PSYCHOMETRIC PROPERTIES OF THE PERCEIVED VULNERABILITY OF DISEASES SCALE IN SOUTH AFRICAN TEENAGERS DURING THE COVID-19 OUTBREAK

by

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Declaration

I hereby declare that **'PSYCHOMETRIC PROPERTIES OF THE PERCEIVED VULNERABILITY OF DISEASES SCALE IN SOUTH AFRICAN TEENAGERS DURING THE COVID-19 OUTBREAK'** submitted to the University of Limpopo in partial fulfilment of the requirements for the degree of **Master of Arts in Clinical Psychology**, has not been previously submitted by me for a degree at any other university, that it is my work in design and execution, and that all the material contained herein has been duly acknowledged.

21/02/2024

Selwin Dolo — Date

Dedication

To the Lord for his strength and guidance. To myself, my loving mother (Mapula G. Dolo), grandmother (Matsobane Patricia), and the rest of my loving, supportive family for their support.

Acknowledgments

First and foremost, I offer all glory to God for His grace that has illuminated my professional path leading up to this pivotal moment. I wish to express my heartfelt gratitude to the following individuals:

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Abstract

Few factors throughout human evolutionary history have impacted human behaviour more than the effect of pathogens and infections as regards our adaptation and survival. To this end, human beings have evolutionary systems to preserve human existence and interact daily with pathogens. The behavioural immune system (BIS) and attachment functions are such evolutionary systems that humans use to perceive and avoid what may be of threat to their survival. This study examined the factor structure and cross-cultural validity of the Perceived Vulnerability to Disease Scale (PVD), a measure of the BIS system, in a sample of South African teenagers (N = 474; Age: *M* = 16.96 [*SD* = 1.31; range = 14 – 22yrs]). The PVD is important as it assists in understanding individual's perceptions of infections, hence assisting in public health interventions. Varying CFA models (unidimensional and bidimensional models) were evaluated and cross-validated with Rasch analysis. The results showed that the PVD had a two-factor structure (Perceived Infectibility [PI] and Germ Aversion [GA]) in South African teenagers. Among other results, the findings show that the PVD measures perceived infectability equivalently across gender groups. Furthermore, the study highlights the impact of culture on the reliability of the measure.

Keywords: Perceived vulnerability, Factor structure, Measurement invariance, Item loading, Attachment, Teenagers**.**

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CHAPTER 1: INTRODUCTION

1.1 General introduction

In the first chapter, the motivation for the research is discussed along with the research problem and aim of the research. Thereafter, the objectives are outlined, the significance of this study is elaborated, definition of terms concludes this chapter. The research method and division of chapters are then discussed afterwards.

1.2 Background and motivation

Infectious diseases can be regarded as pandemics when they affect many people, increasing morbidity and mortality rates as well as disrupting certain areas of life such as the economy and social functioning (Madhav et al., 2017). Recently, the world was experiencing such a pandemic, officially announced by the World Health Organization on the 11th of March 2020. In South Africa, the long-term impact of COVID-19 may have struck hard given the vulnerabilities already prevalent in developing countries (Kollamparambill & Onyenubi, 2021). The importance of public risk perception is increasingly backed by the increase in infection rates and reported deaths due to COVID-19 (Dryhursta et al., 2020). However, the threat has influenced individuals to, as a response, adopt behavioural changes to prevent infection (Kollamparambill & Onyenubi, 2021). Therefore, the use of separation of those infected such as quarantining individuals (Fraser et al., 2004; Tognotti, 2013), the culling technique (Fevre et al., 2006), the stoppage of schools (Earn et al., 2012) as well as a prohibition on traveling and meetings in the public (Hatchett et al., 2007; Markel et al., 2007) have all been attempts to contain epidemics.

Research links the perception of risk of contracting COVID-19 to emotional distress and mental illness (e.g., depression and PTSD) (Nguse & Wassenaar, 2021; Stangier et al., 2021). In South Africa, teenagers in vulnerable conditions, particularly in the context of infectious diseases and the restrictions imposed during the COVID-19 pandemic, have been found to develop various health issues, including depression, anxiety, eye-related problems, and myopia (Rasheed, 2022). The Human Science Research Council (2020) found that 33% of their participants experienced depression, 45% experienced fearfulness and 29% were also experiencing loneliness during the first lockdown period. Furthermore, a study by Deng et al. (2023) based on primary and secondary school students or children and adolescents aged 18 years and younger, found that 31% had depressive symptoms and anxiety symptoms, and 42% had sleep disturbance as a result of Covid-19. South Africa faces profound socio-economic inequality, which exacerbates challenges in managing infectious diseases (Nyashanu, 2020). The percentage of young people with no income surged from 5.2% before lockdown to 15.4%, highlighting the worsening struggles faced by vulnerable groups (Mudiriza & De Lannoy, 2020).

Individuals respond with disgust, negative reactivity, and avoidance to any perception of a threat to their health. For example, in Lau et al. (2006) study around 20% of the respondents believed that even after a year and a half post the initial infection of SARS, those previously infected were still actively infectious and sharing space with the individuals would risk transmission of the disease, hence they would be avoided or socially excluded. At the center of how individuals respond to a threat to their health is the emotion of fear (Folkman & Greer, 2000). As a result, research on the impact of perceived vulnerability uses several scales such as the Disgust scale, Hypochondria and health-related Anxiety measures, and the Perceived Vulnerability to Disease Scale (PVD) (Diaz et al., 2016; Duncan et al., 2009) to measure Perceived Infectability (PI). However, the PVD seems to have more traction among researchers because it measures individual differences in reaction to disease transmission, attitudes, and avoidance (Diaz et al., 2016; Duncan et al., 2009).

Furthermore, the PVD has an advantage over other alternative measures, because while other scales evaluate beliefs about current health challenges, its PI subscale examines beliefs about susceptibility to future health troubles (Duncan et al., 2009). Similarly, its Germ Aversion (GA) subscale relates to individuals' discomfort in an environment that suggests an increase in the likelihood of pathogen transmission (Duncan et al., 2009). The PVD is useful for both researchers and clinicians because understanding individuals' perceived personal risk and vulnerability to infection is critical for pandemic public health interventions. For instance, research shows perceived susceptibility to infection to predict non-compliance with non-pharmacological pandemic recommendations (Randolph & Barreiro, 2020). There is therefore a need to investigate the psychometric properties of the PVD scale for use with South African teenagers – a cohort that research shows to have been severely affected by the COVID-19 pandemic.

1.3 Research problem

The PVD is popular among researchers due to, amongst other things, its three different scaling options (Diaz et al., 2016). The two-factors measured by the PVD are PI and GA, they both asses personal susceptibility beliefs and potential disease transmission along with emotional discomfort (Duncan et al., 2009). The problem arises due to the difference in the versions of the scale, as well as the inconsistency in the scoring of the scale: single overall PVD score (Faulkner et al., 2004) and multiple (subscale) scores (Park et al., 2003) – suggesting that the factor structure of the measure is yet to be resolved. The scale has different renditions; ranging from 10 items (Park et al., 2007), 13 items (Diaz et al., 2016), 14 items (Ahmadzadeh et al., 2013),15 items (Duncan et al., 2009; Park et al., 2003) up to 18 items version (Hodson & Costello, 2007).

This is due to factorial loading results differences obtained with several items of the scale; for instance, Ahmadzadeh et al. (2013) found Item 15 to not have acceptable factorial loading; Diaz et al. (2016) also found unacceptable factorial loadings for both item 11 and item 13; while Duncan et al. (2009) initially found the 15 items to have acceptable factorial loading. Also, most of the dimensionality research on the PVD is conducted within classical test theory (i.e., exploratory factor analysis [EFA] and confirmatory factor analysis [CFA]). Classical test theory (CTT) methods have their limitations. For instance, parameters such as factor loadings, discrimination, reliability, or location are reliant on the sample being used. Rasch analysis (part of Item Response Theory [IRT]) is an alternative that overcomes these limitations (Bichi, 2016; Hambleton & Jones, 1993; Marci et al., 2021). Inconsistencies in adaptation methodologies have led to conflicting approaches among researchers. For example, Ahmadzadeh (2013) utilised EFA in his study, Rokvić & Karan (2022) employed CFA, while Ferreira (2022) used both CFA and EFA. These differences are significant, as the two methods have different statistical assumptions, procedures and objectives. For example, EFA is hypothesis-generating (i.e., begins with data and extracts a model from it), whereas CFA is hypothesis-testing (tests how well a pre-specified model fits the data). As a result, the measurement tool may not always assess what we intend or produce the desired latent structure (Suhr, 2006). Proper validation of a psychometric tool also requires consideration of linguistic, cultural, contextual, and scientific information (Tanzer, 2005). The use of CFA and EFA for validation, along with Differential Item Functioning (DIF) for ensuring measurement invariance, is essential for successful adaptation (Borsa et al., 2012).

Also, the PVD has mostly been investigated for use with university students and young adults, with little to no research on teenagers. Different populations and age groups perceive environmental threats variously. Teenagers are reported as being unable to fully assess risk(s) due to their perception of invulnerability to harm (Fischhoff & Nightingale, 2001). This issue has become a matter of public concern (Cohn et al., 1995). For instance, in the Tshwane District alone, between October 31 and December 11, 2021, 6,286 adolescents and younger individuals contracted COVID-19, with 2,550 requiring hospitalization, 18% of whom were teenagers (Cloete et al., 2022). The PVD's use in South Africa has largely been limited and mostly used as a supplementary tool for validating other instruments (Padmanabhanunni et al., 2022; Pretorius et al., 2021). To the best of my knowledge, the measure is yet to be validated for use with South African teenagers. Henceforth, highlighting the need and the importance of validating the measure for this specific population (Eder et al., 2021; Millstein & Felsher, 2002). The purpose of evaluating the scale for its psychometric evidence is to ensure that before its use, the measure evaluates that which it claims to measure (Pauline, 2013). Valid psychological measures assist in the collection of better-quality data, yielding comparable results across studies, which in turn increases the credibility of psychological data (Kazi & Khalid, 2012).

Due to the general shortage of psychometric data on the PVD (particularly in South Africa) as well as the highlighted conflicting psychometric evidence of the measure mentioned above, the current study accordingly sought to examine the psychometric properties (i.e., dimensionality, measurement invariance across sex [male and female], construct validity and reliability) of the PVD for use with South African teenagers.

1.4 Purpose of the study

1.4.1 Aim of the study

The study investigated the psychometric properties of the Perceived Vulnerability to Disease Scale in South African teenagers during the COVID-19 pandemic outbreak.

