany, Indonesia	GAD-7	Total sample: ω =0.910); English (ω =0.930); German (ω =0.897), and Indonesian version (ω =0.898).	The GAD-7 proved to be measurement invariant across the three countries	English, German, Indonesian
53	Validation of the Chinese version of the Perseverative Thinking Questionnaire	Yao et al.	China	GAD-7	PSWQ (S1):α = 0.93; DASS-21 (S1): anxiety-α =0.81; Beck Anxiety Inventory (BAI) (S2): α =0.90 (time 1) and α =0.89 (time 2); GAD-7:S2-α =0.90 for both time points	NR	Chinese

55	Validity of the PROMIS depression and anxiety common metrics in an online sample of Australian adults	Sunderland et al.	Australia	GAD-7	GAD-7 item response obtained ICC of 0.91–0.92, and the GAD-7 cross-walk scoring an ICC of 0.90–0.92	The study found excellent agreement between the PROMIS and the GAD-7 (ICC between 0.90 and 0.92), suggesting concurrent and criterion validity.	NA
56	Worry about {COVID}-19 contagion and general anxiety: {Moderation} and mediation effects of cognitive emotion regulation	Muñoz-Navarro et al.	Spain	GAD-7	α =0.89	NR	Spanish
58	Psychometric properties of a Spanish version of the Fear of COVID-19 Scale in general population of Lima, Peru.	Huarcaya-Victoria et al.	Peru	GAD-7	α =0.898	NR	Spanish
59	COVID-19 related depression and anxiety among quarantined respondents.	Tang et al.	China	GAD-7	a=0.89	NR	NA
60	Perception of health conditions and test availability as predictors of adults' mental health during the COVID-19 pandemic: A survey study of adults in Malaysia	Dai et al.	Malaysia	GAD-7	α=0.92	NR	NA
62	Generalized anxiety and depressive symptoms in various age groups during the COVID-19 lockdown in Poland. Specific predictors and differences in symptoms severity	Gambina et al.	Poland	GAD-7	α=0.94	authors referred to other studies where the psychometric properties of the GAD-7 were good	Polish

63	Adjustment disorder, traumatic stress, depression and anxiety in Poland during an early phase of the COVID-19 pandemic	Dragan et al.	Poland	GAD-7	α = .92	Previous studies (Kertz et al., 2012) referred to the GAD-7 as reliable and valid (e.g. cut-off point is ≥10; Correlations between symptoms of generalized anxiety and symptoms of adjustment disorder, AjD-C and AjD-AS, were r = .67 (p < .001) and r = .70 (p < .001), respectively.	Polish
69	Fear, Anxiety and Depression among Bosnia and Herzegovina Citizens during the Third wave of COVID-19	Šljivo and Kulenović	Bosnia and Herzegovina	GAD-7	α = 0.916	NR	Bosnian, Croatian, Serbian
73	Psychometric properties of the Generalised Anxiety Disorder Dimensional Scale in an Australian sample	Groves et al.	Australia	GAD-7	GAD-D: α = .92; GAD-7:α =91	A score of 10 or more on the GAD-7 was established as the cut-point with an optimal balance of sensitivity (89%) and specificity (82%).	NA
75	Psychometric validation of the Indonesian Version of the Fear of COVID-19 Scale: Personality traits predict the fear of covid-19	Nazari et al.	Indonesia	GAD-7	α = 0.83	NR	NA
76	The factor structure and measurement invariance of the PHQ-4 and the prevalence of depression and anxiety in a Southeast Asian context amid the COVID-19 pandemic.	Mendoza et al.	Philippines	GAD-7	GAD-2 (as part of the PHQ-4) α =0.83; GAD-7: α = 0.79	NR	NA
83	The effect of age, gender, income, work, and physical activity on mental health during coronavirus disease (COVID-19) lockdown in Austria.	Pieha et al.	Austria	GAD-7	α=0.90	NR	NA

84	Longitudinal predictors of depression, anxiety, and alcohol use following COVID-19-related stress	Venanzi et al.	United States	GAD-7	At baseline, Cronbach's alphas = 0.93, and 0.93 at 3-month Follow-up	NR	NA
85	Anxiety, depression, traumatic stress and COVID-19-related anxiety in the UK general population during the COVID-19 pandemic	Shevlin et al.	United Kingdom	GAD-7	(α=0.94	Sensitivity = 89% and specificity=82 %	NA
86	The Italian COVID-19 Anxiety Syndrome Scale: Investigation of the COVID-19 anxiety syndrome and its association with psychological symptoms in an Italian population	Mansueto et al.	Italy	GAD-7	Cronbach's alpha = 0.93	Authors report the GAD-7 as having good psychometric properties	Italian
87	Individual, social and national coping resources and their relationships with mental health and anxiety: A comparative study in Israel, Italy, Spain, and the Netherlands during the Coronavirus pandemic	Mana et al.	Israel, the Netherlands, Italy, Spain	GAD-7	α = 0.91, 0.85, 0.88, 0.90	NR	Hebrew; Dutch; Italian; Spanish
92	The hierarchical factor structure of the Spanish version of Depression Anxiety and Stress Scale -21	Ruiz et al.	China	GAD-7	Sample 3: Online Spain-α=..95; Sample 4: Online Colombia-α=.93	Invariant across countries and sample type. One general factor (emotional) with 3 separate first order factors.	Spanish
94	An assessment of the psychometric properties and psychological correlates of the Greek Covid€□19 Anxiety Syndrome Scale (Câ€□19ASS)	Seydavi et al.	Greece	GAD-7	ω=.93	Other studies referred to proving the validity and reliability of the GAD-7	Greek
99	Psychological impact of COVID-19 in the Sweden Population: Depression, anxiety, and insomnia and their associations to risk and vulnerability factors	McCracken et al.	Sweden	GAD-7	α=0.90	Previous studies were referred to where the GAD-7 demonstrated strong psychometric properties. A cutoff score of 10 was stated as yielding a sensitivity = 89%, and a specificity = 82%	NA

100	Psychological adjustment in Spain during the COVID-19 pandemic: Positive and negative mental health outcomes in the general population	Valiente et al.	Spain	GAD-7	α =.93	Authors reported measure to be validated in Spanish with good psychometric properties	Spanish
102	Measurement invariance of the Patient Health Questionnaire (PHQ-9) and Generalized Anxiety Disorder scale (GAD-7) across four European countries during the COVID-19 pandemic	Shevlin et al.	United Kingdom; Ireland; Spain; Italy	GAD-7	UK α = 0.921; Ireland α = 0.905; Spain α = 0.889; Italy α = 0.918	Invariant across countries; age; and sex	NA
103	Health anxiety and mental health outcome during COVID-19 lockdown in Italy: The mediating and moderating roles of psychological flexibility	Landi et al.	Italy	GAD-7	α=0.90	Authors report the measure as having good psychometric properties	Italian
104	Anxiety and depression in the Republic of Ireland during the COVID-19 pandemic	Hyland et al.	Ireland	GAD-7	a = 0.94	A cut-off score of ≥10 was used and yielded a sensitivity of 89% and a specificity of 82%	NA
106	Depression and anxiety in Hong Kong during COVID-19	Choi et al.	China	GAD-7	α=0.95	1A cutoff of 10 indicated possible anxiety, and yielding a sensitivity of 89%, and a specificity of 82%	NA
107	Psychometric properties of 7- and 30-Day versions of the PROMIS Emotional Distress Item Banks in an Australian adult sample	Batterham et al.	Australia	GAD-7	GAD-7: α = .92;	GAD-7: Sensitivity (0.81); Specificity (0.826)	NA

1	Optimism, mindfulness,ˇand resilience as potential protective factors for the mental health consequences of fear of the coronavirus.	Vos et al.	Predominantly Belgium and Netherlands (Australia, Canada, Czech Republic, Denmark, France, Germany, Ireland, Israel, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States of America)	DASS-21	a=0.82	NR	NA
10	Factor structure and psychometric properties of the Body Perception Questionnaire“ Short Form (BPQ-SF)	Najari et al.	Persia	DASS-21	α=0.82	NR	Persian
12	The effect of ego-resiliency and COVID-19-related stress on mental health among the Japanese population	Kubo et al.	Japan	DASS-21	anxiety: α =0.92, ω =0.92	NR	Japanese
15	Association of social media use with mental health conditions of nonpatients during the COVID-19 outbreak: Insights from a national survey study	Zhong et al.	China	DASS-21	α=.860	NR	NA
16	Mental health risk factors during the COVID-19 pandemic in the Polish population	Larionow and Mudło-Głagolska	Poland	DASS-21	α=.0.91	NR	NA
20	Inhibition on irrelevant negative information alleviates the mediating role of psychological distress in the association between trait rumination and symptoms of depression and anxiety	Putra et al.	Indonesia	DASS-21	anxiety (α = .75)	Authors report that the DASS-21 has been validated in a previous study amongst an Indonesian population.	Indonesian