1.4.2 Objectives of the study

1.4.2.1 To establish if there will be a theoretically justifiable factor structure of the PVD in South African teenagers, using both CFA and Rasch analysis;

1.4.2.2 To evaluate the gender invariance of the PVD in South African teenagers;

1.4.2.3 To examine the reliability of the PVD in South African teenagers; and

1.4.2.4 To assess if there will be theoretically and empirically justifiable associations between perceived vulnerability and external criteria (i.e., attachment dimensions).

1.4.3 Research questions of the study

1.4.3.1 Will there be a theoretically justifiable factor structure of the PVD in South African teenagers, using both CFA and Rasch analysis?

1.4.3.2 Will there be gender invariance of the PVD in South African teenagers?

1.4.3.3 Does the PVD have good reliability for use with South African teenagers? and

1.4.3.4 Will there be theoretically and empirically justifiable associations between perceived vulnerability and external criteria (i.e., attachment dimensions)?

1.5 Significance of the study

Valid psychological measures assist in the collection of better-quality data, yielding high comparability across studies and this increases the credibility of psychological data (Kazi & Khalid, 2012). Credible data is important to clinicians and researchers as they rely on it to make informed decisions about health care options, public health strategy, and policy (Skelly, 2014). Because cultural differences also play a crucial role in the performance and use of psychological measures, (Hernandez et al., 2020), the cross-cultural utility of measures and issues such as test bias are of grave concern due to the influence these psychological measures carry in the decision making (Reynolds et al., 2021). Culture affects the expressions of certain psychological qualities and mental health (i.e., depression, anxiety, etc) as well as their manifestations (Bibi et al., 2020), this then builds some of the challenges with using a measure outside of its intended cultural context or validated population without first validating it for the new context (Swanepoel & Kruger, 2011).

Alternatively, other than establishing psychometric evidence for the use of a measure in new contexts – the option of translation, validating, and adaptation of established tests is convenient and facilitates cross-cultural/national comparison in psychological research (Hernandez et al., 2020). Given how culturally diverse South Africa is (Emuze & James, 2013; Ramlutchman & Veerasamy, 2013) and what the studies have highlighted above, it is then deemed necessary to examine whether psychometric properties observed on the PVD in the extant literature would also be found within the diverse cultural context of South African teenagers.

1.6 Operational definition of terms

1.6.1 *Perceived Infectability*

In this study, perceived infectability is defined as how much an individual feels about their susceptibility and threat of infectious diseases (Ding & Luo., 2023; Safra et al., 2021).

1.6.2 Validity

This study follows Messick (1989)'s concept of validity: a metric of the extent to which empirical evidence and theoretical justifications support the adequacy of interpretations and actions based on assessment outcomes or alternative assessment methods.

1.6.3 Construct validity

Construct validity in this study refers to the rational empirical process for recognizing the psychological characteristics of a measure or scale, and the quantity of concurrence connecting a theoretical concept and a specific measuring tool or mechanism (Cohen & Swerdlik, 2009; Fitzner, 2007). Construct validity further refers to associations (convergent or discriminating) amongst scores and other variables pertinent to the construct being measured (Beckman et al., 2005).

1.6.4 Internal structure

For this study, internal structure is defined as "the standard to which the associations among measure items and measure components conform to the construct on which the suggested test score interpretations are built" (American educational research association, American psychological association, and National council on measurement in education, 2014. p.16).

1.6.5 Reliability

In this study, reliability refers to the extent to which a test is consistent across different occasions of testing (Livingston, 2018).

1.6.6 *Factorial invariance*

According to Nolte & Elsworth (2014), factorial invariance is seen as the factorial consistency or uniformity of a questionnaire across different demographic variables and over time (established through factor means comparisons).

1.6.7 *Differential item functioning (DIF)*

Differential item functioning in this study refers to dissimilarity in the performance of measures (or sets of items) for non-identical determined groups (American educational research association, American psychological association, and National council on measurement in education, 2014).

1.7 Conclusion

Measures used on a population that they have not been validated for may produce measurement error, yielding questionable conclusions in scientific evidence (Dowrick et al., 2015). The chapter introduced the study, stated the nature of the problems to be investigated, provided the main aim of the study, along with the objectives of the study, and concluded with the definition of significant terms within the study.

CHAPTER 2: THEORETICAL PERSPECTIVE AND LITERATURE REVIEW

2.1 Introduction

This chapter is dedicated to examining the available literature on the PVD and the theory underlying the scale. It further reviews and discusses the PVD's psychometric properties across different studies.

2.2 Theoretical perspective

This study used a combination of theoretical explanations (i.e., behavioural immune system theory and attachment theory) to examine the psychometric properties of the PVD.

2.2.1 The behavioural immune system theory

Behavioural responses are regulated by different motivational systems for functionally different phenomena (usually related to multiple emotional attribute conditions; Beall & Tracy, 2017). The biological sciences theory and research as well as evolutionary psychology tools of conception have illuminated research on behavioural immune system (Schaller, 2016). For example, among our familial populations, physical good health benefits have probably developed following interaction with family and friends during hunting for food and other fitness-requiring activities, however, it could be argued that unalike behaviours would have been accommodative in different occasions from interaction with the same family and friends or even children. Due to different motives for each environment, countless systems regarding motivation developed in pursuit to assist in regulating associative behaviour, breeding behaviour, and caring behaviour by parents (Schaller et al., 2017). Therefore, it is evident that contrasting systems develop or evolve in response to distinct types of environments, especially those threatening human existence.

The entirety of mechanisms that help identify prospective infection threat within the surrounding of the individual and further assist in producing emotional and analytical responses that then encourage which behavioural decisions will be adaptive or useful in the current exposed environment through the reduction of the likelihood of exposure to infection is dubbed the behavioural immune system – responsible for the provision of immunological defence against pathogens seeking to infect the body (Schaller, Murrey, & Hofer, 2022).

The exposure of pathogens to humans is in millions daily, through either consumption or inhalation. And because pathogens enter the body unrecognizable by the naked eye and attack it from within, they then pose different defence demands due to their method differing from other threats that can be identified, thereby behaviourally requiring different means of mitigating their threat which is different from other behavioural means towards other threats. It is due to this reason and others that uniquely functional motivational systems adapted to disease-causing pathogens through modulating behavioural defences against them (Aunger & Curtis, 2013; Schaller, 2016; Tybur & Lieberman, 2016). To combat and avoid infection we depend partly on our adaptive immune system (Alberts et al., 2002). However, pathogens tend to bypass this first line of defence and succeed in the invasion of the body, therefore showing that regardless of its advanced and dynamic nature, it is inherently limited in its ability to combat pathogens (Kelley et al., 2005). It may be a great way to oppose pathogens infection is to simply avoid being in contact with them.

The avoidance of pathogens is seen not just in humans but in animals too through their behaviour to reduce exposure. The use of superficial sensory cues and the appearance of infection risk their ability to strategically avoid contact with the identified thing (Goodall, 1986; Kiesecker et al., 1999; Schulenburg & Müller, 2004). For instance, elephants use tree branches as a fly switch to repel being bitten by flying animals (e.g. mosquitoes), Mother dogs and cats consume faecal deposits of newborns to avoid parasite eggs from hatching into infectious larvae to infect the newborn, mice abstain from breeding with others that are exposed to parasitic protozoa (Hart, 2011; Kavaliers & Colwell, 1995).

The concept “behavioral immune system” originated from the psychological scientist Mark Schaller and conceived of it as a compounded suite of the analytic, emotional, and behavioural processes geared towards pathogen communication in the presence of repetitive infectious disease threats. Fundamentally, the responsibility of this system is to detect threatening and appropriate cues in the environment and activate relevant responses aimed at nullifying those threats. Similar to other numerous evolved threat management systems, together contextual sensitivity and biases that aid adaptive responding mark the behavioural immune actions (Ackerman et al., 2018). One of the first lines of defense said to have developed and evolved against infections is thought to be the behavioural immune system.

Its primary activity is to minimise or avoid contact between uninfected hosts and potential pathogens. A variety of animals have been observed to utilize the behavioural immune system including insects, amphibians, and mammals, however, research mostly focuses on the behavioural immune system usage in humans because of the complex cognitive and emotional processing involved (Shakar, 2019).

The behavioral immune system in humans still differs in its expression or impact, the difference is either influenced by culture or individual differences, hence the apparent difference in sensitivity of the system itself (Schaller, Murray, & Hofer, 2022; Tybur, Lieberman, & Griskevicius, 2009). The persistent usage of the behavioural immune system and the distribution of individual differences is improbably random, in all probability there is the likelihood that these individual differences are somewhat heritable (Sherlock et al., 2016; Tybur, Wesseldijk, & Jern, 2020), but not only that but they (i.e. these individual differences) could further be impacted by communal observation processes partially (Stevenson et al., 2010). As a result, a pile of differences could form – with diversification linking the relationships with families, friendship networks, and cultural populations. However, consideration of other variables that may moderate responses to threats to diseases should be noted, for example, values helped by collectivist as well as interconnected self-analysis (Kim et al., 2016; Salvador et al., 2020).

As such, the PVD was developed based on the behavioural immune system theory. The theory conceives of perceived vulnerability as an adaptive psychological response to threatening stimuli including aversive emotional experiences and arousal (Schaller & Park, 2011). The behavioural immune system activation can elicit conformity to social norms through PVD. However, with superficial cues, the responses may be aversive to no actual threat leading to aversion to unfamiliar people and chances of prejudice. The principle reflected is functional flexibility which has implications for emotional, cognitive, and behavioural phenomena (Bacon & Corr, 2020; Schaller & Park, 2011). The behavioural immune system theory embraces psychological processes that deduce contamination threats from perceptual reminders, and that react to these perceptual reminders by arousal of aversive feelings, thoughts, and behavioural instincts (Schaller, 2011).

2.2.2 Attachment theory

John Bowlby conceived attachment theory from his engagement with developmental psychology, psychoanalysis, ethological studies, communication studies, and information processing (Bretherton, 1992). Attachment theory is the joint work of John Bowlby and Mary Ainsworth (Ainsworth & Bowlby, 1991). By Mary Ainsworth's development of the strange situation, she aided in the identification and classification of differences in individuals regarding attachment security and insecurity for infants (Ainsworth et al., 1978). Furthermore, to support Bowlby's view that the process of attachment identifies humans "from the cradle of the grave", research has since exploded and grown beyond attachment processes in parent-child dyads to explore attachment in relationships outside the parent (i.e. romantic relationships; Cassidy et al., 2013).

The relationship between the mother and the child and the tie they shared as well as the impact of it being disrupted either through bereavement or separation or/and deprivation was transformed through John Bowlby (Vicedo, 2011). Through Mary Ainsworth's efforts and innovative methodology, it was made possible to evaluate Bowlby's ideas empirically which further assisted in the theory's expansion (Spies & Duschinsky, 2021). She also contributed with concepts such as "secure base" for attachment figures concerning the infant and their exploration of the world, and "maternal sensitivity" regarding the infant's signals as well as its impact on the child-mother attachment pattern development (Flaherty & Sadler, 2011; Yorgason, 2015). As individuals, we are born equipped with a variety of innate behaviour drives that assist maximise our survival - such as attachment behaviour which allows us to have this need to draw others towards us at moments of needs or distress (Burkhart & Borelli, 2020). This basic adaptation for survival is seen when one experiences stress, feels unwell, frightened, or under threat, their attachment becomes alerted, behaviours such as crying, and clinging in infants and more sophisticated behaviour in older individuals (National Collaborating Centre for Mental Health, 2015).

Attachment functioning through infancy to adulthood is categorised into three: secure attachment, anxious-avoidant attachment, and anxious-ambivalent attachment. How individuals receive and attend to their relationships around them with others (i.e. parents, children, close friends, and romantic partners) are contained within these attachment categories (Hazan & Shaver, 1987; Heim, 2015). These attachment styles influence stress and uncertainty reaction patterns - to successfully cope with stressful events, an inner working style of a secure attachment is key, whereas an anxious attachment style may compromise one's adaptive response to stress (Blalock et al., 2015; Segal et al., 2021).

Anxiety-provoking, distressing, and life-threatening situations activate cognitive-affective schemas associated with individuals' attachment systems (Bowlby, 1979). Attachment security promotes a good sense of self and self-capability (Mikulincer & Shaver, 2019) and leads to the use of adaptive problem-solving strategies (Simpson & Rholes, 2018). As such, attachment might regulate people's ability to manage infectious outbreaks, framing risk perception by influencing perceived vulnerability and self-efficacy. Additionally, each attachment strategy has its own regulatory goal shaped for facilitating specific goal attainment (Mikulincer et al., 2003). Perceived vulnerability and distress are commonly found when the attachment system is activated by likely ill-health or disease (Thompson & Ciechanowski, 2003). The outbreak of the COVID-19 pandemic, could, for example, be one such situations that present threatening conditions and trigger the automatic attachment system (Vismara, et al., 2022). Therefore, people possess attachment systems that assist them to avoid pathogens especially when they spread through the population (Makhanova & Shepherd, 2020).

2.3 Literature review

The investigated scale, the PVD scale, was developed by Park et al. (2003) to examine specific perceived vulnerability to disease and reactive negativity toward people with physical disabilities (Diaz et al., 2016). The measure was later updated and modified to assess individual differences concerning chronic concerns for infectious disease transmission (Duncan et al., 2009).

2.3.1 *Factor structure*

The few studies that examined the factorial structure of the PVD scale were inconclusive, indicating that the two-factor structure consisting of PI and GA may not be consistently reproduced, or that some of the scale items may be susceptible to cultural bias (Karakulak et al., 2023). Owing to the potential effects of cultural characteristics biases, the PVD's latent construct needs be investigated in diverse populations (Mylonas & Furnham, 2014). The factor structure of the PVD has mostly been studied using CTT analytic strategies: EFA and CFA. For instance, Diaz et al. (2013) and Duncan et al. (2009) found that the PVD had two-factors, using EFA with a principal component analysis (PCA) and oblimin rotation (i.e., the transformational system utilised in factor analysis when two or more factors being latent variables are correlated), which was responsible for 35.87% of the discrepancy, however, Diaz et al. (2013) had poor loading on items 11 and 13 both factors compared to Duncan et al. (2009) where all 15 items loaded in their appropriate factor with no cross item loading.

Ahmadzadeh et al. (2013), found similarities to both Duncan et al. (2013) and Diaz et al. (2016), with the PVD consisting of two factors (viz. Perceived Infectibility [PI] and Germ Aversion [GA]) - all item loading were significant except for item 15 which was removed due to low factorial loading. Fakukawa et al. (2014) translated the PVD scale into Japanese and their factor analysis replicated the original two-factor structure with both subscales reflecting good reliability and validity. The German version also reflected two-factors after both EFA and CFA, although two items were removed due to being unfit for present-life situations (i.e., items 4 and 15). While factor analysis revealed two- factors, the German version only had acceptable internal consistency reliability for the PI subscale and not GA (Stangier et al., 2021). Moradi-motlagh et al. (2020) for the Persian population, found a two-factor structure using EFA but item 13 had cross-loading. Ferreira et al. (2022), for the Portuguese adaptation, found a bifactorial structure with items 2, 6, 9, and 13 showing low item loading, and item 5 cross loading therefore resulting in the items removal.

Do Bu et al. (2023) adapted the scale for the Brazilians and found a bifactorial structure, but items 11 and 12 had low item loadings and were subsequently removed. Rokvic and Karan (2021), for the Serbian adaptation of the scale, also found a bifactorial structure but items 13 and 14 were similarly removed due to low factorial loading. The Turkish adaptation by Egemen, Ozlem, and Gokler (2023), had a bifactorial structure with all items loading successfully. Karakulak et al. (2023) investigated a global factor structure and found that item 11 had weak factor loading in Germany, Bulgaria, and Serbia, item 13 not only had weak factor loading in Spain, Australia, Greece, India, and Bulgaria but also cross-loaded on the PI factor in Bulgaria, Australia, and India - the items were then excluded from the final bifactorial structure.

Item response theory outlines the association between dormant traits (e.g., the construct that the measure presented to evaluate), the properties of the items in the measure, and the respondent’s answers to the individual item (Yang & Kao, 2014). As opposed to the conventional CTT, it permits measuring devices to be equated or cross-calibrated as well as investigating issues such as cross-cultural differentiation (Embretson & Reise, 2004). Do Bu et al. (2023) used IRT analysis for the scale's items uncovering items (e.g., item 11 and item 12) with low precision in determining latent traits. This results/problem was similarly reported by Ferreira et al. (2022) (e.g., item 5 and item 13), in both instances these items were removed resulting in a more robust instrument. As can be seen from the above, only a handful of studies examined the factorial validity of the PVD using IRT, and the measure appears to be faced with an inconsistent factorial structure across different cultural contexts (Karakulak et al., 2023).

2.3.2 *Measurement Invariance*

There is generally a lack of studies on the measurement equivalence of the PVD. Gender is one of the important factors in nearly all of the MI evaluation of the PVD (Chiesi et al., 2022). The limited existing research shows the two factors (viz. Perceived Infectibility [PI] and Germ Aversion [GA]) of the PVD to be identical and strong across different sex groups (female and male), suggesting that the two-factor structure is consistent across different demographic categories (Diaz et al., 2016; Do Bu et al., 2023; Duncan et al., 2009).

The existence of indistinguishable factorial structure across genders does not seem to equate to gender invariance within the very structure (Chiesi et al., 2022). Aspects such as resilience, the capability to remain calm in stressful situations, impulse control, and self-efficacy are quite essential in managing oneself in an uncertain environment such as encountering the Covid-19 pandemic (Hardiyati et al., 2022). Either substantive differences may result in differing results psychometrically between a group (males and females) or it may originate from a measurement that is biased. This is why one of the main concerns in psychometrics is identifying items or tools that individuals may understand and respond to similarly (Berry et al., 2011; Vandenburg & Lance, 2000).

Rokvic & Karan, (2022) found that gender difference on the PI scale is non-existent ($M = 3.06$; $SD=1.11$ for female participants and $M = 3.17$; $SD = 1.16$ for male participants), but female participants scored ($M = 3.96$; $SD = 1.03$) which was remarkably elevated than the male score ($M = 3.7$, $SD = 1.08$) on the GA scale. Ahmadzadeh et al. (2013) reported the two-factor model to be constant across dissimilar demographic categories, females attained higher on the scale of perceived vulnerability as compared to males but it was considered not statistically significant.

Also, further research shows women report an elevated perceived vulnerability to disease than their counterparts and these gender differences are also the same for fear of pathogens (Diaz et al., 2016; Ferreira et al., 2021). Women are reported to be getting these elevated scores than men in both the PVD factors (Duncan et al., 2009; & Faulkner et al., 2004). De Coninck et al. (2020) also found that females outlined significantly elevated Germ aversion (GA: M = 4.73) and perceived infectability (PI: M = 3.87) than their counterparts (GA: M = 4.39; PI: M = 3.57). There are dissimilarities in the way boys and girls assess risk and make decisions in adolescence (d'Acremont & Van der Linden, 2006). So, it remains to be seen if gender will influence how South African teenagers interpret the PVD items.

2.3.3 *Reliability*

Duncan et al. (2009) found that the 15 item-version of the PVD had an acceptable internal consistency with a Dutch sample (i.e., only after reverse scoring) (total scale: Cronbach's alpha of 0.82; "PI": Cronbach's alpha of 0.87 and "GA" factor of 0.74). These results are consistent with Ahmadzadeh et al. (2013), who found the two- factors to have acceptable internal consistency with an Iranian sample. Ferreira et al. (2023) and Egemen et al. (2023) also reported good internal consistency reliability for the two factors (i.e., alpha > 0.71). However, while Diaz et al. (2013) showed an adequate internal consistency for "PI" (0.78) in their Spanish study, the "GA" subscale reliability results were low (0.59). Similar results were reported by Skolnick and Dzokoto (2013) who found the "PI" subscale to have acceptable internal consistency but the "GA" subscale to have poor internal consistency in their Ghanaian study. Rokvic and Karan (2022) likewise found a low Cronbach's alpha value on the Germ Aversion scale, while Stangier et al. (2022) found internal consistency of the subscale perceived infectability was excellent (ω = 0.91 [95% CI: 0.90; 0.92]), but not adequate for the Germ Aversion subscale (ω = 0.50 [95% CI: 0.45; 0.55]).

However, other studies found different results, especially regarding Germ Aversion, Murray et al. (2013) found the Germ Aversion subscale (PVD-GA; Cronbach's Alpha = 0.76) and Perceived Infectability subscale (PVD-PI; Cronbach's Alpha = 0.91). Do Bu et al. (2023) found an overall adequate internal consistency within all the 13 items making up the factorial structure after using composite reliability. Karakulak et al. (2023) calculated the McDonald's omega for internal consistency, which ranged between 0.64 and 0.86. Chiesi et al. (2022) both factors showed a satisfactory internal consistency, with a higher value for the PI when compared to GA with a reported relative 95% confidence. Besides the inconsistent reliability findings of the measure across studies, the majority of studies that examined the reliability of the PVD used Cronbach's alpha. There are alternative reliability measures to Cronbach's alpha, including coefficient omega and the greatest lower bound reliability. These alternatives are more robust and overcome the Cronbach alpha's limitations such as the underestimation of the true reliability of measures (Deng & Chan, 2017; Peters, 2014).