21	Measuring decentering -Development and validation of the French version of the Experiences Questionnaire (EQ-F)	Gamaiunova et al.	France and Switzerland	DASS-21	Cronbach's α for anxiety = .86; stress = .89; McDonald's ω anxiety = .85;	NR	French
22	Psychological states of Bangladeshi people four months after the COVID-19 pandemic: An online survey	Zubayera et al.	Bangladesh	DASS -21	α =0.85	Authors reported using a validated Bangladeshi version of the measure	Bangla
30	Six addiction components of problematic social media use in relation to depression, anxiety, and stress symptoms: A latent profile analysis and network analysis	Peng and Liao	China	DASS-21	anxiety: α =0.876	NR	NA
32	Rasch model analysis of the Depression, Anxiety and Stress Scales (DASS)	Shea et al.	Australia	DASS-21	anxiety: PSI = 0.77. The removal of item 2 "I was aware of dryness of my mouth" resulted in an improved model fit with PSI changing from 0.76 to 0.77. This suggests the usefulness in comparing groups, but not diagnosis. The PSI further increased to 0.84 with the further removal of items 2, 11, and 15 from the DASS 21	NR	NA
36	Assessing psychological flexibility: The psychometric properties of the Czech translation of the compact questionnaire	PTÁČEK and JELÍNEK	Czech Republic	DASS-21	, ω anxiety = .90	NR	Czech
38	Conceptualising social media addiction: a longitudinal network analysis of social media addiction symptoms and their relationships with psychological distress in a community sample of adults	Tullett-Prado et al.	Australia	DASS-21	t1 and t2: α=0.85; ω=0.86	NR	NA
48	The relationship between interoceptive emotional awareness, neuroticism, and depression, anxiety, and stress	Grimble et al.	Australia	DASS-21	Anxiety (α = .83)	NR	NA

53	Validation of the Chinese version of the Perseverative Thinking Questionnaire	Yao et al.	China	DASS-21	DASS-21 (S1): anxiety-α =0.81	NR	Chinese
57	Risk of depression, anxiety, and stress among the Saudi general population during the COVID-19 pandemic	Alsaif et al.	Saudi Arabia	DASS-21	anxiety (α = 0.81)	NR	Arabic
61	Can the Depression Anxiety Stress Scales Short be shorter? Factor structure and measurement invariance of DASS-21 and DASS-9 in a Greek, non-clinical sample	Kyriazos et al.	Greece	DASS-21	DASS-9: α=.77, ω=.76; DASS-21: α=.88, ω=.84. Average Variance Extracted: DASS-21=.51; DASS-9=.51	Convergent validity measured by AVE was adequate. Anxiety was strongly related to other measures of emotionality, wellbeing, resilience, hope, and QoL.	NA
65	COVID-19 fear and anxiety as mediators in the relationship between repetitive negative thinking and psychopathology: A community-based study during the 2nd confinement in Portugal	Peixoto and Cunha	Denmark	DASS-21	α = 0.90	NR	Portuguese
66	Cross-cultural validation and measurement invariance of the Perth Alexithymia Questionnaire (PAQ): A study in Iran and the USA	Mazidi et al.	Iran and United States	DASS-21	Iran: α =.80; ω= .80; US: α = .90; ω=.90	NR	English, Persian
74	Psychometric properties of the Italian Tendency to Avoid Physical Activity and Sport Scale relationship to weight stigma and body esteem	Soraci et al.	Italy	DASS-21	anxiety: α = .94	NR	Italian
77	The psychometric properties of the Turkish version of the Pre-sleep Arousal Scale	Türkarslan et al.	Turkey	DASS-21	α =0.83	NR	Turkish
79	Using a bifactor exploratory structural equation modeling framework to examine the factor structure of the Depression Anxiety and Stress Scales-21: Research and Reviews	Koğa and Koğar	Turkey	DASS-21	Anxiety scale: α =0.76. According to this model, the ECVgen and the ECV for depression, anxiety, and stress were 0.70, 0.14, 0.09, and 0.08, respectively.	In this study, the DASS-21 demonstrated measurement invariance across genders The DASS-21 also demonstrated concurrent validity	Turkish

81	A nationwide survey of psychological distress among Italian people during the COVID-19 pandemic: Immediate psychological responses and associated factors.	Mazza et al.	Italy	DASS-21	anxiety: a =0.85	The study reported the DASS-21 as being a valid measure.	Italian
82	Stress, anxiety, and depression levels in the initial stage of the COVID-19 outbreak in a population sample in the northern Spain,	Ozamiz-Etxebarria et al.	Spain	DASS-21	anxiety α = 0.82	The study included correlations between the subscales to suggest the validity of the measure: anxiety and stress (r = 0.713), depression and stress (r = 0.698), and depression and anxiety (r = 0.681),	NA
90	Fear of COVID-19 and positivity: Mediating role of intolerance of uncertainty, depression, anxiety, and stress	Bakioğlu et al.	Turkey	DASS-21	Cronbach's alpha =.93 at T1 and .94 at T4	CFA confirmed the factor structure of the measure within the sample.	NA
91	Mindfulness and symptoms of depression and anxiety: The underlying roles of awareness, acceptance, impulse control, and emotion regulation	Cheung and Ng	Spain and Colombia	DASS-21	α=.85	NR	Turkish
95	Fundamental fears in Greece (i): The psychometric properties of the Greek adaptation of the Anxiety Sensitivity Index-3	Makrygiorgos et al.	Greece	DASS-21	α = .88	the article mentions the DASS-21 as being a valid tool	Greek
96	Investigating the structure of the CESD-R and DASS-21 across adults with low and high levels of autistic traits.	McKernan and Russo	NR	DASS-21	α =.905	The DASS-21 obtained scalar variance indicating its construct validity.	NA
105	Confirmatory factor analysis and exploratory structural equation modelling of the factor structure of the Depression Anxiety and Stress Scales-21	Gomez et al.	NR	DASS-21	a =.71	Authors refer to other studies reflecting acceptable validity of the DASS-21.	NA
7	Development and initial validation of a short form of the Memories of Home and Family Scale	Redican et al.	United Kingdom	STAI-State	a = .95	NR	NA

8	Elevated cognitive failures in trait anxiety	Goodhew and Edwards	United Kingdom	The State and Trait Anxiety Inventory (STAI)	Trait anxiety ω=0.95; State Anxiety ω=0.96	NR	NA
13	Instagram: Friend or foe? The application's association with psychological well-being.	Mackson et al.	NR	State Trait Anxiety Inventory (STAI-T	α = 0.95	NR	NA
25	The psychological impact of {COVID}-19 in {Italy}: {Worry} leads to protective behavior, but at the cost of anxiety	Prete et al.	Italy	State-Trait Anxiety Inventory, STAI Y1(	α =0.94	NR	Italian
29	Affective forecasting in individuals with trait anxiety: Increased anticipated unpleasantness and the underlying psychological mechanism.	Wang et al.	NR	STAI-T	α =0.89	NR	Chinese
34	Exploring lifestyle habits, physical activity, anxiety and basic psychological needs in a sample of Portuguese adults during covid-19	Antunes et al.	Portugal	STAI	state = 0.93; trait = 0.93	NR	Portuguese
52	Validation of Korean version of the Anger Discomfort Scale	Kim and Stead	South Korea	STAI-Y (Trait)	community sample:α = 0.95	NR	Korean
64	Clarifying the link between anxiety and conspiracy beliefs: A cross-sectional study on the role of coping with stressors	Krüppel et al.	Germany	State-Trait Anxiety Inventory (STAI)	state (α 0.94). = 0.92) and trait anxiety (α =0.94) [S1]; state anxiety(α =0.92) and trait anxiety (α =0.93) [S2].	NR	German
89	Intolerance of COVID-19-related uncertainty and depressive and anxiety symptoms during the pandemic: A longitudinal study in Argentina	del-Vallea et al.	Argentina	STAI-state	Time 1: α 2: α =0.93; Time 3: α =0.95).	NR	Argentinian
4	Optimizing process-based therapy: A Boruta-driven approach to Identifying key clinical outcomes in a Swedish validation of the process-based assessment tool (PBAT)	Larsson and Sundstrom	Sweden	PHQ-4	α =0.90	NR	Swedish
9	Enabling brief assessments of alexithymia: psychometric properties of the Russian version of the Perth Alexithymia Questionnaire-Short Form (PAQ-S) and its correlates with ill-being and well-being	Larionow et al.	Russia	PHQ-4	α=0.69; ω= 0.69	NR	Russian

35	The patient health questionnaire–4: factor structure, measurement invariance, latent profile analysis of anxiety and depressive symptoms and screening results in Polish adults.	Larionow and Mudło-Głagolska	Poland	PHQ-4	McDonald's ω: female (0.73); male (0.85); non-binary (0.79); Test retest reliability was suggested by ICC of all the PHQ–4 scores between the two measurements being high (≥ .59) and statistically significant (all ps < .001; anxiety = .59; depression = .62; total PHQ–4 score = .68), thus	Kroenke et al. (2007) suggested the GAD–2 to have a cut-off score of ≥ 3 for good sensitivity (86%) and specificity (83%) for GAD	Polish
67	Dimensionality and reliability of the online version of the Patient Health Questionnaire-4 in a large Colombian sample: results from the PSY-COVID study	Sanabria-Mazo et al.	Colombia	PHQ-4	α =.83; ω=.83; λ2=.82	The article referred to other articles indicating the validity of the PHQ-4 both online and paper-and-pencil. The study also confirmed the 2-factor structure of the PH4-4, and measurement invariance for age, gender, income and education level, and region	NA