2.3.4 Construct validity

Past studies have investigated the convergent validity of the PVD with anxiety measures (Ahmadzadeh et al., 2013; De Coninck, d'Haenens, & Matthijs, 2020; Diaz et al., 2016; Duncan et al., 2009). Of all the reviewed research, none seem to have tested the PVD's construct with attachment concepts. Duncan et al. (2009) only examined the discriminant validity of the PVD with an anxiety measure (Health Anxiety Inventory), while other researchers either used personality-related measures or illness-related measures. Attachment theory stipulates that peoples' internal working models (also understood as a cognitive-affective schema) inform how they view themselves when faced with a perceived threat, how they assess threats, and their behavioural reactions in the face of potential threats (Hunter & Maunder, 2001). So, it is plausible that risk perception will have a relationship with attachment dimensions (viz. security, avoidance, and anxiety).

2.4 Conclusion

The chapter discussed the existing literature on PVD's psychometric evidence and the theory underlying the psychological measure. This was to highlight, contrast, and evaluate the different findings of the literature – relating to the PVD's reliability and validity (factorial and construct).

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter delineates the methodologies employed in this investigation. This will also encompass deliberations on the tools for data gathering and the procedures adhered to during the research process.

3.2 Research design

This study utilised a quantitative research approach, following a cross-sectional survey design. Qualitative research is primarily used to gain a deep understanding of human behavior, emphasizing the importance of participants' perspectives and experiences. Unlike quantitative research, which focuses on measurable data and precise facts (Ahmad et al., 2019), qualitative methods prioritize the richness of individual viewpoints, making them especially valuable when exploring complex human dynamics. On the other hand, quantitative research is more suited for testing hypotheses and confirming the validity of tests (White et al., 2022). The psychometric properties of the PVD were assessed using methods within the empiricist perspective to research (i.e., IRT). Empiricist epistemology privileges empirical evidence in the development of ideas and knowledge (i.e., derived through experiments and validated measurement tools). It rests on the idea that knowledge is not definite (i.e., it is probabilistic) and must face constant falsification and re-examination (Wilson & McLean, 2011).

3.3 Sampling

This study was a secondary data analysis of the data previously gathered as part of a study on COVID-19 in South African teenagers (see attached ethics clearance letter of the original study). Authorisation to use this data was given by the primary researchers. The data for the main study (N = 1400) comprised of teenagers between the grades 10 – 12 who attended school in Limpopo, Gauteng, and Eastern Cape provinces. The sample of learners was drawn for the original study as follows: cluster sampling was used to draw 3 secondary schools from the secondary schools in the districts of the participating provinces; and finally, a simple random sampling technique was used to select 450 participants from the selected schools.

Larger samples (over n = 200) are, overall, considered obligatory for the Rasch model to acquire vigorous item framework estimation (Chen et al., 2013).

3.4 Data collection

The following: a demographic questionnaire, the Perceived Vulnerability to Disease Scale, and the Attachment in Middle Childhood Questionnaire were used to collect the data.

3.4.1 Demographic questionnaire

The demographic questionnaire included variables such as race, age, gender, and socio-economic status.

3.4.2 Perceived Vulnerability to Disease Scale (PVD)

The PVD is a 15-item self-report measure that uses a 7-point scale response ("strongly disagree" to "strongly agree"). The scale measures two factors, namely: Perceived Infectibility and Germ Aversion. The instrument gives subscale scores or the overall PVD score (Duncan et al., 2009; Diaz et al., 2016; Makhanova & Shepherd, 2020; Schaller & Murray, 2008). The measure has been found to be valid in past research (Diaz et al., 2016; Duncan et al., 2009).

3.4.3 The Attachment in Middle Childhood Questionnaire (AMCQ)

The AMCQ is a 15-item self-report measurement tool of attachment, with three subscales namely Anxiety, Avoidance, and Security (supplementary scale). The tool assesses the quality of the child-mother and father relationships in middle childhood. The instrument uses a Harter's response format, also known as the "some/other" format, which offsets the children's tendency to answer in desirable ways. Research shows the AMCQ to have good psychometric properties (Marci et al., 2021). The subscales of the measure similarly had good internal consistency in the current study (i.e., Mother_Anxiety = 0.86; Mother_Avoidance = 0.89; Mother_Security = 0.87; Father_Anxiety = 0.75; Father_Avoidance = 0.88; Father_Security = 0.89).

3.5 Data analysis

All the analyses were conducted using R version 4.0.3 (R-core team, 2020). Initial analysis included examining the sample and data characteristics (such as the mean, standard deviation, frequencies and percentages, kurtosis and skewness, correlation matrix, Kaiser-Meyer-Olkin measure of sample adequacy, and missing values). This was done to ensure that no analytic assumptions were violated. Second, Rasch analysis was used to examine the factor structure of the PVD. Lastly, the MI of the PVD among sexes was also examined together with the reliability and construct validity of the instrument.

3.6 Quality Criteria

Pilot study

Sampling in the original study was conducted in phases. During the pre-sampling phase, 30 learners were selected for inclusion in a pilot study aimed at testing the quality aspects of the questionnaire such as (i) readability, (ii) whether the length of the questionnaire is manageable, (iii) instructions, whether they were easy to follow, (iv) the level of difficulty of each item and item comprehensibility, (v) the amount of discomfort experienced when responding to each item (sensation). The pilot results indicated no need to make changes to the questionnaire - the quality aspects stated above were met. Preliminary reliability results (αs > 0.75) on the pilot study further supported the utility of the questionnaire with identified sample population.

3.7 ETHICAL CONSIDERATIONS

Ethical considerations are an essential aspect of the research process and serve to protect the rights of the research participants, especially when they are children (Foxcroft & Roodt, 2013).

3.7.1 *Permission*

Protocols for conducting ethical research from the University of Limpopo were followed. Data were only collected after ethical clearance was granted by the Turfloop Research and Ethics Committee (TREC).

3.7.2 *Informed consent*

All participants gave written agreement before taking part in the study. Involvement in the study was non-compulsory.

3.7.3 *Privacy, anonymity, and confidentiality*

Participants' confidentiality was protected because no personal details were required in the data collection.

3.7.4 *Possible benefits and risks*

Participants were not paid to take part in the research. No possible risk for harm and distress could be expected by taking part in the survey study. Respondents were allowed and knew that they could stop taking part in the research at any time if they wished so, without suffering any repercussions.

3.7.5 *Debriefing*

As already stated, there are no known risks associated with completing a questionnaire about perceived vulnerability to infection, and attachment. However, some teenagers could react apprehensively; being sensitive to completing questions about situations that were not particularly comfortable for them. When this happened, participants were referred for debriefing at the *LifeLine* (Counselling organization), at no cost to them (prearranged by the primary researchers).

3.7.6 *Data management*

The raw data is securely stored in the Department of Psychology (University of Limpopo) for reuse and archiving for a minimum period of 15 years. Other researchers may also have access to the data during this period.

3.8 Conclusion

This chapter outlined the research methods, the data collection instruments as well as the procedures that were followed in conducting the research.

CHAPTER 4: RESULTS

4.1 Introduction

The fourth chapter presents the study results and their interpretations. It also includes the data analysis plan, and the statistical programmes used to analyse the data (i.e., the Statistical Package for Social Sciences (SPSS) programme, R software, and WINSTEPS).

4.2 Data analysis plan

Socio-demographic data and Exploratory Factor Analysis (EFA) were analysed using the SPSS; Omega and Greatest Lower Bound with R software and Rasch models with WINSTEPS (Linacre, 2009). A Partial Credit Model within WINSTEPS software was employed to analyse the polytomous data. First, the dimensionality of the PVD items was estimated using EFA with maximum likelihood using principal axis factoring (PAF) with varimax rotation. Factor selection was done using parallel analysis (PA). Second, the factor structure found with EFA was then confirmed with Confirmatory Factor Analysis (CFA) by comparing it with alternative CFA models of the PVD (found in the literature) with the Weighted Least Squares Means and Variance adjusted (WLSMV) estimator for ordinal data in Mplus 7.4 (Muthén & Muthén, 2017).

The model fit was evaluated with the comparative fit index (CFI), the Tucker-Lewis index (TLI), the Standard Root Mean Residual (SRMR) and the root mean square error of approximation (RMSEA) (i.e., TLI and CFI ≥ 0.95 [adequate at 0.92 to 0.94], and RMSEA < 0.08), Akaike's information criterion (AIC) and Bayesian information criterion (BIC) (see Bentler 1990; Bentler & Bonett 1980; Burnham & Anderson, 2004; Hu & Bentler 1995; Kline, 2005). A (1) unidimensional PVD model: with all items loading on one-factor, (2) a bidimensional PVD model: with two correlated latent factors (i.e., PI: items 2, 5, 6, 8, 10, 12, 14 and GA: items 1, 3, 4, 7, 9, 11, 13, 15), and (3) the South African bidimensional PVD model: with two correlated latent factors (i.e., PI: items 2, 6, 8, 10 and GA: items 1, 4, 7, 9, 15) were examined.

Lastly, Rasch analysis adopted two rating scale models (RSM), namely, PI and GA. The information-weighted fit (infit) and outlier-sensitive fit statistic (outfit) mean square (MnSq) were applied to examine item fit (i.e., item infit or outfit MnSq ranging between 0.5 -1.5 =

misfit). Average and step measures of the descriptors were used to check if disordering threshold exists in the PVD. Additionally, infit MnSq, outfit MnSq and monotonically increased difficulties between 0.5 and 1.5 suggested no diso65rdering (Tennant & Conaghan, 2007). Lastly, DIF across the sexes was also estimated. Reliability was deemed acceptable at > 0.70 for all indices (i.e., Cronbach's Alpha, separation reliability, Omega, greatest lower bound) (Dunn, Baguley, & Brunsden, 2014).

4.3 Results

4.3.1 *Descriptive statistics*

This study used a portion of the original research (i.e., N = 474; Age: M = 16.96 [SD = 1.31; range = 14 – 22yrs]). Most of the participants came from Capricorn municipality = 57.4% followed by Thulamela = 18.1%, and Nelson Mandela = 24.5%. The sample was mostly female = 60.3%, while about 25.5% of the participants came from rural/village contexts and 74.5% from urban/township. The ethnicity composition was dominated by Black at 67.7%; followed by White at 13.0%; and Coloured at 10.2% with lastly Indian at 9.0%. The level of education ranged from Grade 10 with 20%; Grade 11 with 23% and Grade 12 with 57%. About 59.5% of the participants were from married parents' households, 28.3% were from single parents' households, blended family was at 6.5%, with extended family at 4.6% and lastly child-led family at 1.1%.

4.3.1.1 *Item analysis*

Item means standard deviations and normality were examined. The univariate skewness and kurtosis for each of all the items (except for PI 8) are within the normal range of -1.5 to 1.5 (see table 1).

Table 1: Normality, mean, and standard deviation of the PVD items

Item	Skewness	Kurtosis	Mean	SD
GA 1	- 1.19 (0.11)	0.96 (0.23)	5.62	1.61
GA 4	- 0.68 (0.11)	- 0.48 (0.23)	5.05	1.88
GA 7	- 0.19 (0.11)	- 0.55 (0.23)	4.21	1.65
GA 9	- 0.44 (0.11)	- 0.74 (0.23)	4.80	1.89
GA 15	- 0.36 (0.12)	- 0.53 (0.23)	4.67	1.75
PI 2	0.17 (0.12)	- 0.44 (0.23)	3.55	1.55
PI 6	0.38 (0.12)	- 0.48 (0.24)	3.17	1.67
PI 8	11.08 (0.12)	187.19 (0.23)	4.22	3.00
PI 10	0.21 (0.12)	- 0.58 (0.23)	3.28	1.69

Note: PVD = Perceived Vulnerability to Disease Scale; SD = standard deviation

4.3.2 *Exploratory factor analysis*

The Kaiser-Meyer-Olkin (KMO) measure = 0.86 showing that the sample size used in the study was adequate for EFA (Field, 2009), while the Bartlett test of sphericity was less than the critical level of significance indicating that the data was suitable for EFA. Principal axis factoring (PAF) produced a two-factor solution. Table 2 shows the factor loadings (> 0.30). Items GA 11 and PI 12 had poor loading (< 0.30) and items 5 and 14 were cross-loaded, while items GA 3 and 13 had negative loading on the two factors despite recoding them. In sum, the EFA results suggest that items 3, 5, 11, 12, 13, and 14 of the original PVD should be dropped and we should remain with 9 items.

Table 2: Factor matrix of the PVD

Principal factors		
	Factor 1	Factor 2
Item descriptor	Loading	
GA 1	0.471	
PI 2		0.430
GA 4	0.420	
PI 6		0.591
GA 7	0.579	
PI 8		0.587
GA 9	0.606	
PI 10		0.644
GA 15	0.457	

Note: PVD = Perceived Vulnerability to Disease Scale

4.3.3 *Confirmatory factor analysis*

CFA was applied to three PVD measurement models and the models were compared against each other. Table 3 shows the fit indices of all of the tested models. Model 3 (two-factor) displayed a significantly improved and adequate fit, to the data, compared to Models 1 and 2. The AIC, BIC, and the chi-square tests confirm that model 3 had a significantly better fit to the data and is more parsimonious than the unidimensional and bidimensional model (with all the items).

All the estimated factor loadings for Model 3 (see figure 1) had expected signs and were statistically significant (see table 4). Items loaded significantly on their relevant factors (with regression coefficients ≥ 0.40). The intercorrelations between the two factors were both statistically and practically significant (r = 0.319, p < 0.001).

Table 3

Model fit estimates of the confirmatory factor analyses

Model	x^2	*df*	*TLI*	*CFI*	*RMSEA*	*RMSEA (90% CI)*	*AIC*	*BIC*
Model 1	228.339	61	0.84	0.91	0.05	0.042—0.055	67837.83	68136.81
Model 2	300.219	72	0.82	0.90	0.05	0.046—0.058	67872.51	68115.75
Model 3	46.511	26	0.97	0.98	0.05	0.024—0.069	15240.08	15356.24

Note. Model 1 = PVD (one factor), Model 2 = PVD (15 item two-factor), Model 3 = PVD (9 item two-factor).

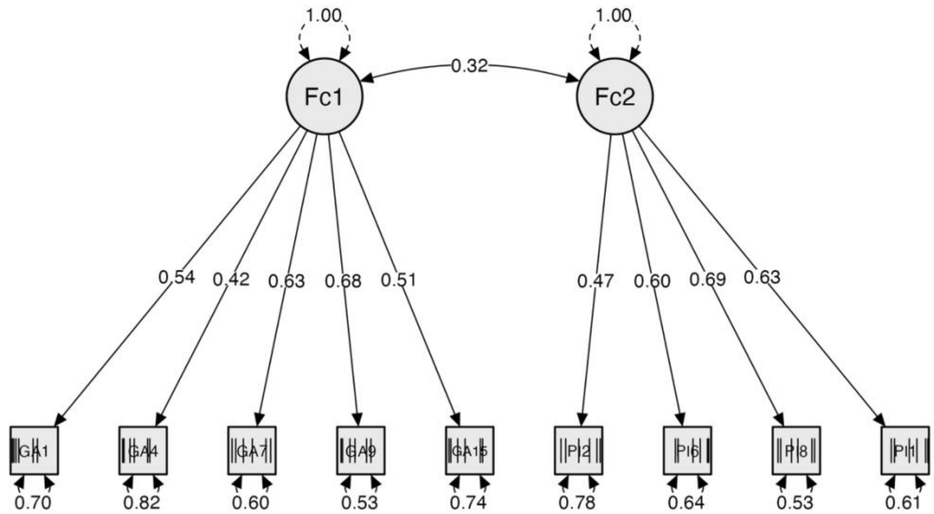

Figure 1: Two-factor model

Table 4: Standardized loadings on the latent factors for all the models

	Model 1	Model 2		Model 3	
Items	One factor	*GA*	*PI*	*GA*	*PI*
1	0.778	0.68		0.55	
2	0.267		0.79		0.47
3	0.292	0.37		-	-
4	0.779	0.70		0.42	
5	0.351		-0.23	-	-
6	0.196		0.68		0.60
7	0.904	0.89		0.63	
8	0.503		1.11		0.69
9	1.045	1.06		0.68	
10	0.354		0.92		0.63
11	0.191	0.17		-	-
12	-0.154		0.08	-	-
13	0.428	0.58		-	-
14	-0.275		0.32	-	-
15	0.862	0.87		0.51	

Note. Model 1 = Unidimensional, Model 2 = Two correlated factors (all items), Model 3 = Two correlated factors (9 items).

4.3.4 *Rasch analyses*

4.3.4.1 ***Item threshold ordering***

Both the average and step measures show that the difficulties of responses (i.e., Likert scale) were monotonically increased (see Tables 5 & 7). The infit and outfit mean squares also suggested no disordering (see Tables 6 & 8).

4.3.4.2 ***Item fit***

Total PVD

All items with item difficulties from -0.65 to 0.49 fit the latent construct well (infit and outfit: between 0.5 and 1.5).

PI

All items with item difficulties from -0.40 to 0.25 fit the latent construct well (infit and outfit: between 0.5 and 1.5).

GA

All items with item difficulties from -0.42 to 0.34 fit the latent construct well (infit and outfit: between 0.5 and 1.5).

4.3.4.3 ***Dimensionality***

Total PVD

The PCA of residuals shows that the total scale accounted for 39.1% of the variance. The unexplained variance of the eigenvalue for the first contrast was 2.0, suggesting that the total scale was not unidimensional.

PI

The PCA of residuals shows that the 4-item subscale accounted for 48.0% of the variance. The unexplained variance of the eigenvalue for the first contrast was 1.4, suggesting that PVD-PI was unidimensional.

GA

The principal component analysis of residuals found the 5-item subscale to be responsible for 41.7% of the variance. The unexplained variance of the eigenvalue for the first contrast was 1.4, suggesting that PVD-GA was unidimensional.

Table 5

Rasch difficulties and fit statistics for each item

Item descriptor	Rasch		
	Difficulties	Infit MnSq	Outfit MnSq
PVD 6	.49	1.00	1.01
PVD 10	.44	.90	.96
PVD 2	.33	.83	.82
PVD 8	.09	.87	.88
PVD 7	.04	.82	.82
PVD 15	-.17	1.04	1.05
PVD 9	-.23	1.10	1.07
PVD 4	-.34	1.38	1.41
PVD 1	-.65	1.18	1.14

Note: Infit = information-weighted fit statistic; Outfit = outlier-sensitive fit statistic; MnSq = mean square.

Table 6:

Response disordering test

	Average measure	Step measure	Infit MnSq	Outfit MnSq
Model				
1	-1.48	_	1.19	1.21
2	-1.38	-.71	1.16	1.26
3	-1.26	-2.61	.84	.88
4	-1.08	-.86	.81	.78
5	-.85	-1.44	.90	.91
6	-.70	.54	1.07	1.06
7	-.41	-1.61	.96	.99

Note. 1: Strongly disagree; 2: mildly disagree; 3: disagree; 4: neither agree nor disagree; 5: agree; 6: mildly agree 7: strongly agree.

Table 7

Rasch difficulties and fit statistics for each item

Item descriptor	Rasch		
	Difficulties	Infit MnSq	Outfit MnSq
PI			
PVD 6	.25	1.04	1.00
PVD 10	.16	.94	.94
PVD 2	-.01	1.03	1.04
PVD 8	-.40	1.00	.97
GA			
PVD 7	.34	.79	.79
PVD 15	.12	.98	.97
PVD 9	.04	.96	.93
PVD 4	-.07	1.21	1.16
PVD 1	-.42	1.17	1.03

Note: Infit = information-weighted fit statistic; Outfit = outlier-sensitive fit statistic; MnSq = mean square.

Table 8:

Response disordering test

	Average measure	Step measure	Infit MnSq	Outfit MnSq
PI				
1	-2.06	_	1.08	1.07
2	-1.70	-1.23	1.12	1.14
3	-1.40	-2.89	.82	.83
4	-1.00	-.69	.77	.76
5	-.66	-.96	.85	.84
6	-.37	.67	.98	.97
7	.03	-.30	1.29	1.30
GA				
1	-3.07	_	1.27	1.36
2	-3.12	-2.51	.95	1.01
3	-2.91	-4.15	.95	.97
4	-2.77	-2.84	.83	.96
5	-2.52	-3.40	.85	.77
6	-2.24	-1.07	1.02	.84
7	-1.31	-3.37	.96	.97

Note. 1: Strongly disagree; 2: mildly disagree; 3: disagree; 4: neither agree nor disagree; 5: agree; 6: mildly agree 7: strongly agree.

4.3.5 Association between PVD and attachment dimensions

Table 9 presents the results of the relationship between PVD factors and attachment dimensions. PI only had a significant relationship with attachment security (*rs* = 0.144 and 0.106, $p < 0.05$), whereas GA had significant relationships with all attachment dimensions ($p < 0.01$).