76	The factor structure and measurement invariance of the PHQ-4 and the prevalence of depression and anxiety in a Southeast Asian context amid the COVID-19 pandemic.	Mendoza et al.	Philippines	PHQ-4	GAD-2 (as part of the PHQ-4) (anxiety) α =0.83;	Convergent validity of the PHQ-4 was confirmed through positively associated correlations where depression ($r = 0.60$, $p < 0.01$) and anxiety subscales ($r = 0.64$, $p < 0.01$) of the PHQ-4 were positively correlated to stress. Anxiety symptoms ($r = -0.29$, $p < 0.01$) had significant negative relationship with positive affect	NA
88	Incremental validity of coronaphobia: Coronavirus anxiety explains depression, generalized anxiety, and death anxiety	Lee et al.	United States	PHQ-4	α=.84	NR	NA
97	Psychometric properties of the Polish version of the Perth Emotional Reactivity Scale	Larionow et al.	Poland	PHQ-4	anxiety:α = 0.78; ω=0.78	NR	Polish version
28	Relationships among repetitive negative thinking types, change in employment, and mental health	Pössel et al.	United States	HADS	PSWQ: α = 0.95; HADS: α = 0.88	NR	NA
41	Effectiveness of an online short-term audio-based mindfulness program on negative emotions during the COVID-19 pandemic: Latent growth curve analyses of anxiety and moderated mediation effects of anxiety between mindfulness and negative affect.	Kang et al.	China	HADS	Baseline: α = 0.76, 1 week: α = 0.73; 2 weeks: α =0; 3 weeks: α = 0.75	NR	Chinese
71	Psychometric evaluation of the Arabic version of the Fear of COVID-19 Scale	Alyami et al.	Saudi Arabia NR	HADS	HADS-A, α=.80	NR	Arabic
80	Validation and psychometric evaluation of the Italian version of the Fear of COVID-19 Scale	Soraci et al.	Italy	HADS	anxiety (α =0.722)	NR	Italian

28	Relationships among repetitive negative thinking types, change in employment, and mental health	Pössel et al.	United States	PSWQ	PSWQ: α = 0.95; HADS: α = 0.88	NR	NA
31	Don't worry, it won't be fine. Contributions of worry and anxious arousal to startle responses and event-related potentials in threat anticipation	Carsten et al.	Germany	PSWQ	α = 0.93; α = 0.90	NR	NA
43	Intolerance of uncertainty, anxiety sensitivity, and health anxiety during the COVID-19 pandemic: Exploring temporal relationships using cross-lag analysis	Bredemeier et al.	International, with majority from European countries (89.3), 6.7% from the US; and 4% from other countries	PSWQ	time 1: α 2.3. Procedures =0.94; time 2: α =0.95	Authors referred to other studies reporting the validity of PSWQ	NA
53	Validation of the Chinese version of the Perseverative Thinking Questionnaire	Yao et al.	China	PSWQ	PSWQ (S1):α = 0.93; DASS-21 (S1): anxiety-α =0.81; Beck Anxiety Inventory (BAI) (S2): α =0.90 (time 1) and α =0.89 (time 2); GAD-7:S2-α =0.90 for both time points	NR	Chinese
37	Beliefs about sleep: Links with ruminations, nightmare, and anxiety	Faccini et al.	France	BAI	α = 0.85	We used the validated French version of this scale in this study	French
53	Validation of the Chinese version of the Perseverative Thinking Questionnaire	Yao et al.	China	BAI	PSWQ (S1):α = 0.93; DASS-21 (S1): anxiety-α =0.81; Beck Anxiety Inventory (BAI) (S2): α =0.90 (time 1) and α =0.89 (time 2); GAD-7:S2-α =0.90 for both time points	NR	Chinese

101	Social media use and anxiety in emerging adults	Anna Vannuccia et al.	United States	BAI-T	Cronbach's α was 0.96.	Authors reported the measure as being valid.	NA
44	Mapping of the network connection between sleep quality symptoms, depression, generalized anxiety, and burnout in the general population of Peru and El Salvador	Yupanqui-Lorenzo et al.	Peru and El Salvador	GAD-2	Peru (ω = .76) and El Salvador (ω = .85).	NR	Spanish
51	Trait and situation-specific intolerance of uncertainty predict affective symptoms during the COVID-19 pandemic	Broos et al.	United States	GAD-2	α =0.91	NR	NA
54	Validation of the Chinese version of the Sleep Regularity Questionnaire (SRQ) and analysis of influencing factors	Zhao et al.	China	GAD-2	α =0.846	NR	Chinese
17	Establishing a common metric for self-reported anxiety: Linking the MASQ, PANAS, and GAD-7 to PROMIS Anxiety	Schalet et al.	United States	MASQ	Internal consistency was high amongst individual scales (.89 to .98); as well as for the combined scales (.98).	Combining of the measures resulted in the finding of a general overall construct of anxiety. PROMIS and MASQ-GA (48 items) fit values were: CFI = 0.951, TLI = 0.948, and RMSEA = 0.093.	NA
31	Don't worry, it won't be fine. Contributions of worry and anxious arousal to startle responses and event-related potentials in threat anticipation	Carsten et al.	Germany	MASQ	α = 0.93; α = 0.90	NR	NA
68	Emotion regulation frequency and self-efficacy: Differential associations with affective symptoms	Ramos-Cejudo et al.	Spain	PROMIS-A	a=.93; x=.95	NR	NA
107	Psychometric properties of 7- and 30-Day versions of the PROMIS Emotional Distress Item Banks in an Australian adult sample	Batterham et al.	Australia	PROMIS-A	GAD-7: α = .92; PROMIS Anxiety: NR	PROMIS A: sensitivity (0.830); specificity (0.784)	NA

24	The Cleveland Adaptive Psychopathology Inventory: Preliminary validity and reliability of a multi-scale personality and psychopathology questionnaire	Poreh and Levin	United States	Cleveland Adaptive Psychopathology Inventory (CAPI)	Anxiety: α =.871. anxiety items have a mean inter item correlation of .376 amongst the normative sample with α= .883	The study reported that all the scales, including the CAPI, had demonstrated reasonable criterion validity, with sensitivity=0.519174; and specificity=0.867511	NA
2	Validation, reliability, and specificity of CliniCom™ Psychiatric Assessment Software	Handal et al.	United States	CliniCom™ Psychiatric Assessment Software	The authors state that the CliniCom has good reliability due to its 78% concordance when measured twice within the same subject. Furthermore, The CliniCom was concordant at the diagnostic level with another measure of anxiety (HAM-A), with a concordance percentage of 88.2%	81% concordance for GAD	NA
61	Can the Depression Anxiety Stress Scales Short be shorter? Factor structure and measurement invariance of DASS-21 and DASS-9 in a Greek, non-clinical sample	Kyriazos et al.	Greece	DASS-9	DASS-9: α=.77, ω=.76; DASS-21: α=.88, ω=.84. Average Variance Extracted: DASS-21=.51; DASS-9=.51	Convergent validity measured by AVE was adequate. Anxiety was strongly related to other measures of emotionality, wellbeing, resilience, hope, and QoL.	NA
5	Validation of the Acceptance and Action Questionnaire-II in the general Spanish population.	Menéndez-Aller et al.	Spain	Educational-Clinical Anxiety and Depression Questionnaire	anxiety (α =0.90)	NR	NA
26	Validation of the Arabic version of the cyberchondria severity scale 12 items (CSS-12-Ar) among a sample of Lebanese adults	Hallit et al.	Lebanon	LAS-10	α =0.93	NR	Lebanese

93	COVID-19 pandemic and mental health in Lebanon: a cross-sectional study	El Othman et al.	Lebanon	LAS-10	a=0.886)	Authors mention that scale has shown good sensitivity and specificity	Lebanese
70	Phubbing among Lebanese young adults: Scale validation and association with mental health (depression, anxiety, and stress): Research and Reviews	Bitar et al.	Lebanon	Lebanese Anxiety Scale (LAS)	α = 0.886	NR	NA
78	The Self-Compassion Scale: Validation and psychometric properties within the exploratory structural equation modeling framework	Rakhimov et al.	United Kingdom	Patient Reported Outcomes Measurement Information System (PROMIS) Emotional Distress-Anxiety Short Form	α =.93	NR	NA
98	Testing the metacognitive model of rumination and depression in non-clinical populations: New data about PBRS and NBRS scales.	Cano-López et al.	Spain*	PSWQ-3	α =.88	Article reported that the measure had good psychometric properties but was not explicit about validity.	Spanish
17	Establishing a common metric for self-reported anxiety: Linking the MASQ, PANAS, and GAD-7 to PROMIS Anxiety	Schalet et al.	United States	PANAS	Internal consistency was high amongst individual scales (.89 to .98); as well as for the combined scales (.98).	Combining of the measures resulted in the finding of a general overall construct of anxiety.	NA
72	Psychometric evaluation of the Swedish version of the Types of Positive Affect Scale	Lehmivaara et al.	Sweden	STAI-short form 10 item	State-Anxiety (α = .906); Trait-Anxiety (α = .897)	NR	Swedish

73	Psychometric properties of the Generalised Anxiety Disorder Dimensional Scale in an Australian sample	Groves et al.	Australia	GAD-D	GAD-D: α = .92; GAD-7:α =91. The ICC between GAD-D scores at Part 1 and Part 2 was .85 (p < .001; 95%CI=.66-.94). This strong, positive correlation indicates good test-retest reliability.	positive correlation was found between the GAD-D and GAD-7, r =.77 (p <.001), indicating convergent validity. Furthermore, the correlation between the GAD-D and the GAD-7 was higher than the correlation between the GAD-D and the PDSS, indicating discriminant validity of the GAD-D.	NA

Of the 107 included articles, only five reported on the diagnostic criteria screening tools were based on (2, 44, 50, 68, 76). Four of these articles reported that their anxiety screening tools were based on the DSM-5 (2, 50, 68, 76). These tools included the CliniCom™ Psychiatric Assessment Software, the GAD-7,the PROMIS-A, and the PHQ-4 (GAD-2 subscale), respectively. One article (44) stated that the tool was based on the DSM-V-TR, with the tool used being the GAD-2**.** Of these studies that reported on the diagnostic criteria tools were based on, only two studies used adapted anxiety tools. These were studies by Yupanqui-Lorenzo et al. (2024), who used the adapted GAD-2, and Jaya et al. (2024), who used the adapted GAD-7. The adapted version of the GAD-2 used by Yupanqui-Lorenzo et al. (2024) was adapted into Spanish and had been reported to have adequate reliability following adaptation. The version of the GAD-7 used by Jaya et al. (2024) used adapted versions for the German and Indonesian population.