Table 9:

Intercorrelation between PVD factors and attachment dimensions

	Anxiety (D/M)	Avoidance (D/M)	Security (D/M)
PI	0.106/0.060	0.114/0.087	0.144*/0.106*
GA	0.137*/0.156**	0.138*/0.214**	0.159**/0.144**
Total PVD	0.161*/0.160**	0.176**/0.245**	0.222**/0.190**

Note: *p < 0.05; **p < 0.01, D: Dad, M: Mom

4.3.6 ***Differential Item Functioning across sexes***

The two-factor and nested models showed a good fit to the data for both sexes with all parameters being viable and statistically significant. Table 10 shows the tests for multigroup models for sex. The ΔCFI and ΔRMSEA values for sex groups were less than 0.02 (with no deterioration). This means that the PVD measures perceived infectability invariantly across both sexes of learners in South Africa.

Table 10: Goodness-of-fit statistics for tests of invariance for the PVD two-factor model across sex

	Model and constraints	χ^2	*df*	*CFI*	*SRMR*	*RMSEA*	*Model comparison*	*Δ*CFI*	*Δ*RMSEA*
	Sex								
1.	Configural	70.366	52	0.951	0.056	0.045			
2.	Metric	76.033	59	0.954	0.060	0.040	2 vs 1	0.003	0.005
3.	Scalar	84.325	66	0.951	0.057	0.040	3 vs 1	0.000	0.005

Note. $p < .001$; *df* = degrees of freedom; χ^2 = Chi-square test; CFI = Comparative Fit Index; RMSEA = root mean square error of approximation and its 90% confidence interval; SRMR = Standardized Root Mean-Square Residual; ΔCFI = Comparative Fit Index difference value; ΔRMSEA = root mean square error of approximation difference value.

4.3.7 *Reliability analyses*

Internal consistency, Omega, and Greatest Lower Bound of the two domains were acceptable (see Table 11).

Table 11

Reliability of the total scale and subscales

	α	Person separation	Item separation	ω	GLB	Items
PVD Total	0.585	0.62	0.99	0.59	0.70	9
PI	0.524	0.60	0.97	0.53	0.55	4
GA	0.591	0.00	0.98	0.60	0.65	5

Note: α = Cronbach's Alpha; ω = Omega; GLB = greatest lower bound

CHAPTER 5: DISCUSSION, CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

5.1 Introduction

The aim of this research was to examine the psychometric properties of the Perceived Vulnerability to Disease Scale in a sample of South African teenagers during the COVID-19 outbreak. While the results of this study were presented in chapter four, this chapter provides a discussion of the results and a comparison of the findings with existing literature on the scale.

5.2 Discussion

5.2.1. *The factor validity of the PVD in South African teenagers*

The PVD due to its ability to (a) assess a person's susceptibility to infectious disease transmission and (b) emotional distress of potential occurring of disease transmission, has been used in a wide range of recent studies (Ahmadzadeh et al., 2013). It seems its utility has always been favored over other tools for this reason. However, its factorial structure since its conception has been a source of debate (Diaz et al., 2015; Do Bu et al., 2023). One of the causes may be due to the use of different statistical techniques across studies, causing the contradiction in the factor structure findings within the literature for PVD (Do Bu et al., 2023; Ferreira et al., 2022). Our study used two different statistical analytic methods (CFA and Rasch analysis) which should overcome the restrictions found within the literature, as CFA allows for a formal statistical test of the factor structure of a model (Brown, 2015) while Rasch analysis can serve as a contrasting statistical approach (Allison et al., 2015). This study is the first to follow such a procedure – allowing for the cross-validation of results across different analytic methods. A potential limitation of CFA is the need for a sufficiently large sample size (Suhr, 2006). Similarly, the Rasch model requires a substantial number of observations or replications to accurately estimate the model's parameters (Ghaemi, 2011).

The results showed that the PVD had a two-factor structure (Perceived Infectibility [PI] and Germ Aversion [GA]) in South African teenagers. However, the bidimensional model was found with the exclusion of items 3, 5, 11, 12, 13, and 14 due to poor item loading or cross-loading. This bidimensional structure is consistent with those found by some research with older adults, clinical population, and university students (Ahmadzadeh et al., 2013; Chiesi et al., 2022; Diaz et al., 2016; Do Bu et al., 2023; Duncan et al., 2009; Ferreira et al., 2022; Karakulak et al., 2023; Moradi-motlagh et al. 2020; Stangier et al., 2021; Unal et al., 2023) as well as Schaller (2016)'s behavioral immune system theory on the perception of vulnerability to disease. However, while the abovementioned studies found bidimensional structures, their item loadings and compositions vary (Rokvic & Karan, 2022). For instance, the Ferreira et al. (2022) measure was made up of 10 items (i.e., Items 2, 6, 9, and 13 removed due to low loadings and item 5 showing inadequate complexity as well as cross-loading): Items 8, 12, 10, and 14 loaded on the PI factor whilst items 1, 3, 4, 7, 11, 15 loading on the GA factor. The difference in item loading on these items ranged from 0.52 to 0.75. However, Duncan et al. (2009) found all 15 items to be robust and viable (factor loading > 0.42 and no items cross-loaded).

This can be explained by cultural differences and sample population differences, which could also be the driving factor of the difference (Gjersing et al., 2010). For instance, Karakulak et al. (2023) highlighted that item interpretation due to different norms of behaviour existing within each culture and its associated practices affected the overall composition and item loading of a scale in different regions. Some researchers go to the extent of altering items making up the factors (e.g. from negatively worded to positively worded or exclusion) to accommodate the cultural understanding (and response style) of the targeted population (Ertan & Eker, 2000). Furthermore, the sample bias (i.e. the use of an incomparable sample) is also imperatively influential in the resulting item composition of a scale as well as a crucial factor between nations (Byrne, 2016). For instance, research shows the measure to perform well with participants from a similar cultural background (i.e., Canadians; Duncan et al., 2009), but poor psychometric results in incomparable samples, especially with regards to cultural practices (see Karakulak et al., 2023). These findings can be further understood through theoretical frameworks. The Behavioral Immune System framework suggests that individuals' responses are deeply influenced by their cultural background, meaning that the internal processes of those being studied significantly affect the outcomes measured by the instrument. Similarly, Attachment Theory posits that individuals possess innate drives, which are activated during times of distress (e.g., the COVID-19 pandemic), leading them to seek familiar behaviours for comfort, such as social connection. This could explain why certain items in the measurement tool are not well endorsed—they may conflict with individuals' internal systems or beliefs, leading to their exclusion.

The 6 items removed (3, 5, 11, 12, 13, & 14) in the current study were negatively worded. Negative wording tends to make items harder to comprehend, which in-turn prevents participants from fully comprehending their content and thus causing problems in their item-loading. This problem is prominent in culturally diverse populations and has been reflected in other validation studies (see Diaz et al., 2016; Ferreira et al., 2022; Karakulak et al., 2023; Moradi-motlagh et al., 2020; Rokvic & Karan, 2022). Research shows African participants to experience response problems when using instruments containing negatively worded items (see. Schmitt & Allik, 2005). This relates to negative item bias, in addition to this, the items are also contradictory to the expected behaviours that were encouraged during the COVID-19 outbreak such as social distancing, avoiding close contact, avoiding big groups, and staying at home (Kollamparambil & Oyenubi, 2021), which the presence and the manner of contagiousness of the disease would mostly within the participants illicit a believe that they would be more susceptible to the illness than not (Do Bu et al., 2023). Another possible explanation is that the problematic items, from a theoretical perspective, could show the variance in perception interconnected to the regularity of infectious diseases in varying locations (Duncan et al., 2009; Ferreira et al., 2022). The current study's validity results, specifically construct validity, do reflect the intended construct (Fitzner, 2007). However, this is achieved by reducing items from the original measure, which in turn may alter the comparability of results with those from other measurement tools.

5.2.2. *Gender invariance of the PVD in South African teenagers*

PVD research with teenagers is very limited. Teenagers go through a phase of evaluating their self-concept, which is related to their interpretation of the world (Palenzuela-Luis et al., 2022). The same applies to gender groups and they similarly vary in their perception of health (Verbrugge, 1985) – this may influence how different age and gender groups interpret items about aspects such as vulnerability to disease or personal vulnerability generally (Schneiderman et al., 2005). The findings of the current study show that the PVD provides a measurement of perceived infectability that is consistent across male and female learners in South Africa.

These results are consistent with existing literature (see Rokvic & Karan., 2021). Although other studies (see. Diaz et al., 2016) found different results amongst genders, such as females scoring high on the PI subscale due to them having a higher pathogen disgust sensitivity (Chiesi et al., 2022). Similarly, Ahmadzadeh et al. (2013) found female mean scores (M = 58/34) on perceived vulnerability to disease to be significantly different from that of their male counterparts (M = 54/88), however, the contrast was not statistically significant.

5.2.3. *The reliability of the PVD in South African teenagers*

The methods used to assess reliability in this study included Cronbach's Alpha, separation reliability, Omega, and the greatest lower bound. The PVD's reliability within the literature seems to be quiet a problem, as researchers seem to be struggling to get a stable reliability for the two subscales (Diaz et al., 2016). Duncan et al. (2009) when establishing the reliability for the first time found a satisfactory internal consistency (i.e., 0.82; with PI = 0.87 and GA = 0.74, respectively) for the PVD. However, subsequent studies have generally struggled to find satisfactory reliability results for the GA subscale. Similarly, the current study found poor internal consistency reliabilities for both subscales of the PVD. While this finding varies with studies (Duncan et al., 2009; Makhanova et al., 2015; Murray et al., 2013) that obtained good internal consistency for both factors it is however consistent with the majority of the research that reported poor reliability for the GA subscale (Miller & Maner, 2012; Prokop & Fančovičová, 2013; Wu & Chang, 2012). Although the reliability estimates of the PVD obtained in the present study are low compared to those acquired in studies from varying geographic contexts (Ahmadzadeh et al., 2013; Chiesi et al., 2022; Diaz et al., 2016; Duncan et al., 2009; Do Bu et al., 2023; Ferreira et al., 2022; Karakulak et al., 2023; Moradi-motlagh et al., 2020; Stangier et al., 2021; Unal et al., 2023), they are nonetheless considered adequate (Unal et al., 2023).