Psychometric Properties Of Tools

All of the included articles reported on the reliability of the anxiety screening tools. Reliability was reported in terms of Cronbach's Alpha, McDonald's Omega, and concordance. The Cronbach's alpha across all the studies ranged from 0.69 to 0.95. This indicates that all of the screening tools displayed acceptable reliability. Similarly, across the 13 articles that used McDonald's Omega to report on reliability, scores ranged from 0.69 to 0.96. The majority of the articles (94.39%) did not provide additional information on the reliability of tools, such as the item correlations of scales (1-23, 25-31, 33-54, 56-60, 62-72, 74, 75-78, 80-107). Of the 5.61% of articles that provided additional reliability information, two articles (55, 73) reported the intra-class correlational coefficient (ICC) of items. The GAD-7 scored an ICC of .91 to .92 for item responses obtained, and an ICC of .90 to .93 for cross-walk scores (Sunderland et al., 2018). Similarly, the ICC for the GAD-D between times one and two were .85, which was taken to indicate test-retest reliability (Groves et al., 2023).

Furthermore, Kyriazos et al. (2018) reported the Average Variance Extracted (AVE) from the DASS-9 and DASS-21 were .51 each. Lastly, Shea et al. (2009) reported that the PSI of the DASS-21 increased from 0.76 to 0. 84 with the removal of items 2, 11, and 15.

While all of the articles reported on the reliability of anxiety screening tools, only 40 articles reported on the validity of tools (2, 6, 14, 17, 20, 24, 35, 37, 40, 43, 47, 50, 55, 61-63, 67, 73, 76, 79, 81, 82, 85, 86, 91-95, 97-107). These tools that reported on validity had reliability ranges of Cronbach's a =.71 to a =.98, and McDonald's ω=.73 to ω=.93. Of these 40 articles that did not report Cronbach's alpha or McDonald's omega, 88.2% concordance was reported for the CliniCom and HAM-A (Handal et al., 2018), with the GAD-7 cross-walk obtaining an ICC score of between .90 and .92 (Sunderland et al., 2018).

Furthermore, of the 40 articles that provided information on validity, 27.5% referred to prior studies to report on the validity of the tool being used (20, 22, 37, 40, 43, 63, 67, 93, 94,100, 104). Similarly, 15% referred more broadly to 'acceptable' psychometric properties of the tools used in their studies (62, 86, 97-99, 102). The measurement invariance of the respective tools was stated by 10% of articles reporting on validity (50, 79, 91, 101). The sensitivity and specificity of the screening tools was stated by 17.5% of the articles reporting on validity (35, 47, 85, 103, 105, 93, 106). Further relating to sensitivity and specificity, only 39.25% of the articles provided cutoff scores or ranges for their respective screening tools. Of these articles, 64.29% reported on the cutoff scores of the GAD-7, with the most commonly reported cutoff score selected for the GAD-7 being ≥10. Cutoff scores were also provided for the PROMIS A; STAI; HADS; MASQ; LAS-10; and PSWQ. These cutoff scores amounted to 16.67% of the 42 articles reporting cutoff scores. Cutoff scores for DASS-21 amounted to 14.29% of articles that reported cutoff scores, with the most common cutoff score for the DASS-21 being ≥10. Convergent validity was reported by 77% of articles. These studies conducted correlation studies between the anxiety tools and related measures, with

correlations across these studies ranging from r=-.25 to r=.70. Similarly, 9.52% of articles (17, 50, 79, 82, 96, 105) reported on construct validity of the studies, with construct validity being confirmed through the conduction of Confirmatory Factor Analysis (CFA). Together, 7.5% of articles spoke to discriminant and criterion validity (24, 55, 73). These articles did not report using adapted screening tools.

The reliability of the GAD-7, as the most commonly used tool, ranged from Cronbach's alphas of α=.79 to α=.95, McDonald's omegas of ω =.89 to ω =.93, and an item response ICC of 0.91–0.92 and 0.90–0.92 for the cross-walk. Besides the ICC reported (55), there was no additional information provided by any of the studies using the GAD-7. Regarding the diagnostic criteria the GAD-7 was based on, one article reported that the GAD-7 was based on the DSM-5 (50). Of the 44 articles that used the GAD-7, only 23 provided some information on validity, with 39.13% of these studies (6, 14, 40, 63, 86, 94, 99, 100, 103) referring to other studies where the GAD-7 had acceptable psychometric properties. Two studies (6, 55) confirmed the convergent and divergent validity of the measure. Some studies (50,100) confirmed the measurement invariance of the GAD-7, while others (90) confirmed the structure of the measure using CFA. Of the studies that reported on the sensitivity and specificity of the GAD-7, the most common results were a sensitivity of 89%, and a specificity of 82% when the cutoff was >10 (47, 85, 104, 106). Of the tools using the GAD-7, only eight (47, 50, 62, 63, 86, 94, 100, 103) had reported using an adapted version of the GAD-7, in various languages, including Turkish, English, German, Indonesian, Polish, Italian, Greek, and Spanish. Cronbach's alpha ranged from α=0.90 to α=0.94, with McDonald's Omega ranging from ω =0.90 to ω =0.93 for these translated versions of the GAD-7. Validity of the use of these adapted versions were reported to be measurement invariant across countries (50), with one study reporting a sensitivity of 89% and a specificity

of 82 % with a cutoff score of 10 (47). Other studies (62, 63, 86, 94, 100, 103) referred to the acceptable psychometric properties of the adapted tools.

The DASS-21 as the second most commonly used tool had Cronbach's alphas ranging from a=.71 to a=.95. Similarly, the DASS-21 had McDonald's omegas ranging from ω=.85 to .92. Regarding the reporting of additional information pertaining to reliability, an increase of PSI from .76 to .84 was reported when items 2, 11, and 15 were removed from the DASS-21 (Ptáček & Jelínek, 2024). None of the studies reported on whether the DASS-21 was based on any major diagnostic criteria. Of the 28 studies that reported using the DASS-21, only 10 (20, 22, 61, 79, 81, 82, 92, 95, 96, 105) provided information on validity. Of these 10 studies, five (20, 22, 81, 95, 105) referred to other studies for the validity of the DASS-21. The remaining five reported the DASS-21 as displaying convergent validity (61, 82), and being measurement invariant (79, 92, 96). Only three studies (22, 81, 82) provided cutoff scores for the DASS-21, with the most common cutoff score for the DASS-21 being ≥10, to display moderate anxiety. The sensitivity and specificity of the DASS-21 was not reported. Furthermore, six of the studies (20, 22, 79, 81, 92, 95) reported using adapted versions of the DASS-21. These included Indonesian, Bangla, Turkish, Italian, Spanish, Columbian, and Greek versions. For these adapted versions, reliability scores ranged from α = .75 to α = .94. Regarding the validity of the adapted versions of the DASS-21, some articles (20, 22, 81, 95) referred to other studies where validity for the adapted versions were indicated, while others (79, 92) reported on the measurement invariance of the tool across genders, countries, and sample type.

The STAI was the third most commonly used anxiety screening tool and had Cronbach's alphas ranging from α =0.89 to a = .95, and McDonald's omegas ranging from ω=0.95 to ω=0.96. No additional information pertaining to the diagnostic criteria the measurement was based on, nor additional reliability information was mentioned by studies

using the STAI. Similarly, studies using the STAI did not report on the validity of the tool, with only two studies (8 and 28) reporting that a range of 20-80 were the cutoff scores for the STAI, with higher scores indicating higher anxiety. Of the nine studies that used the STAI, six (25, 29, 34, 52, 64, 89) had reported using an adapted version of the STAI. These adaptations included versions of the STAI in Italian, Chinese, Portuguese, Korean, German, and Argentinian. Of the studies that used these adapted versions, Cronbach's alphas ranged from $\alpha = 0.89$ to $\alpha = 0.95$.

Of the tools that were used amongst the various samples, 50.47% of the included articles mentioned using anxiety screening tools that were adapted (see table 3). The studies that reported using adapted anxiety screening tools had reliability ranges of Cronbach's $\alpha = .69$ to $\alpha = .95$, and McDonald's $\omega = .69$ to $\omega = .93$. Similarly, of the tools that were adapted and reported on validity, majority had referred to previous studies that reported that adapted tools were valid (20, 35, 37, 47, 50, 62, 63, 79, 81, 86, 92, 93, 94, 95, 98, 100, 103). Tools that were adapted included the STAI (25, 29, 34, 52, 64, 89), BAI (37, 53), HADS (41, 71, 80), DASS-21 (10, 12, 20, 21, 22, 36,53, 57, 65, 66, 74, 77, 79, 81, 91, 92, 95), GAD-7 (11, 27, 33, 39, 42, 46, 47, 50, 53, 56, 58, 62, 63, 69, 86, 87, 94, 100, 103), GAD-2 (44, 54), LAS-10 (93), PSWQ (53), PSWQ-3 (98), PHQ-4 (4, 9, 35, 97) and the STAI short form 10 (72). Of these tools, 96.23% were adapted according to language, with all of these being adapted to the respective languages in prior studies. Two of the studies mentioned that the tool was adapted for the country the sample was taken from (del-Vallea et al., 2022; Zhao et al. 2024). These studies were not clear if tools were adapted for culture or for the country as a whole. The article that reported on a study whose sample was taken from The Gambia in West Africa and used the GAD-7 stated that the English version of the measures was used (Szczuka et al., 2023).