The identified potential limitations of the methods used in this study include the impact of the measure's length. A shorter length can affect invariance when using Cronbach's Alpha, especially if it is the sole measure. It may also lead to an underestimation of reliability or reduce sensitivity with separation reliability. Additionally, Omega may produce biased estimates, and the greatest lower bound (GLB) can overestimate reliability (Agbo, 2010; Boone, 2014; Malkewitz et al., 2023). There are multiple reasons why the reliability of a measure could be compromised (i.e., low) and one of them relates to the length of the measure (a factor applicable to the present study) because the longer the test the greater the reliability is (Rosaroso, 2015). The exclusion of items within our model resulted in a good factor structure, but low internal consistency, However, this is consistent with results reported in literature by Prokop and Fancovivova (2013), Wu and Chang (2012), Duncan and Schaller (2009), and Miller and Maner (2012). Similarly, the subscale responsible for a wide range of behaviour such as touching money and shaking hands is the GA subscale, henceforth the internal consistency may be affected by these very reasons (McCrae et al., 2011). The inadequate reliability reported for the GA subscale in the current study also conforms with the pre-and post-pandemic literature (Diaz et al., 2016; Miller & Manner, 2012; Prokop & Fancovicova, 2013; Wu & Chang, 2012) and it could also be explained by the heterogeneity of its questions/items.

The study found an unexpected result in that the reliability of the PI subscale was poor/low. This finding deviates from most studies on PVD (Ahmadzadeh et al., 2013; Duncan et al., 2009; Makhanova et al., 2015; Murray et al., 2013). In fact, according to current research knowledge, the present study is the only one to find such a result. However, this finding could be explained by the number of items making up the factor (i.e. 4 items within PI). It is generally regarded that five or more items in a factor are desirable and indicate a solid factor which in turn affects the reliability of the said factor (Costello & Osborne, 2019). Another reason could be that since humans are regarded to display inter-individual differences in their perceived risk of pathogen contamination (Park et al., 2003), the collectivist culture that South Africa falls within, the perception that others are exposed to the same risky situation one is exposed to tends to bring a sense of safety, therefore, encouraging a perceived less of a risk to harm (Keh & Sun, 2008). This is due to the prominence of values regarding social harmony as well as the obligations to connections to members within the ingroup especially the family and close friends. Additionally, this anomaly could be attributed to the nature of the subscale. Specifically, Perceived Infectibility (PI) is more closely linked to rational appraisals (Ferreira et al., 2022), reflecting an individual's belief in their likelihood of being infected by pathogens. This creates a direct correlation between perception levels of infectibility and the fear of infection—the higher the perception, the greater the fear (Troisi et al., 2023). Considering the interplay of factors such as viable items in the measure, culture difference, individual differences, and perception influences (e.g. environment), the unexpected PI result in our study becomes more understandable.

There have always been several advantages of living within large social groups (Shultz et al., 2011). The possibility of predation is greatly reduced, food security (food foraging & food protection) is improved and offspring care is far more simplified. However, the limitation of this is the increased rate of transmissible infections (McCallum et al., 2001). Therefore, these particular reasons may have a significant influence on the deviation of the PI reliability values from existing literature – which is further sustained by the fact that this study is the first (according to my knowledge) to investigate the PVD in Africa and with teenagers as participants.

5.2.4. *Construct validity of the PVD*

The construct validity of the PVD has generally studied with constructs such as personality (Salkovskis et al., 2002) and anxiety-related attributes (Alexandre et al., 2020) but there has not yet been one with Attachment dimensions. In our study, we investigated the PVD in relation to attachment dimensions (viz., Anxiety, Avoidance, and Security).

While the literature generally shows a strong correlation between anxiety and perceived infectability (Chiesi et al., 2022; Duncan et al., 2009), however, some researchers find it to weakly correlate with both PI and GA (Rokvic & Karan, 2022). Miller and Manner (2012) stated that when worried about communicable disease, individuals may exhibit an over-perception of the disease prejudice, this ability assists individuals to be able to avoid any threat to their health. According to our result, the Perceived infectibility scale of the PVD reflects a poor relationship with attachment Anxiety and Avoidance, however, this could be explained by the fact that adolescents, when it comes to diseases, are usually a population with a low perception of risk, this is attributed to their age compared to older ages (Yang et al., 2020). For instance, a significant positive relationship was observed between perceived infectability and coronavirus anxiety in adults, while moderate anxiety and the presence of a perception of vulnerability were observed in university students in past studies (e.g., De Pasquale et al., 2021; Fatima et al., 2023). This is indeed contrary to our study that found both Anxiety and Avoidance to not be associated with Perceived infectability in an adolescent sample – a phenomenon that may be explained through the Behavioral immune system of teenagers. Given the age and development during teenage years, the levels of health literacy are low and this has a significant impact on teenagers' attitudes and perceptions related to health (Brown et al., 2007).

A higher Behavioral Immune System reactivity results in both heightened pathogen sensitivity and potential contamination avoidance (Shook et al., 2020). Individuals tend to display their attachment behaviors when in strange or threatening situations - this is due to the attachment system maintenance of balance between proximity-seeking and exploratory behavior (Feeney, 2000). The internal working model of the self and others is said, at the core of attachment in early development, to be informed by met or unmet emotional and physical needs (Venta et al., 2014). How individuals regulate themselves (i.e. behavior and emotions) is greatly influenced by their attachment processes, hence important in their health behavior prediction (Pietromonaco et al., 2013). Although research connecting attachment functioning to particular health behaviors is sparse, the discoveries stipulate that attachment security predicts or affects the perception of risk of disease infection in adolescents (Cooper et al., 1998).

Therefore, given the information above, it would be expected that there would be a negative relationship between PI and attachment security as well as between GA and Attachment security, however, in our sample, the results were of a positive correlation in both instances. This phenomenon can be explained by the nature of the culture/cultural orientation of the sample as well as the age group of the sample. There is a positive correlation between attachment security and prosocial behavior (Eisenberg et al., 2019). African cultures are considered collectivist (Eaton & Louw, 2000). Similarly, when we look at the age and development of our sample, we notice a conflict between the cultural orientation and the individual orientation/exploration. Therefore, characteristics such as individuation from parents and risk-taking as well as connectedness and a sense of obligation to in-group membership seem to be in conflict. This could be the explaining factor why our results are a positive correlation between the two subscales with the attachment security scale. The environment or individuals that one is supposed to exercise (i.e. for the BIS to be active) their aversion and perception of risk for infectibility is the same environment that offers relief or comfort (i.e. attachment of security is active).

5.2 Recommendations

The present study revealed important implications for future research and various recommendations can be made. Firstly, this study corroborates past research studies suggesting that culture and the high proportion of women impact the generalizability of the study. Revising or establishing separate studies with a different sample among adolescents would hopefully contribute towards more clarification as well as timely identification of the factor structure and its influences, such as culture, given how culturally diverse non-Western regions are.

5.3 Limitations of the study

In the present study, PVD was validated on non-clinical teenagers, so the application of scale and the generalizing of the findings to other groups should be done with caution. A larger sample could have enhanced the precision and reliability of the Rasch model results. Furthermore, the limited age range of the participants and the provinces the participants were recruited from limits the generalizability of the psychometric data to the general or other populations. Again, given that this research was conducted during the COVID-19 outbreak, the application and interpretation of the scale's psychometric evidence should be applied with caution in non-COVID-19 contexts.

5.4 Conclusion

The study aimed to determine whether the PVD scale is a valid and reliable measure for use with South African teenagers. While the results are not fully generalizable for the whole population of South African teenagers, the findings indicated that the South African version of the scale of perceived vulnerability to disease (a 9-iitem form) possesses favourable psychometric properties for use with South African teenagers facing disease outbreaks.

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Appendices

Appendix A: Information sheet and consent form

Appendix 1a: Information letter

NELSON MANDELA UNIVERSITY   UNIVERSITY OF THE FREE STATE UNIVERSITEIT VAN DIE VRYSTAAT YUNIVESITHI YA FREISTATA UFS   UNIVERSITY OF LIMPOPO   University of Venda Creating Future Leaders

INFORMATION FOR PARTICIPANTS

PROJECT TITLE: **"Pre-University Students' Susceptibility and Psychological Reactions to the Spread of the SARS-CoV-2 and COVID-19 during the South African Emergency Lockdown."**

1. You are invited to participate in the following research project:

"Pre-University Students' Susceptibility and Psychological Reactions to the Spread of the SARS-CoV-2 and COVID-19 during the South African Emergency Lockdown."

2. Participation in the project is completely voluntary and you are free to withdraw from it at any time, without providing any reasons.

3. It is possible that you might not personally experience any advantages during the project, although the knowledge that may be accumulated through the project might prove advantageous to others.

4. You are encouraged to ask any questions that you might have in connection with this project at any stage. The researchers will gladly answer your question(s).

5. There are no known consequences of completing a questionnaire about COVID-19 and psychological reactions to it. However, some individuals may react apprehensively; being sensitive to completing a questionnaire about situations that were not particularly comfortable for them. If this happens, you will be referred for debriefing at **Life Line** at no cost to you.

[Note: Centre addresses will change according to study region].

6. Should you at any stage feel unhappy, uncomfortable, or concerned about the research, please **contact the researchers: Profs S Mashegoane and M Makhubela at the Department of Psychology; University of Limpopo, 015 268 3505 / 2317**

   [Note: Researchers details, including address, will change according to study region].

Appendix 2a: Parent consent form

CONSENT FORM (PARENT)

PROJECT TITLE: **"Pre-University Students' Susceptibility and Psychological Reactions to the Spread of the SARS-CoV-2 and COVID-19 during the South African Emergency Lockdown."**

I, ____ hereby consent to my child's participation in the following project:

"**Pre-University Students' Susceptibility and Psychological Reactions to the Spread of the SARS-CoV-2 and COVID-19 during the South African Emergency Lockdown.**"

I realise that:

1. The study deals with the evaluation of psychological reactions to the Novel Coronavirus (2019-nCoV) pandemic in South African school learners.

2. The research project, that is, the extent, aims, and methods of the research, has been explained to me.

3. The **Turfloop Research and Ethics Committee at the University of Limpopo** has approved that individuals may be approached to participate in the study.

4. The project sets out the risks that can be reasonably expected as well as possible discomfort for persons participating in the research, an explanation of the anticipated advantages for myself or others that are reasonably expected from the research, and alternative procedures that may be to my advantage.

5. I will be informed of any new information that may become available during the research that may influence my willingness to continue my participation.

6. Access to the records that pertain to my child's participation in the study will be restricted to persons directly involved in the research.

7. Any questions that my child may have regarding the research or related matters, will be answered by the researchers.

8. If I, or my child, have any questions about, or problems regarding the study, or experience any undesirable effects, I may contact the researchers (contact person: Prof S Mashegoane or Prof M Makhubela, at Tel.: 015 268 3505).

9. Participation in this research is voluntary and my child can withdraw their participation at any stage without any consequences.

10. The raw data will be securely stored at the Department of Psychology (UL) for a minimum period of 15 years for archiving and reuse. During this period the raw data might also be used for further research by other researchers.