Considering the main findings from the results, it is evident that the most commonly used anxiety screening tools were the GAD-7, DASS-21, and the STAI. Regarding the psychometric properties of tools, all of the included articles used reliable online anxiety screening tools, including studies that used adapted versions of anxiety tools. Of the most commonly used anxiety screening tools, the GAD-7 and the STAI yielded the highest reliability scores. Whilst all of the studies reported using reliable anxiety screening tools, only 37.37% of the included articles reported on the validity of the tools used. Furthermore, only two of the included articles included a comparison of online and paper-and-pencil based administrations of online anxiety tools. Similarly, only five articles mentioned the diagnostic criteria of which anxiety screening tools were based. Furthermore, whilst anxiety screening tools were used for various analyses, majority of the included articles (50.47%) included measurements of the impact of the COVID-19 pandemic. Regarding the country samples were from, majority of the studies were conducted amongst European samples, with only one article reporting having a sample from The Gambia, in West Africa.

Chapter Five: Discussion

The following chapter will discuss the results stated above and their relevance to the aim of the study, which was centred on investigating the availability of online screening tools, their psychometric properties, and whether they could be used in the South African general population. The discussion will be based on the 107 included articles, where 22 anxiety screening tools were identified, with the common three being the GAD-7, the DASS-21, and the STAI.

Publication Trends

One of the main findings from this systematic review was the change in publication trends after the year 2019, where the number of included articles increased from five in 2019, to 19 in 2020, with the most articles included being published in the years 2023 and 2024. This increasing publication of studies pertaining to anxiety may be attributed to the COVID-19 pandemic, where an increase in mental disorders was observed (WHO, 2022). Further, the implementation of social distancing during the pandemic impacted the access to in-person services, which was then accommodated for via digital technology and health. Therefore increased prevalence of mental disorders in the past few years, along with the increased use of mental health apps and digital technology has thus possibly resulted in the increased use of online screening tools for screening mental health and disorders, beyond those which were used in 2016.

The publication trends found in this study suggest the increasing attention towards mental health and the use of technology in mental health which supports the National Digital Health Strategy for South Africa but also the digital dimension of the BPS model. This asserts that digitalising mental health can increase access to mental health services, as well as increase information on what we know about mental health. This further aligns with the National Digital Health Strategy for South Africa (NDP, 2022) stating that an important step

in shifting into digital health will need to be based on “the available and potential resources, and the current eHealth environment” (p. 14). This suggests the importance of understanding current eHealth practices and services.

Commonly Used Anxiety Tools

The assertion by the National Digital Health Strategy regarding awareness and use of available and potential resources highlight the importance of identifying what mental health resources are currently available. As stated in the results chapter above, this systematic review has identified 22 anxiety screening tools, with three tools being commonly used, specifically the GAD-7, the DASS-21, and the STAI. These screening tools were identified in Mughal et al’s. (2020) systematic review of screening tools for PTSD and anxiety in LMICs. However, none of the three commonly used tools (GAD-7, DASS-21 and STAI) identified in this systematic review were identified in the systematic review by Ali et al. (2016) on validated CMD screening tools in LMICs. Contrastingly, Ali et al. (2016) reported the most commonly used and validated screening tool for use in LMICs was the HADS, which was only used by 4 of the included studies in this review. The absence of the GAD-7, DASS-21, and STAI from the systematic review by Ali et al. (2016) might be attributed to the review being conducted earlier than this systematic review, and the one conducted by Mughal et al. in 2020. An additional factor that might have influenced the absence of these tools within the systematic review by Ali et al.’s (2016) might include an increase of usage of online mental health apps and digital technology over recent years, as well as during the COVID-19 pandemic (Linden et al., 2020; Sorkin et al., 2021).

The GAD-7

The most commonly used screening tool found within the included articles was the GAD-7. The GAD-7 was developed by Spitzer et al. (2006), was based on the DSM-IV criteria, and was not explicitly stated to have been developed for online administration. Of

the 45 studies using the GAD-7 to screen for anxiety online, only one reported the diagnostic criteria the GAD-7 was based on, which Jaya et al. (2024) reported as being the DSM-5. However, the original developers of the GAD instruments reported that "…the initial item pool consisted of 9 items that reflected the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)" (Spitzer et al., 2006, p. 1092). However, it should be acknowledged that no major changes were made to the DSM-IV criteria for GAD and revised fifth DSM edition , suggesting its applicability for continued usage.

The GAD-7 being the commonly used anxiety screening tool online is consistent with previous literature (Mughal et al., 2020) using the paper-based version administered within clinical populations. Furthermore, these results concur with the GAD-7 been commonly used offline in the South African context amongst a variety of subpopulations (Kigozi, 2021; Stockton et al., 2024; van Heyningen et al., 2018).

Based on the studies using the GAD-7, the GAD-7 appears to be a reliable screening tool when administered online, as indicated by the Cronbach alpha's ranging from 0.79 to 0.95, as well as the McDonald's omegas of ω =.89 to ω =.93, with both indicating acceptable to excellent reliability. This range is similar to that of the Cronbach alpha that was yielded in the study by Mkhwanazi & Gibbs (2021), where the computer assisted self-interview administered GAD-7 obtained α >.8 amongst the sample of participants from an informal South African population. Furthermore, the GAD-7 displayed excellent reliability ranges of α=0.90 to α=0.94, and ω =0.90 to ω =0.93, when studies used adapted versions of the GAD-7 on an online platform. These reliability scores concur with those found in a South African and paper-based version of the GAD (Kigozi, 2021; Mkhwanazi & Gibbs, 2021). These findings reiterate Donker et al., (2011) who concluded the GAD-7 to be a valid and reliable tool when conducted both online and using a paper-and-pencil method. This suggests the

ability of the GAD-7 to be adapted to the South African context and still maintain psychometrically sound properties.

One adapted version of the GAD-7 that was used by one of the included studies conducted by Jaya et al. (2024) also stated the GAD-7 as being measurement invariant across three countries, including Indonesia, Germany, and the United States. This is important considering that Indonesia, like South Africa, is a country with collectivist cultures (Gupta & Sukamto, 2020). This suggests that if the GAD-7 is invariant when administered in different countries like Indonesia and Germany, the GAD-7 could also be adapted, and therefore, applicable in the South African context. This is also true when considering that Indonesia, like South Africa, is considered a LMIC, belonging specifically to the upper middle income category (The World Bank, n.d.). Therefore, the GAD-7 is thus not only a popular screening tool but also has the potential of maintaining psychometrically sound properties when administered online, and when adapted to suit different contexts, such as South Africa.

The DASS-21

The second most commonly used screening tools amongst the included studies was the DASS-21 which was used by 28 articles and amounted to 26.17% of the 107 included articles. While none of the included articles stated which diagnostic criteria the tool was based on, the DASS-21 was developed by Lovibond and Lovibond (1995), was not based on any external criteria such as the DSM or ICD and was not stated as being developed for online administration.

Regarding the psychometric properties of the DASS-21, Cronbach's alphas of a=.71 to a=.95, and McDonald's omegas of ω=.85 to .92 were obtained. The Cronbach's alpha range for the DASS-21 indicates acceptable to excellent reliability, with the McDonald's omega range indicating good to excellent reliability. Of the included studies that used the DASS-21, the majority referred to previous studies that validated the DASS-21, with the

reliability and validity of the DASS-21 being suggested in other studies conducted in diverse samples (Makrygiorgos et al., 2023). In one of these studies, the DASS-21 demonstrated excellent reliability and validity when conducted in a clinical and non-clinical sample, with Cronbach alpha for the anxiety subscale across the entire sample equating 0.87; as well as the DASS-21 displaying expected convergent validity with other anxiety measures amongst the clinical sample (Antony et al., 1998). Similarly, a study using a computer program to present scores from various scales as percentiles found the DASS-21 to display excellent reliability with a Cronbach's alpha of .84 (Crawford et al., 2009). Furthermore, a correlational and confirmatory factor analysis conducted on the DASS-21 amongst a large non-clinical United Kingdom sample reported the DASS-21 to be a valid measure, with the DASS-21 indicating its convergent and divergent validity when correlated with the HADS and the Personal Disturbance Scale (Henry & Crawford, 2005).

The DASS-21 has been used in South Africa. A study in South Africa that administered the DASS-21 online to a combined sample of COVID-19 infected and non-infected workers found the anxiety subscale of the DASS-21 to display excellent reliability scores ($\alpha = 0.87$), with the model fit of the DASS-21 also enhancing from acceptable to good when certain items were allowed to covary (Hill, 2022). The DASS-21 was also used to measure psychological distress in a sample of South African healthcare workers (Stals et al., 2024). However, no psychometric properties were provided for this study. Adapted versions of the DASS-21 used by included articles in this study obtained Cronbach's alphas of $\alpha = .75$ to $\alpha=.95$, indicating acceptable to excellent reliability when adapted and administered online. These adapted versions of the DASS-21 used by included studies were stated as being invariant across genders, samples, and countries (Kogar & Kogar, 2023; Ruiz et al., 2017). Invariance was observed between Spain and Colombia (Ruis et al., 2017). As with the use of the GAD-7 within Indonesia discussed above, this is important as both Spain and Colombia

can be considered as collectivist societies (Bello et al., 2006; Gouveia et al., 2002). Furthermore, Columbia is also considered a LMIC, belonging specifically to the upper middle income category (The World Bank, n.d.). The invariance of the DASS-21 in collectivist societies, as well as in a LMIC like Columbia, suggests its applicability for use in South Africa as another collectivist and LMIC. Based on the studies referred to by the included articles, as well as the psychometric properties reported in the included studies, the DASS-21 appears to be a reliable and valid measure that is capable of being administered online to a South African population.

The STAI

The STAI, was developed by Spielberger and others in 1983 (APA, 2011), with Mughal et al. (2020) having listed the STAI as being based on DSM-IV criteria. Furthermore, the STAI being based on the DSM-IV as stated by Mughal et al. (2020) aligns with potential concern associated with the diagnostic criteria on which the GAD-7 is based on, which is the DSM-IV being out of date. However, as discussed above, this is of minimum concern considering that the DSM 5 has not undergone any major changes from the DSM-IV in terms of general anxiety, which is acceptable considering that this study was based on screening tools measuring general or broad associations of anxiety, and not specific anxiety disorders with specific diagnostic criteria.

As the third most commonly used tool amounting to nine (8.41%) of the included articles, the STAI displayed excellent reliability with Cronbach's alphas ranging from α =0.89 to a = .95, and McDonald's omegas ranging from ω=0.95 to ω=0.96. These scores indicate the STAI as being a reliable tool. The reliability of the STAI as a measure is further verified by its demonstration of excellent reliability when online and adapted versions were used, as indicated by Cronbach's alphas ranging from α =0.89 to α =0.95. The use of the STAI adapted for Korean and Chinese populations is significant, as these countries display

collectivist cultures (Tinmaz & Ozturk, 2022; Xiao et al., 2021). As discussed above, this is important as it suggests the applicability of reliable online screening tools for collectivist cultures, such as those within South Africa. Similarly, Argentina and China have been defined as LMICs, specifically belonging to the upper middle income group (The World Bank, n.d.). As with the collectivist category, this suggests the applicability of online screening tools like the STAI for measuring anxiety within LMICs like South Africa.

Regarding the validity of the STAI, none of the included studies that used the STAI provided any information on validity. However, the validity of the STAI has been stated in other studies. These include a face-to-face administration of the STAI amongst a sample of pregnant women where the STAI was found to be valid (Gunning et al., 2010). Similarly, the Italian adapted version of the STAI was proven to have convergent validity when conducted online amongst a sample of Italian students, with the STAI also being invariant across gender and age (Valente et al., 2025). This suggests the STAI to be a valid measure capable of maintaining validity when administered online. Furthermore, the STAI has been used amongst South African populations. This includes the face-to-face administration of a shortened version of the STAI to a sample of South African antenatal women, where reliability was found to range from questionable to acceptable (α=. 65 at time one and α=.71 at time two) (Redinger et al., 2020). The STAI-T was also administered face-to-face amongst a sample of South African para-athletes (Badenhorst et al., 2021). However, no psychometric properties were reported within Badenhorst et al.'s (2021) study. Moreover, the STAI has also been administered face-to-face to a South African sample of adult schizophrenic patients (Seedat et al., 2007). Seedat et al. (2007) reported that patients could complete questionnaires in English or Afrikaans, with the STAI yielding a reliability score of α=.62, suggesting questionable reliability. The STAI is thus a suitable screening tool to be administered online and when adapted.

For the remaining 19 anxiety measures identified in this systematic review, internal consistency ranged from questionable reliability to excellent reliability with Cronbach's alphas scores ranging between 0.69 and 0.95. Furthermore, of the less commonly used screening tools, majority did not report on being adapted or translated. Therefore, when compared against the reliability and validity of the more commonly used screening tools found across the included studies, the GAD-7, DASS-21, and STAI appear to be the most appropriate.

When comparing the three most commonly used tools, it appears that the GAD-7 is the most appropriate tool to be used in the South African context. The appropriateness of the GAD-7 is based on the excellent reliability of the GAD-7 when adapted and administered online. This is despite the STAI showing marginally better reliability, with both the STAI and GAD-7 having excellent reliability scores. Furthermore, the GAD-7 has been previously used in the South African population, including amongst the general population, and has displayed good reliability and validity. The GAD-7 has been used in more South African studies than both the STAI and the DASS-21. The previous use of the GAD-7 within South African suggests the applicability of the GAD-7 to be further adapted and remain a suitable measure of anxiety. The GAD-7 is also based on DSM-IV GAD criteria, which shows no differences from the DSM-V-TR GAD criteria, proving its alignment with the current diagnostic model.

Lastly, the GAD-7 has also been the most commonly used tool found in this systematic review amongst a variety of countries worldwide, suggesting that not only can it be adapted for use amongst South Africans, but that it is also recognised and used in other contexts as well, further suggesting its criterion validity to be used across multi-cultural contexts. This is further important for the field of mental health, where the demonstrated reliability and validity of online screening tools for anxiety remains a scarcity within LMICs (Ali et al., 2016b; Mughal et al., 2020c). This was evident in this study where only one of the

included studies was conducted amongst an African sample (Szczukaa et al., 2023); while majority of the studies and most commonly used anxiety measures was conducted amongst samples from European and Asian countries. The presence of only one study conducted in Africa is further concerning considering the lack of cultural specifiers within the DSM-V-TR, as well as the influence collectivist worldviews may have on understandings and experiences of mental disorder, and ultimately treatment. This highlights the significance of the GAD-7 being a tool capable of being adapted while maintaining psychometrically sound properties.

The ability of the GAD-7 to be further adapted for South African use is important for understanding the experiences of mental health and wellness amongst individuals. As discussed in the literature review, consideration of the stressors surrounding the sociopolitical and economic settings individuals are embedded in is influential in understanding the prevalence of distress (and anxiety) individuals may experience, as well as the interventions that can be implemented in addressing these stressors (Mkhwanazi & Gibbs, 2021). This aligns with the National Digital Health Strategy for South Africa and the BPS-D model that underpins this study, with both emphasising the importance of acknowledging the experiences of individuals and digital technology to enhance healthcare. The lack of tools within a South African context, coupled with the lack of comparison between online and paper-and-pencil administrations of online screening tools, further emphasises the need for tools to be validated amongst LMICs like South Africa. The GAD-7 can thus serve as a tool to enhance understanding of anxiety amongst South Africa.

In addition to the usefulness of online screening tools like the GAD-7 amongst the general population of South Africa, the increasing access to the internet amongst the South African population indicates the opportunity and space for online screening of anxiety. This is indicated by the provision of online screening questionnaires to measure mental health amongst South Africans by SADAG (n.d.). SADAG (n.d.) provides free access to

questionnaires measuring a variety of mental disorders including anxiety, depression, bipolar, PTSD, and ADHD. Upon completion, visitors can review their results with an expert provided by SADAG. However, despite the provision of these questionnaires via the internet, along with access to mental health experts, the psychometric properties of these questionnaires are not explicitly stated on the website; nor are the screening tools of which the questionnaires are based on mentioned, making it difficult to investigate the reliability and validity of the SADAG questionnaires. Furthermore, the SADAG test provided for anxiety consists of a combined test that is stated as measuring both anxiety and panic disorder. The questionnaire also appears to only be available in English. These discrepancies relate to a finding by Gama and Laher (2024) which states that many mental health apps are not yet formally accessed for their efficacy or reported in the literature. This suggests that while there is a space for online screening tools in South Africa, there is still the need for tools to be proven psychometrically sound. These findings align with the intentions behind the National Digital Health Strategy for South Africa and the BPS-D model in their assertions that platforms are available for digitalising health in a manner that can prove efficient in providing access to healthcare services. However, these findings also suggest that a lot of information is still needed to make the shift possible and effective. This further highlights the need for information pertaining to the psychometric properties of online screening tools.

Strengths and Limitations

A strength of this study includes its investigation of online screening tools for use in the South African general population. This study, to the best of our knowledge, is the first to investigate the availability of online screening tools, and their fit for the South African general population. This is important as mental health has been an area of increasing importance and priority, including amongst South Africa, and indicates the provision of online screening tools for anxiety as a health service. Furthermore, the emphasis of online

screening tools as it relates to the digitalisation of healthcare systems in South Africa has been an additional strength of this study, which contributes to the much needed data necessary to further enhance the digitalisation of South African healthcare systems, which is a key principle within National Digital Health Strategy for South Africa.

Another strength of this study includes the rigorous methodology used. This systematic review remained as transparent as possible through the detailed documentation of the various steps followed regarding the procedures involving data collection and analysis. This is important as transparency is vital to ensure the reproducibility of the study in other contexts. This is evident by this study being registered with PROSPERO, with the hopes of reducing redundancy and enhancing transparency. Furthermore, an important aspect of systematic reviews includes the attention to potential bias. Potential bias was addressed through the study using two reviewers to select articles to be included within the systematic review, with reviewers using a blinded process to select articles for inclusion.

The study has also presented with various limitations. One limitation included the lack of detailed information by some of the included studies. This includes the lack of reporting of the sampling strategies, studies not explicitly stating the age range of their samples, and none of the studies reporting on how the aims and objectives of their respective studies were explained to participants. This lack of information made it difficult to ascertain how generalisable some of the studies were, which coupled with some of the studies not being explicit regarding the age range of their samples, made it difficult to ascertain whether some of the studies were indeed suitable to the target population of this study, that is, the general population. Furthermore, the lack of information pertaining to how the objectives were explained to study participants, as well as some of the included studies not requiring informed consent, made it difficult to assess the ethical quality of the studies. This is important as it refers to transparency, which is not only important for ensuring the safety of

study participants but is also integral to the success of the move towards and maintenance of the digitalisation of health in South Africa.

An additional limitation of the study relates to the exclusion criteria and procedure followed by the systematic review. One of the exclusion criteria stated that studies conducted in any other language besides English had to be excluded due to the reviewers only being fluent in English. This may have resulted in the exclusion of key studies that might have been published in languages other than English. Furthermore, whilst this study made efforts to reduce bias, it is possible that some bias may have still been introduced into the study, as is a common limitation of systematic reviews (Uttley et al., 2023)

Implications and Recommendations

A key implication of the findings of this study have been its portrayal of the increasing prevalence of mental disorders such as anxiety, as well as the increasing use of digital technology to address mental health. These findings are imperative as they outline the importance of mental health and digital technology, and the strengths and weaknesses associated thereof. These strengths and weaknesses have been discussed with reference to the National Digital Health Strategy for South Africa, as well as to the theoretical model of the study, which is based on adding a digital dimension to the traditional BPS model. However, the strengths and weaknesses have also been evident in the findings of this study, which has shown increasing prevalence of and attention to mental disorder, while limitations exist pertaining to the role of digital health in mental disorders amongst LMICS, which have proven scarce.

As discussed in detail above, the key implications of this study include its contributions to understanding the current environment of eHealth in South Africa. This is based on the findings of this study identifying what screening tools are available online, and their applicability for the South African context. This identification and its contribution to

understanding the South African eHealth environment is important considering the increased prevalence of mental disorders in South Africa, as well as South Africa's dedication to digitalising its healthcare system to enhance healthcare in South Africa. Furthermore, the identification of applicable online screening tools is vital for addressing the gaps in digital health amongst LMICs.

Based on the key implications of this study, a few recommendations for future research can be made. Future studies should look at conducting psychometric studies of online screening tools for anxiety amongst South African populations, which would contribute to the lacking studies available on the psychometric properties of CMD online screening tools amongst LMICs like South Africa. Such studies could include investigating the literacy levels of participants and ultimately target populations, as this will allow further insight into how well populations are understanding the current items of screening tools, which might influence the psychometric properties of tools. As discussed above, investigating the appropriateness of mental health screening tools is important considering the increased prevalence of mental disorders such as anxiety worldwide. Studies could also look at comparing the psychometric properties of anxiety screening tools based on their modes of administration, which would further contribute to knowledge regarding the efficacy of online tools. Existing tools could also be adapted for suitability to the South African context, which could include introducing appropriate idioms of distress, such as "thinking too much", into screening tools. In line with the further development of online screening tools, more research should be directed towards standardizing the ethical practices of conducting studies online, especially as they pertain to practices such as informed consent and confidentiality within an online space. The ethical storage and adherence to confidentiality is especially important to the mental health field, where mental disorders continue to be stigmatized amongst some individuals (Hines et al., 2024). Furthermore, informed consent is

a key component of transparency, with transparency being integral to the success of online screening tools, and the digital healthcare system as a whole. Reconstructing traditional ethical practices further contributes to supporting the digitalisation of health in South Africa, and the importance thereof.

Conclusion

There is a scarcity of mental health screening tools for LMICs like South Africa. This scarcity can have negative consequences when considering the impact of COVID-19 on mental health in a setting where healthcare professionals and resources are limited, and where accurate and informed identification is a necessity for adequate treatment. Despite the scarcity of online screening tools, a space exists amongst the South African population. This is evident by the shift South Africa has made towards the digitalisation of its healthcare system, as well as the presence of online mental health applications and services such as SADAG. The development of an appropriate online screening tool for anxiety will require inclusion of screening tools that are reliable and valid, with potential tools that could be further adapted including the GAD-7, DASS-21, and STAI. Based on the significance of cultural and sociopolitical and economical context for understanding and identifying mental illness, an appropriate online screening tool for the South African general population will need to be cognisant of the broader context of South Africa, as well as the impact presentations of somatic and cognitive symptomology has in constructing valid measurements. As discussed in the discussion chapter above, the GAD-7 shows the most promise of screening for anxiety online amongst the South African general population, due to its previous use amongst South African populations, whilst still displaying acceptable psychometric properties; as well as its demonstration of excellent validity and measurement invariance when administered online and amongst various countries. As was evident in the inconsistencies identified in the online mental health questionnaires provided by SADAG,

online screening tools for South Africa will need to reach the balance of being accessible and affordable on online platforms, while also proving its ability to diagnose anxiety accurately and stably amongst a diverse population of people.

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Appendices

Appendix A: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	

Section/topic	#	Checklist item	Reported on page #
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome-level assessment (see Item 12).	
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group and (b) effect estimates and	

Section/topic	#	Checklist item	Reported on page #
		confidence intervals, ideally with a forest plot.	
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., health care providers, users, and policy makers).	
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review level (e.g., incomplete retrieval of identified research, reporting bias).	
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	

Appendix B: PROSPERO Registration Document

NIHR | National Institute for Health Research

PROSPERO
International prospective register of systematic reviews

An online screening tool for anxiety in the South African population: A Systematic Review

To enable PROSPERO to focus on COVID-19 submissions, this registration record has undergone basic automated checks for eligibility and is published exactly as submitted. PROSPERO has never provided peer review, and usual checking by the PROSPERO team does not endorse content. Therefore, automatically published records should be treated as any other PROSPERO registration. Further detail is provided here.

Citation

Storm Muriel van Boom, Tasneem Hassem. An online screening tool for anxiety in the South African population: A Systematic Review. PROSPERO 2023 CRD42023465595 Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42023465595

Review question

1. What online screening tools are available to screen anxiety?

2. Are these tools reliable and valid?

3. Can these tools be used or adapted for use in the South African adult population?

Searches

The databases to be searched include Sabinet; PubMed; PsycINFO; Proquest Psychology Journals ;ScienceDirect and EBSCOhost. The search commenced on the 22nd of August and is expected to be complete by or before 30 November. Restrictions include the searching for articles between the dates of 1970 and 2023, this is to account for the presence of the first online screening tools occurring within the early 1970s, with the ending date of 2023 to include any recent publications. Further restrictions include studies limited to the English language, this is due to the reviewers only being proficient in English.

Types of study to be included

The types of studies to be included are both qualitative and quantitative. Studies need to adhere to the inclusion and exclusion criteria:

Inclusion Criteria:

Both qualitative and quantitative studies (this is to account for the possibility of limited articles available on the topic)

Articles written in English

Studies based on tools developed specifically to screen online for anxiety-related disorders

Studies with samples 18 and over (this is to abide by ethical considerations regarding consent)

Studies which mention psychometric properties of screening tools that are used online

Exclusion Criteria:

Studies with samples below the age of 18

Studies based on tools that screen for a variety of disorders (as this could distort the extracting of data pertaining to the reliability and validity of the tools to screen anxiety specifically)

Studies based on populations previously diagnosed with anxiety-related disorders (as such articles would deviate from the research aim of seeking anxiety screening tools applicable for the general public)

Grey literature

Condition or domain being studied

The condition being studied within the systematic review is anxiety. This is due to the increasing prevalence of common mental disorders within low and middle income countries, including that of anxiety; while the resources available to address these common mental disorders within low and middle income countries such as South Africa is scarce. For this review, anxiety is described based on the criterion within the The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; American Psychiatric Association [APA], 2013) and The International Classification of Diseases, 11th revision (ICD-11; WHO, 2018), with both describing anxiety disorders to be characterized by excessive fear, that lasts for six or more months, and exceeds that of a normal reaction to stimuli. Furthermore, the systematic review will be investigating online screening tools available to screen for anxiety online amongst the general South African population.

Participants/population

The sample being studied in the review includes articles discussing the use of an online screening tool for anxiety, whose studies included participants over the age of 18, who are not part of a clinical sample previously diagnosed with anxiety disorders. The inclusion and exclusion criteria for articles is listed below:

Inclusion Criteria:

Both qualitative and quantitative studies (this is to account for the possibility of limited articles available on the topic)

Articles written in English

Studies based on tools developed specifically to screen online for anxiety-related disorders

Studies with samples 18 and over (this is to abide by ethical considerations regarding consent)

Studies which mention psychometric properties of screening tools that are used online

Exclusion Criteria:

Studies with samples below the age of 18

Studies based on tools that screen for a variety of disorders (as this could distort the extracting of data pertaining to the reliability and validity of the tools to screen anxiety specifically)

Studies based on populations previously diagnosed with anxiety-related disorders (as such articles would deviate from the research aim of seeking anxiety screening tools applicable for the general public)

Grey literature

Intervention(s), exposure(s)

This systematic review will follow qualitative analysis of information, and can thus be further defined as a qualitative systematic review that will look at both qualitative and quantitative studies.

The focus of the review is to investigate the psychometric properties of online screening tools for anxiety, in order to decipher if these tools are applicable for the South African population. The psychometric properties include that of reliability, and possibly validity.

Comparator(s)/control

This systematic review will follow qualitative analysis of information, and can thus be further defined as a qualitative systematic review. Considering the conduction of a qualitative systematic review, descriptions of a comparator(s) is not applicable.

Main outcome(s)

The main outcome of this systematic review is to identify what online screening tools are available and reliable for use amongst the South African general population. The identification of such a tool is necessary considering the scarce mental health resources available in low- and middle- income countries to address common mental health disorders, with the identification of a reliable tool being useful for providing access to mental health resources to a population with increasing access to the internet, as well as within an age where technology is becoming increasingly tied to the monitoring and understanding of health. The identification of such a tool will allow members of the general population access to a tool capable of screening their experiences for indication of a possible anxiety disorder, while also providing an indication of the possibility for such a tool, where there are few.

Measures of effect

The outcome of this review will be identified through the content analysis of included articles for their discussion of the psychometric properties of screening tools, and whether the measures of reliability for these tools were generated using a general population. The identification of this information will indicate the availability of online screening tools for anxiety.

Additional outcome(s)

Not applicable

Data extraction (selection and coding)

As discussed above, studies will be included based on their meeting of an inclusion and exclusion criteria. This will be identified through the screening of articles by two reviewers. Articles will be screened based on their title, abstract, and full text, with articles with seemingly applicable titles and abstracts undergoing a full-text screening for final inclusion. Articles will be screened through exporting of articles into the systematic review software Rayyan, which allows for multiple reviewers, and the management of articles.

Once studies are identified, content analysis will be used to identify relevant information. The first phase of content analysis includes the selection of units of analyses. The units of analysis will include the descriptions of screening instruments and samples, as well as the sections discussing the psychometric properties of reliability and validity. The second phase includes organizing data according to codes and categories (Elo & Kyngäs, 2008). This phase includes the grouping of codes into relevant categories, and then describing these categories based on their relation to the research topic and questions. Based on the proposed units of analysis, it is assumed that categories will consist of data pertaining to screening tools, samples, and psychometric properties. The last phase includes the reporting of the analysis process and results (Elo & Kyngäs, 2008). This will be done through the presentation of categories into a results table.

Risk of bias (quality) assessment

The results of included studies will be assessed for quality. Qualitative studies will be assessed for quality using the Critical Appraisal Skills Programme (CASP). The CASP assesses quality through questioning whether studies included a

clear research question(s); if authors consulted the correct papers; how precise the results were and their applicability to the general population amongst other criteria. Similarly, quantitative study results will be assessed for quality using an adapted version of the CASP as adapted by Laher and Hassem (2020). This adapted CASP assesses quality through analysing whether the quantitative methods used by the study was appropriate for the question, if data was collected appropriately, and if the correct statistical analyses were used amongst other criteria.

Strategy for data synthesis

After the analysis of units of analysis as discussed above, results will be presented within a results table that will describe online screening tools, specifically the diagnostic systems they are derived from and their mention of reliability and validity. Using this results table, data will be synthesised through a discussion of the screening tools, specifically the tools identified as the most commonly used and those with the highest psychometric properties. This discussion will answer the research questions of the systematic review regarding what screening tools are available, their psychometric properties, and whether any of these tools were targeted towards the South African population.

Analysis of subgroups or subsets

This systematic review does not intend on analyzing subgroups or subsets.

Contact details for further information

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Organisational affiliation of the review

University of the Witwatersrand

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Review team members and their organisational affiliations

Ms Storm Muriel van Boom. University of the Witwatersrand

Dr Tasneem Hassem. University of the Witwatersrand

Type and method of review

Systematic review

Anticipated or actual start date

17 July 2023

Anticipated completion date

31 March 2024

Funding sources/sponsors

The review is funded as part of a Masters in Psychology Research Report as part of the Masters in Social and Psychological Research under the Postgraduate Merit Award (PMA). The PMA is granted to assist postgraduate students complete their postgraduate studies by research, or by a combination of both research and coursework.

Conflicts of interest

Language

English

Country

South Africa

Stage of review

Review Ongoing

Subject index terms status

Subject indexing assigned by CRD

Subject index terms

MeSH headings have not been applied to this record

Date of registration in PROSPERO

20 November 2023

Date of first submission

09 November 2023

Stage of review at time of this submission

Stage	Started	Completed
Preliminary searches	Yes	Yes
Piloting of the study selection process	Yes	No
Formal screening of search results against eligibility criteria	No	No
Data extraction	No	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No

The record owner confirms that the information they have supplied for this submission is accurate and complete and they understand that deliberate provision of inaccurate information or omission of data may be construed as scientific misconduct.

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PROSPERO
International prospective register of systematic reviews

The record owner confirms that they will update the status of the review when it is completed and will add publication details in due course.

Versions

20 November 2023

20 November 2023

Appendix C: Example of Database Information Format

Date	Database	Search Terms	Number of results yielded	Number saved in Zotero	No. stopped at and reason	Total
15-Nov-23	ScienceDirect (25 results per page)	"online anxiety screening tools	16868	1075	1075,p. 43-repeated articles	
16-Nov-23		"internet anxiety screening tools	8324	0	many repeated articles, or articles to do with internet addiction	
15-Nov-23		web-based anxiety screening tools	13251	550	pg.22	
16-Nov-23		web-based anxiety assessments"	40549	475	p.19-repeated articles, unrelated	
17-Nov-23		screening for anxiety on the internet	13480	150	p.6-repeated articles, treatment based	
17-Nov-23		online screening for persistent worry	1900	275	p.11-repeated articles/unrelated-accidently loaded same page twice	
17-Nov-23		using the internet to screen for unexplained fear/worry	152	50	p.3-unrelated	
17-Nov-23		anxiety AND online screening tools"	16880	0	repeated articles	
20-Nov-23		psychometric properties of online anxiety screening tools	2104	0	repeated articles	
		"anxiety OR anxiety-related screening tools".	584771	100	p5.-repeated/unrelated	
		internet anxiety screening tools OR web-based anxiety screening tools OR using the internet to screen for anxiety OR online screening for persistent worry OR using the internet to screen for unexplained fear/worry/anxiety OR web-based anxiety screening tools OR using the internet to screen for anxiety OR online screening for persistent worry OR using the internet to screen for unexplained fear/worry/anxiety	28947	0	repeated articles	

1625

Appendix D: Adapted CASP

1. **Was there a clear statement of the aims of the research? □Yes □Can't tell □No**

Consider: What was the goal of the research? Why was it thought important? Its relevance

2. **Is a quantitative methodology appropriate? □Yes □Can't tell □No**

Consider: If the research seeks to examine a relationship between variables or comparison of groups. Is quantitative research the right methodology for addressing the research goal?

Were all the participants accounted for in the results and the conclusion?

□Yes □Can't tell □No

Is it worth continuing? **Detailed questions:**

3. **Was the research design appropriate to address the aims of the research?**

□Yes □Can't tell □No

Consider: If the researcher has justified the research design (e.g., have they discussed how they decided which method to use)?

4. **Was the recruitment strategy appropriate to the aims of the research? (Assess selection bias)**

□Yes □Can't tell □No

Consider: If the researcher has explained how the participants were selected, Are the individuals selected to participate in this study likely to be representative of the target population? If there are any discussions around recruitment (e.g., why some people chose not to take part)

5. **Was the data collected in a way that addressed the research issue?**

□Yes □Can't tell □No

Consider: If the setting for data collection was justified. If it is clear how data were collected. If the researcher has justified the methods chosen. If the researcher has made the methods explicit . Were data collection tools shown to be valid? Were data collection tools shown to be reliable? If methods were modified during the study. If so, has the researcher explained how and why?

6. **Have ethical issues been taken into consideration? □Yes □Can't tell □No**

Consider: If there are sufficient details of how the research was explained to participants for the reader to assess whether ethical standards were maintained. If the researcher has discussed issues raised by the study (e.g., issues around informed consent, anonymity, and confidentiality or how they have handled the effects of the study on the participants during and after the study). If approval has been sought from the ethics committee

7. **Was the correct statistical technique used to analyse the data**

□Yes □Can't tell □No

Consider: Was descriptive data provided? Was the sample size large enough for the statistical technique carried out? Were basic assumptions of the statistical test utilised met? Were both significant and insignificant results reported? Did the statistical technique used effectively answer the research question?

8. **Was the data analysis sufficiently rigorous? □Yes □Can't tell □No**

Consider: If there is an in-depth description of the analysis process. Were the statistical methods appropriate for the study design? If sufficient data are presented to support the

findings? To what extent contradictory data are taken into account? Were potential sources of bias discussed?

9. **Were psychometric properties discussed? □Yes □Can't tell □No** Consider: Were reliability and validity of the instruments used discussed or analysed

10. **Is there a clear statement of findings? □Yes □Can't tell □No**

Consider: If the findings are explicit. If there is adequate discussion of the evidence both for and against the researchers' arguments. If the findings are discussed in relation to the original research question

11. **How valuable is the research?**

Consider: If the researcher discusses the contribution the study makes to existing knowledge or understanding, for example, do they consider the findings in relation to current practice or policy?, or relevant research-based literature? If they identify new areas where research is necessary? If the researchers have discussed whether or how the findings can be transferred to other populations or considered other ways the research may be used

Appendix E: Ethics Certificate

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT ETHICS COMMITTEE
CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: MASPR/23/10W**
PROJECT TITLE:	An online screening tool for anxiety in the South African population: A systematic review.
INVESTIGATOR	van Boom Storm Muriel (2281620)
SCHOOL/DEPARTMENT OF INVESTIGATOR	SHCD/Psychology
DATE CONSIDERED	01 June 2023
DECISION OF THE COMMITTEE	Approved unconditionally
RISK LEVEL	No Risk
EXPIRY DATE	31 December 2025
ISSUE DATE OF CERTIFICATE 03 June 2023	**CHAIRPERSON** _____ (Dr Aline Ferreira Correia)

cc: Dr Tasneem Hassem (Supervisor)

DECLARATION OF INVESTIGATOR

To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School/Department ethics committee.

I/we fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure be contemplated from the research procedure as approved, I/we undertake to submit an amendment of the protocol to the Committee.

_____ 06 / 07 / 2023

Signature **Date**