11. I indemnify all the universities, namely, Nelson Mandela University, University of South Africa, University of Limpopo, and the University of Venda, and all persons involved with the above project, from any liability that may arise from my child's participation in the project, or that may be related to it, for whatever reasons, including negligence on the part of the mentioned persons.

____

SIGNATURE OF PARTICIPATING

LEARNER'S PARENT OR GUARDIAN

____

SIGNATURE OF THE PERSON THAT INFORMED

THE RESEARCHED PERSON

Signed at________________________ this ____ day of ____________ 2021.

Appendix 2b: Participant assent form

CONSENT/ASSENT FORM (LEARNER)

PROJECT TITLE: **“Pre-University Students’ Susceptibility and Psychological Reactions to the Spread of the SARS-CoV-2 and COVID-19 during the South African Emergency Lockdown.”**

I, ____ hereby voluntarily agree to participate in the following project:

“**Pre-University Students’ Susceptibility and Psychological Reactions to the Spread of the SARS-CoV-2 and COVID-19 during the South African Emergency Lockdown.**”

I realise that:

1. The research asks questions about Coronavirus (COVID-19).

2. The research wants to find out how learners feel about coronavirus and their views about it and the “lockdown”.

3. The Department of Basic Education in my area knows about the study.

4. The researchers are willing to answer any questions I may have about the research. If I wish to discontinue taking part in the study, I can do so any time I want.

5. I indemnify all the universities, namely, Nelson Mandela University, University of South Africa, University of Limpopo, and the University of Venda, and all persons involved with the above project, from any liability that may arise from my participation in the project, or that may be related to it, for whatever reasons, including negligence on the part of the mentioned persons.

____

SIGNATURE OF PARTICIPATING LEARNER

____

SIGNATURE OF THE PERSON THAT INFORMED

THE RESEARCHED LEARNER

Signed at_________________________ this ____ day of ___________ 2021.

Appendix B: Ethics clearance

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: **31 October 2022**

PROJECT NUMBER: **TREC/539/2022: PG**

PROJECT:

Title:	Psychometric properties of the Perceived Vulnerability of Diseases Scale in South African teenagers during the COVID-19 outbreak.
Researcher:	ST Dolo
Supervisor:	Prof. M. Makhubela
Co-supervisor/s:	N/A
School:	Social Sciences
Degree:	Master of Arts in Psychology

PROF D MAPOSA
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

- **i)** **This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.**
- **ii)** **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.**
- **iii)** **PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.**

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email:anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: **17 August 2021**

PROJECT NUMBER: **TREC/122/2021: IR**

PROJECT:

Title:	Pre-University Students' Susceptibility and Psychological Reactions to the Spread of the Sars-Cov-2 and Covid-19 during the South African Emergency Lockdown
Principal Investigator:	Prof S Mashegoane (UL)
Co-Investigator/s:	Prof M Makhubela (UL) Prof I Khumalo (UFS) Dr N Pule (UFS) Dr J August (NMU) Dr V Baloyi (UniVen)
Research:	Independent Research

PROF P MASOKO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE
The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

i) **This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.**

ii) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.**

iii) **PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.**

Finding solutions for Africa

Appendix C: Questionnaire

Section 1: Demographics

1. How old are you (in years)?: _______________years old.

2. Are you a girl or a boy?

Girl	Boy

3. In what type of living area do you live? Is it a rural or urban area?

Village/Rural area	Township/Urban area

4. What is your ethnic group? Are you "Black African', "Indian", "Coloured" or "White"? Or "Other"? May I point out to you that the labels are used for description only? If you do not want to respond to the item you can skip it.

Black	Indian	White	Coloured	Other

5. In what grade are you presently studying: ______ grade.

6. In what type of family do you come from? Do you have a single parent in your family, or are you living with a step-parent, are both your parents your biological parents and are they living together with you, are you living with your parents together with your relatives, or do you live together only as children in your family?

Single parent family	Step-parent (blended) family	Married parents	Extended) family	Child-led family

7. Please answer "**YES**" or "**NO**" to the following questions:

Item	YES	NO	Don't know	Refuses to answer
a. Do you sleep in your separate bedroom at home?	**YES**	**NO**	**88**	**99**
b. Do you have more than one television set at home?	**YES**	**NO**	**88**	**99**
c. Do you own a smartphone?	**YES**	**NO**	**88**	**99**
d. Do you have access to Wi-Fi at home?	**YES**	**NO**	**88**	**99**
e. Does your family own a car?	**YES**	**NO**	**88**	**99**
f. If you do own a car, is it more than one car?	**YES**	**NO**	**88**	**99**
g. Do you have reading books at home?	**YES**	**NO**	**88**	**99**
h. Does your family frequently eat out at a restaurant?	**YES**	**NO**	**88**	**99**
i. Do you frequently take holiday trips as a family?	**YES**	**NO**	**88**	**99**

j.	When shopping for clothes, do you choose your own clothes?	**YES**	**NO**	**88**	**99**
k.	Do you own a bicycle?	**YES**	**NO**	**88**	**99**
l.	Do you take private lessons for swimming, music, and the like?	**YES**	**NO**	**88**	**99**
m.	Do you have running water at home?	**YES**	**NO**	**88**	**99**
n.	Do you have electricity at home?	**YES**	**NO**	**88**	**99**

8. Do you have a very close friend or family member who has fallen ill because of Coronavirus?

No		Yes		DON'T KNOW		REFUSES TO ANSWER	

9. Do you have a very close friend or family member who has died from the COVID-19 disease?

No		Yes		DON'T KNOW		REFUSES TO ANSWER	

10. Do you have an underlying chronic illness, an illness you are expected to take medication for a long time, such as diabetes, asthma, and so on?

No		Yes		DON'T KNOW		REFUSES TO ANSWER	

11. If yes, please specify the illness: ____

Section 2: Perceived Vulnerability to Disease Scale

Instructions:

State whether you agree or disagree with the following statements. Select among the following response options: “Strongly disagree”, “Mildly disagree”, “Disagree”, “Neither agree nor disagree”, “Agree”, “Mildly agree”, and “Strongly agree”.

		Strongly disagree	*Mildly disagree*	*Disagree*	*Neither agree nor disagree*	*Agree*	*Mildly agree*	*Strongly agree*
1.	It really bothers me when people sneeze without covering their mouths.	1	2	3	4	5	6	7
2.	If an illness is ‘going around’, I will get it.	1	2	3	4	5	6	7
3.	I am comfortable sharing a water bottle with a friend.	1	2	3	4	5	6	7
4.	I do not like to write with a pencil someone else has obviously chewed on.	1	2	3	4	5	6	7
5.	My past experiences make me believe I am not likely to get sick even when my friends are sick.	1	2	3	4	5	6	7
6.	I have a history of susceptibility to infectious diseases.	1	2	3	4	5	6	7
7.	I prefer to wash my hands pretty soon after shaking someone’s hand.	1	2	3	4	5	6	7
8.	In general, I am very susceptible to colds, flu, and other infectious diseases.	1	2	3	4	5	6	7
9.	I dislike wearing used clothes because you do not know what the last person who wore it was like.	1	2	3	4	5	6	7
10.	I am more likely than the people around me to catch an infectious disease.	1	2	3	4	5	6	7
11.	My hands do not feel dirty after touching money.	1	2	3	4	5	6	7
12.	I am unlikely to catch a cold, flu, or other illness, even if it is ‘going around’.	1	2	3	4	5	6	7
13.	It does not make me anxious to be around sick people.	1	2	3	4	5	6	7

		Strongly disagree	Mildly disagree	Disagree	Neither agree nor disagree	Agree	Mildly agree	Strongly agree
14.	My immune system protects me from most illnesses that other people get.	1	2	3	4	5	6	7
15.	I avoid using public telephones because of the risk that I may catch something from the previous user.	1	2	3	4	5	6	7

Section 3: The Attachment in Middle Childhood Questionnaire (AMCQ)

Instructions:

The following questions are about how some kids feel about/relate to their mom/dad.
Indicate your agreement with the statements by selecting among the following response options: “strongly disagree”, “disagree”, “undecided”, “agree”, or “completely agree”.

		Strongly Disagree	Disagree	Undecided	Agree	Completely Agree
1.	Some kids are worried that their mom/dad might want to leave them BUT Other kids are sure that their mom/dad will never leave them.	1	2	3	4	5
2.	Some kids are worried that their mom/dad doesn’t really love them BUT Other kids are sure that their mom/dad really loves them.	1	2	3	4	5
3.	Some kids are worried that their mom/dad doesn’t love them as much as they love her/him BUT Other kids are sure that their mom/dad loves them as much as they love her/him	1	2	3	4	5
4.	Some kids, when they show their mom/dad that they love her/him, are afraid s/he doesn’t love them as just as much BUT Other kids, when they show their mom/dad that they love her/him, are sure s/he loves them as just as much	1	2	3	4	5
5.	When they don’t see their mom/dad, some kids worry she/he may stop thinking about them BUT When they don’t see their mom/dad, other kids know that s/he still thinks about them	1	2	3	4	5
6.	Some kids don’t like to tell their mom/dad how they feel deep down inside BUT Other kids like to tell their mom/dad how they feel deep down inside	1	2	3	4	5
7.	For some kids, it is easy to tell a lot about themselves to their mom/dad BUT Other kids find it hard to tell a lot about themselves to their mom/dad	1	2	3	4	5
8.	Some kids tell their mom/dad nearly everything BUT Other kids find it hard to tell their mom/dad nearly everything	1	2	3	4	5

		Strongly Disagree	Disagree	Undecided	Agree	Completely Agree
9.	Some kids usually talk to their mom/dad about their problems and worries BUT Other kids don't talk to their mom/dad about their problems and worries	1	2	3	4	5
10.	Some kids do not really like telling their mom/dad what they are thinking or feeling BUT Other kids do like telling their mom/dad what they are thinking or feeling	1	2	3	4	5
11.	Some kids find it easy to trust their mom/dad BUT Other kids are not sure if they can trust their mom/dad	1	2	3	4	5
12.	Some kids find it easy to count on their mom/dad for help BUT Other kids think it's hard to count on their mom/dad	1	2	3	4	5
13.	Some kids feel like their mom/dad really understands them BUT Other kids feel like their mom/dad does not really understand them	1	2	3	4	5
14.	Some kids think their mom/dad does not listen to them BUT Other kids do think that their mom/dad listens to them	1	2	3	4	5
15.	Some kids find it easy to rely on their mom/dad BUT Other kids find it hard to rely on their mom/dad	1	2	3	4	5

Appendix D: Plagiarism report

ORIGINALITY REPORT

14%	11%	11%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS