# An investigation of functional correlates and predictors of apathy in a Memory Clinic sample

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**COMPULSORY DECLARATION**

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited, and referenced.

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Table of Contents

**Abstract**

Apathy is a common neuropsychiatric symptom in neurological and psychiatric illnesses and is associated with adverse outcomes, significant caregiver burden, cognitive and functional impairment , and poor quality of life. Marin's (1991) definition of apathy as an amotivational disorder has gained widespread acceptance, despite recent contentions about this conceptualization. Marin's Apathy Evaluation Scale reflects his view on apathy as constituted by motivation related deficits. In this study I used Marin's Apathy Evaluation scale to assess apathy in a sample of patients (n = 200) presenting at the University of Cape Town/Groote Schuur Hospital's memory clinic with a query of subjective cognitive impairment . I then investigated the cognitive and functional correlates of apathy in this sample. Due to recent debates on the dimensions of apathy symptoms and the disorder's diagnostic features, I initially performed an exploratory factor analysis of the Apathy Evaluation Scale to determine its factors. I then examined associations between the resulting factors or dimensions of the AES and disease-related characteristics such as depressive symptoms (measured on the Cornell Scale for Depression), year-on cognitive impairment (measured on the Deterioration Cognitive Observee), and functional impairment (measured on the Bristol Activities Daily Living Scale). I found that depression and functional impairment were significant predictors of apathy. Behavioral, cognitive, and emotional subdomains of apathy predicted decline in basic and instrumental activities of daily living differently. Lastly, year-on cognitive impairment was not a predictor of apathy. Results from the exploratory factor analysis supported a three-factor model of the Apathy Evaluation Scale but it yielded a sub-domain of social apathy instead of emotional apathy. Previous factor analysis studies reported emotional apathy, together with behavioral and cognitive apathy as sub-domains of apathy. Results from this study have important implications for

understanding factors that influence patients' capacities for performing activities of daily living and meeting their functional needs.

Keywords: apathy, Apathy Evaluation Scale, cognitive impairment , depression, functional impairment

Apathy is a debilitating and prevalent state particularly in dementing illnesses. The morphology of the word apathy contains the prefix ‘a-’, meaning without and the Greek noun, ‘pathos’ which means emotion or passion therefore apathy was described as a state where an individual lacked emotion or passion. Greek philosophers considered an apathetic state to be desirable because states of extreme emotions could impair an individual’s rationality thus leading to irrational behaviors (Starkstein & Leentjens, 2008).

In the 19th century, a different understanding of apathy was introduced. At that time, apathy was understood as a state of being physically and psychologically non-reactive (Starkstein & Leentjens, 2008). Certainly, a shift in interpreting apathy as a desirable state had occurred. From the 19th century until the present time, apathy is considered a deviant state that is primarily characterized by a loss of motivation. Clinically, apathetic states were commonly described in psychiatric disorders such as depression and schizophrenia. A diagnosis of depression could be made in the absence of low mood provided that the individual exhibited loss of interest or anhedonia (American Psychiatric Association, 2000). In schizophrenia, apathy is recognized as a common behavioral consequence of the disorder and as part of the negative symptoms cluster (Kiang et al., 2003). Apathetic symptoms have since been described in many other disorders such as neurodegenerative conditions, stroke, and traumatic brain injury (Jorge et al., 2010; Theleritis et al, 2018; Worthington & Wood, 2018).

Growing interest in apathy developed due to an observation that apathy manifests across disease states and many clinical disorders. A need for a standard conceptualization of apathy also arose during this time. Recognizing the gap, Marin (1990) pioneered a conceptualization of apathy that informed much of our understanding of apathy today. Marin (1990) defined apathy primarily as a disorder of motivation and developed the Apathy Evaluation Scale as a standardized measure for evaluating it presence and severity. Marin’s

(1990) conceptualization of apathy has received criticism largely because one would have to rely on subjective inferences about an individual's affect or behavior in order to diagnose the disorder. Alternatives to Marin's (1990) conceptualization of apathy emphasize a quantifiable reduction in goal-directed behavior that is a result of a lack of motivation (Levy & Dubois, 2006; Stuss et al., 2000). Various apathy assessment measures have also emerged, but there is still no gold standard measure for apathy (Dickson & Husain, 2022). The Apathy Evaluation Scale however remains one of the most widely used measure of apathy in clinical and research settings.

Marin (1990) proposes cognitive, emotional, and behavioral dimensions to apathy but there is debate about the integrity of these dimensions. For instance, a social dimension of apathy has been included in some proposed apathy diagnostic criteria (e.g., Rea et al., 2018). Rea et al. (2018) diagnostic criteria were published as a collaborative effort of an expert panel (Rea et al., 2009) and were revised in 2018 but the criteria are yet to be included in standard classification systems such as the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; American Psychiatric Association, 2013). The omission of these diagnostic criteria in classification systems have contributed to contentions about what apathy is and what it is not.

Although there are some contentions about apathy, there is consensus that apathy is associated with disease-related characteristics such as depression, impairment in activities of daily living, and cognition (Fahed & Steffens, 2021). An area that has not been vastly explored in apathy research is about these predictors of apathy. This is an important area to investigate as it has implications for the treatment and management of apathy symptoms.

# Literature Review

## Concept of apathy

Currently, there is no solid definition of apathy. Some emphasize symptoms such as indifference or lack of motivation (Husain & Roiser, 2018). Motivation is a difficult concept to define. In the Oxford English dictionary, motivation refers to an individual's reason(s) for acting or behaving in a particular way. The Merriam-Webster Thesaurus has words such as encouragement, incentive, and motive listed as synonyms of motivation. In cognitive science and neuropsychology, motivation may refer to reward related goal directed activity and its emotional, cognitive, and behavioral subcomponents.

In earlier conceptualizations of apathy, Marin (1990) defined the disorder as a multi - dimensional syndrome characterized by a lack of motivation related cognition, behavior and affect that is unattributable to diminished levels of consciousness, intellectual deficits, or emotional distress which is out of keeping with one's norms. This definition is useful in that it differentiates apathy from everyday indifference or amotivation, as well as from other disorders in which goal directed behavior might be impaired (e.g., depression, akinesia). Recently a number of researchers have pointed out some shortfalls in Marin's definition of apathy.

For example, Stuss et al. (2000) argue that apathy cannot simply be reduced to a lack of motivation as the assessment of motivational states requires subjective inference based on observations of affect or behavior. Stuss et al. (2000) then define apathy as an absence of responsiveness to stimuli as demonstrated by a lack of self-initiated goal-directed actions. Stuss and colleagues' definition of apathy allows for an objective behavioral measure of apathy that is independent of psychological interpretations. Levy & Dubois (2006) echoed

Stuss et al. (2000) and suggested that apathy constitutes quantitative reductions of self-generated voluntary and purposeful behaviors (Levy & Dubois, 2006).

Stuss et al (2000) together with Levy & Dubois (2006) center reductions in observable and measurable goal-directed behavior in their descriptions of apathy. Worthington & Wood (2018) define goal-directed behavior as a set of related internal processes of motivation, emotion, cognition, as well as motor aspects of performance, that are translated through action into the attainment of a goal. Goal-directed behavior is characterized by choosing an action according to the outcome it produces in a specific situation (Zwosta et al., 2015). To do that, an individual needs to access stored mental representations of response-outcome relationships and effectively use this knowledge to select an action or response.

While centering goal-directed behavior in the definition of apathy arguably minimizes the subjective nature of observing motivation without measurement, complications such as teasing apart cognitive dysfunction from apathy arise. An individual may not be selecting responses due to an inability to access the stored mental representations of response-outcome relationships as opposed to failing to select an action or response due to a lack of motivation to do so. For example, an individual with a traumatic brain injury is entitled to both executive dysfunction and an apathetic syndrome. In such an individual, it would be challenging to tease apart cognitive dysfunction from goal-directed motivation (Calvillo & Irimia, 2020).

Sockeel et al. (2006) referred to apathy as a set of behavioral, cognitive, and emotional features that include reduced interest and participation in the main activities of life, a lack of creativity, early withdrawal from initiated activities, indifference and flattening of affect. This definition attempts to marry earlier conceptualizations of apathy that emphasize the significance of amotivation and those that stress deficits in observable purposeful actions.

Interestingly, change in the subjective motivational state is argued to be a dissociable component because some patients with the behavioral variant of Frontotemporal

dementia report intact motivation but engage in minimal productive activity while others report indifference or amotivation but still carry out tasks (Ducharme et al., 2018). While this argument is plausible, it relies on the individual's insight about their motivational states. The challenge with this is not only the subjective nature of self-report but the possibility that insight in individuals with apathy may be decreased due to dysfunction in the frontal structures of the brain thus rendering the reports of individuals less reliable. This is especially plausible in individuals with the behavioral variant of Frontotemporal dementia who characteristically also present with impaired insight (Ducharme et al., 2018).

**Dimensions of apathy**

Marin (1990) identified three dimensions of apathy, namely behavioral, cognitive, and emotional apathy. According to Chong (2020), behavioral apathy refers to a reduction in an individual's willingness to initiate or sustain voluntary, goal-directed physical activity, and/or activities of daily living. A reduction in spontaneous ideas or intellectual curiosity, as well as a lower interest in problem-solving, and a reduced willingness to engage in cognitively challenging activities captures the cognitive domain of apathy (Chong, 2020). Finally, emotional apathy is understood as a reduction in empathy, emotional intensity, emotional responsiveness, or spontaneous emotion. Emotional apathy is also referred to as emotional blunting of affective flattening (Chong, 2020).

On the Apathy Evaluation Scale (AES), items such as, 's/he gets things done during the day' and 's/he puts little effort into anything' cluster under the behavioral dimension of apathy. The cognitive dimension of apathy on the AES has items such as, 's/he is interested in things' and 's/he is interested in learning new things'. Finally, items such as 's/he approaches life with intensity' and 'when something good happens, s/he or he gets excited' capture the emotional dimension of apathy (Marin, 1990).

Following criticism from empiricist ideologies, the conceptualization of apathy as well as its dimensions were modified. For instance, Levy & Dubois' (2006) dimensions reflect emotional-affective processing, cognitive processing, and auto-activation processing. The auto-activation processing captures Marin's (1990) behavioral and cognitive domain in one dimension. Behavioral and cognitive dimensions of apathy are also grouped together in the revised diagnostic criteria for apathy as deficits in these dimensions were found to be associated both in clinical practice and studies (Rea et al., 2018).

Levy & Dubois (2006) explain the mechanisms of emotional-affective processing in apathy as the inability to: (1) associate emotion/affect with behavior, (2) accurately decode the affective context that guides behavior, and (3) evaluate the consequences of actions in terms of positive or negative outcome. With regards to cognitive processing, the mechanisms include impairment in the elaboration of plans of actions, i.e., rule-finding, set-shifting, maintenance of goals and sub-goals, as well as strategies to retrieve information (Levy & Dubois, 2006). Finally, the mechanisms of auto-activation processing involve difficulties in self-activating thought or behavior.

Despite Levy & Dubois' (2006) updated dimensions of apathy, Marin's (1990) dimensions of apathy, namely behavioral, cognitive, and emotional apathy are widely recognized (Johnson & Kumfor, 2018). A simple explanation for the persistence of the apathy dimensions identified by Marin (1990) is that the modifications made to the dimensions do not invalidate the dimensions but rather build on them to capture revised conceptualizations. As a result, the fundamental apathy dimensions identified by Marin (1990) are captured in contemporary conceptualizations (Dickson & Husain, 2022; Johnson & Kumfor, 2018).

Part of Fahed and Steffens' (2021) definition of apathy highlights dimished ability to aptly select between options that rely on weighing associated risks and benefits. This part of the definition reflects a more cognitive dimension of apathy. On the other hand, symptoms involving impaired ability to initiate action and learn from outcomes (Fahed & Steffens, 2021) capture both the behavioural dimension (i.e. initiating an action) and cogntive dimension (i.e. learning from outcomes) of apathy. Apathy is also often associated to deficits in executive and emotional functioning, and initiation. Executive functioning deficits include the lack of motivation to plan, organize, and sustain attention while deficits in emotional functioning include blunting and indifference. Deficits of initiation include the impaired generation of thoughts (Fahed & Steffens, 2021; Radakovic & Abrahams, 2014).

Social apathy is an emerging dimension which has been included in the recently revised diagnostic criteria for apathy (Robert et al., 2018). This dimension captures deficits in social interaction such as indifference to social or leisure activities suggested by others and decreased initiative to meet people. Deficits in spontaneous social initiative are differentiated from deficits in environmentally stimulated social interaction (Rea et al., 2018). Marin & Wilkosz (2005) did not necessarily suggest a separate dimension of social apathy, but their work highlighted the importance of evaluating patients' social and physical environments when assessing diminished motivation.

A social dimension of apathy is first hinted at by Sockeel et al. (2006) in their development of the Lille Apathy Rating Scale (LARS). The factor analysis of the LARS generated four factors, one being a reduction in social awareness and impaired behavioral adjustment to social life (Sockeel et al., 2006). The evidence which was considered prior to the inclusion of social apathy in the latest diagnostic criteria centers mostly around literature about prosocial behaviors (Ang et al., 2017; Dickson & Husain, 2022, Robert et al., 2018). Prosocial behavior refers to the willingness of an individual to perform acts that benefit

others. The willingness to perform such acts entails two essential components. The first component is about evaluating the costs and benefits of performing prosocial acts. Secondly, the ability to energize the actions so that change is affected is another component of one's willingness to engage in prosocial behavior (Lockwood et al., 2017).

Marin's (1991)

**Diagnosis of apathy**

According to Marin (1991), four criteria must be met for a diagnosis of apathy to be made. Firstly, there should be either a subjective account or observation of a lack of motivation relative to the patient's previous level of functioning or the standards of their age and culture. Secondly, there must be a presence of at least one symptom belonging to the three domains of apathy: namely, diminished goal-directed behaviour, diminished goal-directed cognition and diminished emotional concomitants of goal-directed behaviour. Thirdly, the symptoms should cause clinically significant distress or impairment in social, occupational or other important areas of functioning. Lastly, the symptoms must not be due to a diminished level of consciousness or the direct physiological effects of a substance, for example, a drug of abuse or medication.

Marin's diagnostic criteria of apathy were later adapted by Starkstein (2000). Starkstein added that the symptoms should be present for at least four weeks during most of the day. This duration criterion was not included in Marin's diagnostic criteria because apathy can occur abruptly, for example, following a stroke (Starkstein, 2000). In a bid to compile diagnostic criteria that would be widely accepted, a task force was set up to revise the adapted criteria for apathy (Robert et al., 2009).

The task force included, among others, members of the European Psychiatric Association as well as experts from Australia, Europe and North America. The revised diagnostic criteria follow a similar general structure to the criteria adapted by Starkstein

(2000). The major changes in the revised diagnostic criteria are seen in Criterion B or the second criterion which states that there must be a presence of at least one symptom belonging to the three domains of apathy. The revised Criterion B states that there must be a presence of at least one symptom in at least two out of the three domains of apathy for a period of four weeks and that the symptom must be present most of the time (Robert et al., 2009), in contrast to the presence of at least one symptom belonging to the three domains of apathy, as originally proposed by Marin (1991).

In addition, the revised criterion B states that for each domain of apathy, the loss of or diminished motivation must be witnessed in either spontaneous self-initiated actions or in environment-stimulated actions. The revised diagnostic criteria were later reviewed and an expert panel consisting of 23 researchers and health care professionals working on apathy and brain disorders updated it (Robert et al., 2018).

The major change in the updated diagnostic criteria is the addition of the social dimension of apathy. Apathy must be observed in either behavioural, cognitive, emotional or social interaction as stated in criterion A of this updated diagnostic criteria. The term ‘domains’ was replaced with ‘dimensions’ to accommodate the overlap between apathy and depression. Moreover, in criterion B, the behavioural and cognitive dimensions have been grouped as one dimension.

Furthermore, the symptoms that characterize each domain have been elaborated on and clustered under subheadings (Robert et al., 2018). For example, in the Behaviour & Cognition dimension, there are symptom subheadings such as general level of activity, personal wellbeing and making choices. Despite these efforts there is currently no gold standard for diagnosing apathy and there is no consensus on the definition of apathy itself.

**Differential diagnosis of apathy**

Apathy symptomatology overlaps with deficits seen in disorders of goal-directed behaviour, mood, and psychiatric disorders. Moreover, apathy exists on a continuum with other disorders and also as part of a cluster of similar symptoms. Apathy exists on a continuum of severity with disorders such as anhedonia and abulia. Anhedonia is defined as an inability to demonstrate interest and experience pleasure. This lack of interest and pleasure is particularly seen in previously rewarding activities (Robert & Manera, 2021).

One way to differentiate anhedonia from apathy is to determine whether the lack of interest presents itself to particular activities or across a range of activities. For example, if an individual stops hiking but is able to perform their activities of daily living, that individual's presentation is more consistent with anhedonia. A potential complication arises based on what the previously enjoyed activity is. If the individual previously enjoyed meeting friends and family, it becomes difficult to tease apart anhedonia from apathy because that individual's presentation is also consistent with an emotional domain of apathy.

A lack of desire to pursue a reward or derive pleasure from a reward is common in both apathy and anhedonia but emotional blunting or indifference is specific to apathy (Fahed & Steffens, 2021). An individual with anhedonia may still consider social interactions and relationships to be important despite a lack of drive to pursue them whereas an apathetic individual loses the ability to appreciate and value social relationships altogether (Fahed & Steffens, 2021).

It is equally challenging to tease apart apathy from abulia. Abulia is defined as a lack of will or motivation. It is also understood as an inability to decide (Marin, 1990). Contemporary definitions of abulia emphasize a difficulty initiating and sustaining spontaneous movements along with reductions in social interactions and responses, as well as spontaneous speech (Robert & Manera, 2021). According to Marin (1990), clinically, the

term abulia was reserved for patients who were awake but severely impaired in their ability to initiate and maintain goal-directed behaviour and communicate.

Recently, psychiatrists and neurologists reported using the words apathy and abulia interchangeably (Robert & Manera, 2021) which deprives the nuance of the two states as being on a continuum of motivational and emotional deficits (Marin, 1990). A useful way to differentiate apathy from abulia is that verbal prompting will assist an individual with abulia in initiating goal-directed behaviour whereas a person with apathy may not benefit from this prompting (Robert & Manera, 2021).

Akinesia is a motor disorder unlike apathy and similar disorders of motivation. It is characterized by an inability or reduction in the initiation of movement. The lack of movement displayed in akinesia is not explained by primary motor deficits such as paralysis (Marin, 1990). Apathy co-occurs with akinesia in clinical practice. While movement is necessary in performing goal-directed behaviours, it is not an essential component of all goal-directed behaviour. For example, being emotionally responsive requires little to no movement.

Depression is a disorder of mood which may resemble apathy. Similar to apathy, depression exists as both a symptom and a syndrome. The depressive syndrome which is known as major depressive disorder is a mood disorder. It has a distinct set of diagnostic criteria with core symptoms of depressed mood and loss of interest which must occur during the same two-week period. The symptoms must be a change from previous functioning. There is an overlap between apathy and depressive symptoms. Symptoms common to apathy and depression include diminished interest, fatigue/hypersomnia, lack of insight and psychomotor retardation (Ishii et al., 2009; Jackson & Robinson, 2022; Mortby et al., 2011). However, symptoms such as dysphoria, hopelessness, feelings of guilt, pessimism, self-criticism and suicide ideation are unique to depression (Robert & Manera, 2021).

Chronic fatigue syndrome, also known as myalgic encephalomyelitis, may mimic apathy. It is a disorder that persists for over 6 months. Chronic fatigue syndrome is characterized by unexplained disabling and persistent fatigue, cognitive difficulties, exercise intolerance, joint pain, and unrefreshing sleep (Robert & Manera, 2021; Stussman et al., 2020). Post-exertional malaise refers to the worsening of symptoms seen in chronic fatigue syndrome following minimal mental or physical activity (Stussman et al., 2020). Post-exertional malaise is a central feature of chronic fatigue syndrome as physical or mental activities would not have the same effect on an individual in the absence of the syndrome.

The negative syndrome is common in schizophrenia and apathy is considered a key criterion of this syndrome (Starkstein & Leentjens, 2008). Symptoms included in the negative syndrome include affective blunting, alogia, anhedonia, asociality, and physical anergia. Interestingly, some of these symptoms such as alogia, which is a poverty of speech, and affective blunting are described as symptoms of apathy (Starkstein & Leentjens, 2008). This imitates that apathy is the negative syndrome and that all the other symptoms are a manifestation of different domains of apathy. On the other hand, the negative syndrome of schizophrenia is considered to be far more complex than apathy therefore the negative syndrome described in schizophrenia is not synonymous with the apathetic syndrome as described by Marin (1990).

Contemporary literature suggests that negative symptoms have five key constructs. These constructs are alogia, anhedonia, asociality, avolition, and blunted affect. These constructs can be categorized into two factors namely diminished expression and avolition/apathy (Correll & Schooler, 2020). Alogia and blunted affect are captured under diminished expression and anhedonia, asociality, as well as avolition cluster under avolition/apathy.

**Apathy in formal diagnostic and classification systems**

The absence of a concrete definition of apathy in psychiatric classification systems such as The *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5; American Psychiatric Association, 2013) and *The International Classification of Diseases* (ICD) -10 (World Health Organization, 1993) contributes to the conceptual difficulties in this area. Currently, the DSM-V does not include operationalized apathy criteria (Ducharme et al., 2018). The DSM-V defines apathy as subjective changes in motivation and reduced observable behaviour (American Psychiatric Association, 2013). Further, apathy is listed as a behavioural disturbance in mild/major neurocognitive disorders, as a form of personality change due to another medical condition, and as a symptom of Frontotemporal neurocognitive disorder (Ducharme et al., 2018). To date, apathy is not classified as a stand alone disorder like depression.

Recently there has been efforts to reach consensus on the conceptualization and diagnostic criteria of apathy (Robert et al, 2018), but the DSM-V is yet to include these criteria. This may also be due to the fact that it takes a substantial number of years for the DSM to be revised. For example, the work to publish the DSM-III began in 1974 and it was published in 1980. The DSM-IV was published in 1994 which is 14 years later from when the DSM-III was published and that also was an effort of 6 years. There is a 19 year gap between the publishment of the DSM-IV and DSM-V (Association Psychiatric Association, 2022). Judging based on this trend, it will take a considerable amount of time for apathy diagnostic criteria to be included in the DSM.

Another challenge impacting publishment of apathy diagnostic criteria in the aforementioned classification systems could be the gap between clinical practice and research. Often, a phenomenon such as apathy is observed, described and managed in clinical settings long before any research on the phenomenon can be produced. While research

emerges, the evidence produced from research is vetted for an extensive period of time and only when there are irrefutable claims about the phenomenon being described can the work of including such phenomena in classification systems begin.

The publishment of apathy diagnostic criteria in research has also followed a similar pattern. Marin proposed apathy diagnostic criteria in 1990. Starkstein revised and published those diagnostic criteria in 2000. The diagnostic criteria were revised again by Rea et al. in 2009 and finally in 2018. There is a considerable amount of years between the revisions.

**The assessment of apathy**

The Apathy Evaluation Scale (AES) (Marin et al., 1991) is one of the most commonly used apathy instrument in both research and clinical settings (Clarke et al., 2014; Dickson & Husain, 2022; Sockeel et al., 2006) and it follows Marin's conceptualisation of apathy as constituting a syndrome marked by a lack of motivation. It is an 18-item scale which assesses apathy symptoms over the past four weeks in the behavioural, cognitive, and emotional sub-domains. The AES has three versions, namely the clinician, informant, and self-report versions.

Despite modifications to Marin's (1990) conceptualization of apathy, the AES remains one of the most commonly used scales for several reasons. The first reason is that the AES is psychometrically robust. Another reason is that the AES can be used across various disease populations. Lastly, the AES has been translated into several languages (Lee et al., 2020). Several assessment scales have been derived from the AES. For example, the Apathy Scale is a 14-item, interviewer administered scale which also assesses apathy symptoms over the past four weeks. It has six items in common with the AES and mainly measures behavioural and cognitive apathy. The Apathy Inventory is a much briefer scale with only three items which is typically rated by a caregiver or informant (Robert, et al., 2002). The Apathy Inventory contains one item to assess each apathy subdomain.

Another assessment scale derived from the AES is the Lille Apathy Rating Scale (LARS). The LARS is more extensive than the AES as it assesses nine domains of apathy using 33 items. It can be administered by a clinician who uses the patient's self-report rating on the items or by an informant. The Dimensional Apathy Scale (DAS) is based on Levy & Dubois' (2006) conceptualization of apathy and was designed by Radakovic and Abrahams (2014). It consists of 24 items which cover behavioural/cognitive initiation, emotional, and executive symptoms of apathy. The DAS measures separate sub-domains of apathy in neurodegenerative diseases (Radakovic & Abrahams, 2018). Apathy assessment scales that are not influenced by prominent conceptualizations, e.g. Marin (1990) and Levy & Dubois (2006), include the Apathy Motivation Index. It is a self-report questionnaire with 18 items that assess apathy in the sub-domains of behavioural activation, emotional sensitivity, and social motivation (Ang et al., 2017). It is also one of the assessment scales that captures a social sub-domain of apathy.

A commonly cited criticism of some of the apathy assessment scales is that the questionnaires are based on subjective interpretations of the informant or caregiver (Levy, 2009). While this is a valid argument, I think it is worth balancing that argument with the idea that informants or caregivers are in arguably the best position to give insight to patients' states because the informants and caregivers observe the patients in their home or care environments over an extended period of time. Having an informant or caregiver version of a questionnaire also circumvents the potential lack of sight or anosognosia that some patients are likely to present with.

Anosognosia is a neurological condition where a patient is unaware of their neurological deficit or psychiatric condition (de Ruijter et al., 2020). Further, in research settings, the clinician does not have the ability to observe each patient or participant over a substantial period of time, as would be the case in a clinical ward, for example, therefore

while an informant or caregiver version of a questionnaire might be susceptible to bias, it is a superior alternative to using the patient or participant's own account.

**Factor Structure of the Apathy Evaluation Scale**

Marin et al. (1991) conducted a factor analysis of the AES which revealed three similar factors across the different versions of the AES and these factors were consistent with the subtypes of apathy identified by Marin (1990). Following this, there have been inconsistent findings on the factor structure of the AES. For example, in one study the researchers re-examined the factor structure of the AES in patients with dementia and identified two factors, namely apathy and interest in the clinician and informant versions of the AES (Clarke et al., 2007). Another study that investigated the factor structure of the clinician version of the AES in patients with first episode psychosis found up to five factors from which a three- and two-factor model were derived (Faerden et al., 2008). The study reported that the three-factor model was clinically meaningful. The three factors were apathy, insight and social contacts (Faerden et al., 2008).

These factors were not consistent with the dimensions of apathy identified by Marin (1990), but they include the social dimension of apathy which was recently added to the latest updated diagnostic criteria (Robert et al., 2018). A different study investigated the clinician and self-report versions of the AES. The findings of that study were compared to results from another study which investigated first-episode psychosis in a sample of young patients. Both studies found that the AES is predominantly a scale with a single factor (Sagen et al., 2010).

The inconsistent findings on the factor structure of the AES may be explained by the use of homogenous patient groups in studies. Each disease or disorder tends to characterise a specific dimension of apathy. For example, patients whose apathy is a symptom of depression may show greater affective or emotional apathy as depression is a disorder of mood. On the other hand, hemiparesis or hemiparalysis in apathetic patients with stroke may

influence the patients to demonstrate greater behavioural apathy and Alzheimer's disease patients with apathy may have an inclination to display cognitive apathy due to the progressive decline in mental functions observed in Alzheimer's disease (Nestor et al., 2004). In Frontotemporal dementia, all the suggested dimensions of apathy, i.e., affective, behavioural, and cognitive, may find expression in patients as the frontal and temporal lobes are implicated in the neuropsychology of cognition, behaviour, and affective states (Malpetti et al., 2021).

Recently, the evidence for the triadic structure of the AES as reported by Marin et al. (1991) has been disputed (Dickson & Husain, 2022). The factor analysis conducted by Marin et al. (1991) produced a single factor of the AES which can be thought of as general apathy. Based on this, the authors argue that there is insufficient evidence to support the three dimensions identified by Marin et al. (1991).

Further, the authors particularly found that the evidence for a separate dimension of cognitive or executive apathy is less robust as compared to evidence for behavioural and emotional dimensions of apathy (Dickson & Husain, 2022). This view is supported by the most recent revision of apathy diagnostic criteria where the dimensions of behaviour and cognition in apathy have been clustered as one dimension due to an overlap between the two dimensions (Rea et al., 2018).

One may argue that the view above appears contradictory. If the conclusion that the AES does not have a three-factor structure mainly because its factor analysis produced a predominantly single factor (Dickson & Husain, 2022), then it becomes inconsistent for the authors to later acknowledge that there is evidence for behavioural and emotional dimensions of apathy. This acknowledgement implies that more than one dimension of the AES exists. A more accurate argument by the authors is that there is varying evidence for the three dimensions of apathy identified in earlier works (Dickson & Husain, 2022).

**Neurobiological Substrates of Apathy**

The neurological substrates of apathy involve diverse brain regions including frontal and subcortical structures such as the basal ganglia as well as the circuitry between these brain regions (Fahed & Steffens, 2021; Levy, 2012; Mortby et al., 2012; Rea et al., 2014). Apathetic states are associated with focal lesions of the frontal lobes and lesions of the basal ganglia (Levy, 2012). For example, apathy has been described in frontal tumors (Snyder et al., 2006) and basal ganglia strokes are reported to consistently produce apathy (Costello et al., 2023) . Specifically, damage to the Anterior Cingulate Cortex (ACC) which forms part of the medial frontal cortex can precipitate a severe form of apathy known as akinetic mutism (Costello et al., 2023). Further, disruption in subcortical structures such as the medial thalamus, ventral striatum, and ventral tegmental area has also been linked to apathy. In their review, Fahed & Steffens (2021) reported that damage to the dorsal ACC and ventral striatum consistently results in apathy.

Similar neurological substrates are involved in effort-based decision-making which goal-directed behaviour is dependent on. Effort-based decision-making involves option generation, option selection, cost-benefit decision making, reward anticipation, and reward learning (Costello et al., 2023). The prefrontal cortex is involved in option generation and option selection. In additon to the prefrontal cortex, the ventral striatum and ventral tegmental area are involved in deciding what the value of a reward is, while the anterior cingulate cortex and anterior insula are involved in evaluating the effort to carry out a task. An overlap in neuroanatomical areas is observed in effort-based decision-making as the ventral striatum and insula have also been identified to contribute to the anticipation of a reward. Reward delivery is subserved by the anterior cingulate cortex. Finally, dopaminergic neurons in the substantia nigra and ventral tegmental play a key role in reward learning (Costello et al., 2023).

**Clinical significance of apathy**

The significance of apathy is demonstrated through its high prevalence rates across neurological and psychiatric illness as well as its association with various disease-related characteristics such as cognitive impairment, functional impairment and caregiver burden. Prevalence rates of apathy vary across illnesses; apathy is reported in 61.4% of the traumatic brain injury population and in 34.7% of individuals following a cerebrovascular accident (Lane-Brown & Tate, 2009). Apathy affects 50% to 70% of people with dementia (Baber et al., 2021).

Specifically, in the behavioural variant of Frontotemporal dementia, up to 90% of individuals experience apathy across the disease course (Johnson & Kumfor, 2018). Apathy is reported in approximately 25% to 90% of patients with Alzheimer's disease and in approximately 20% to 70% in patients with Parkinson's disease (Cummings et al., 2015). Several factors can account for the significant variation in apathy prevalence rates in, but not exclusive to, Alzheimer's and Parkinson's disease. These factors include the apathy instrument used, duration of the disease, stage of the disease process, the individual's level of education, as well as their mental status (Nobis & Husain, 2018).

For example, a brief instrument such as the Apathy Inventory, which only has three apathy items may not detect apathy symptoms in individuals whose presentation is subtle or mild whereas an instrument which covers a range of apathy symptoms may be able to better detect these symptoms. Similarly, if an individual with a high level of education presents with cognitive apathy, their presentation may differ from an individual with a lower level of education due to cognitive reserve.

Regarding cognitive impairment and decline, apathy predicts the onset of dementia in patients with mild cognitive impairment (Chilovi et al., 2009; Palmer et al., 2010). After controlling for factors such as age, congitive and functional status at baseline, Chilovi et al.

(2009) found that apathy still predicted the onset of dementia in patients with mild cognitive impairment. Similarly, Ruthirakuhan et al. (2019) found that patients with mild congitive impairment with apathy were at a greater risk of developing Alzheimer's disease compared to patients with mild cognitive impairment who did not present with any neuropsychiatric symptoms. Further, Malpetti et al. (2021) reported that baseline apathy predicted cognitive impairment over a 2-year period in inidviduals with presymptomatic genetic Fronto-temporal dementia.

The above findings are difficult to dispute in light of the available conceptualizations of apathy. Whether we think about apathy as a lack of motivation or a measurable reduction in goal-directed behaviour, performance on cognitive tests, even the most basic tests, require a willingness from individuals to firstly engage and some level of cognitive effort to be exerted therefore it is reasonable to argue that apathy negatively affects cognition. In addition, it is not surprising, for the same reason mentioned above, that apathy in otherwise healthy individuals is linked to a risk of developing dementia in the later stages of life (Altieri et al., 2023).

Specific domains of cognitive function are reported to be associated with apathy. These domains include executive functioning (Andersson & Bergedalen, 2002; Kawagoe et al., 2017), long-term verbal memory (Chiaravalloti et al., 2003) and working memory (Montoya-Murillo et al., 2019). Evidence from studies has demonstrated that apathy is associated with lower Mini Mental Status Examination (MMSE) scores (den Brok et al., 2015; Montoya-Murillo et al., 2019). Executive functioning, long-term verbal memory, and working memory are congitive domains mediated by the frontal lobes therefore it is expected that these domains are affected by apathy given that apathy is associated with disruption in frontal and subcortical structures (Fahed & Steffens, 2021).

Apathy is associated with impairment in both basic and instrumental activities of daily living. The skills required to perform basic physical needs such as feeding, mobility and personal hygience constitute basic activities of daily living whereas complex adaptive behaviours, requiring higher congitive functions, such as housekeeping and mananging finances and medication constitute instrumental activities of daily living (Boyle et al., 2003; Kamat et al., 2012; Green et al., 2021).

For example, Lechowski et al. (2009) found that Alzheimer's disease patients who were both apathetic at initial testing and one-year follow up demonstrated a more rapid decline in instrumental activities of daily living compared to Alzhimer's disease patients without persistent apathy. Apathy has been found to be a significant predictor of functional impairment  when cognitive impairment is added to the predictor model (Norton et al., 2001). This suggests that the association between apathy and functional impairment  cannot be explained by an overlap between apathy and cognitive impairment .

Importantly, Criterion C in the revised diagnostic criteria for the apathy disorder is that apathy symptoms have to cause clinically significant distress or impairment in social, occupational or other important areas of functioning (Robert et al., 2018). Considering that engagement in activities of daily living are a prerequisite of social and occupational functioning, for example, an individual needs to practice personal hygience before they can leave their homes and interact with others, it is not unreasonable to suggest that Criterion C necessitates impairment in activities of daily living before the apathy disorder can be diagnosed as such. This leaves little doubt about the association between apathy and functional impairment.

Finally, apathy is associated with caregiver burden which is defined by Etters et al. (2008) as the psychological and physical strain of providing care to family members with chronic illnesses. Without support and resources, caregivers experience greater psychosocial,

physical and financial stressors (Bastawrous, 2013). Consequently, patients' likelihood of being institutionalized is increased when there is significant cargeiver burden (Miller et al., 2011; Fahed & Steffens, 2021).

Apathy is also observed in the general population (Brodaty et al., 2010; Pardini et al., 2016). In healthy populations, people may experience fluctuating states of apathy where they are not motivated or interested in usual activities or interests (Radakovic & Abrahams, 2014). A longitudinal study reported apathy over a period of 5 years in normal ageing and revealed that apathy levels increased over time (Brodaty et al., 2010).

Similarly, Pardini et al. (2016) conducted a study aimed at investigating isolated apathy in non-depressed young healthy adults aged 19 -40 years. The results of the study showed that 1.45% of participants presented with significant apathy levels. Further, the apathetic participants demonstrated lower behavioural activation compared to controls and a significant correlation between apathy and perceived quality of life was observed (Pardini et al., 2016). In light of the fact that apathy is commonly observed in older adults i.e. 40 years and above, with or without cognitive impairment (Fahed & Steffens, 2021), it is reasonable to expect low prevalence rates in younger healthy individuals.

Apathy in healthy or non-clinical populations who are both young and old requires attention and intervention due to serious associated consequences of apathy which interfere with educational and vocational opportunities (Altieri et al., 2023). The most pressing concern for the otherwise healthy population who are apathetic is the reported increased risk of developing dementia in the later stages of life (Altieri et al., 2023).

## Correlates of Apathy

Research suggests that demographic variables like age, gender, and marital status associate with neuropsychiatric symptoms and their outcomes in dementing illnesses (Meyer et al., 2015). Below I discuss these variables.

### *Ageing, gender, and apathy*

There is a growing body of evidence that age and gender are associated with apathy in dementia illnesses and depression (Apostolova et al., 2007; Groeneweg-Koolhoven et al., 2017; Meyer et al., 2015). The general finding is that apathy is associated with old age but regarding gender (especially in Parkinson's disease) some studies have found that males are more affected by apathy than females (Pedersen et al., 2010; Ready et al, 2004;). However other studies on patients with Parkinson's disease have found opposite results (Martinez-Martin et al., 2012).

### *Apathy and depression*

Due to the symptomatic overlap between apathy and depression, there is often a tendency to think of the two as one. For instance, apathy was traditionally considered a symptom of depression, especially the apathy dimensions involving lack of emotion and interest. Over the years, apathy has increasingly being recognized as a distinct syndrome characterized by an absence of motivation across several domains (Levy et al., 1998). According to Tagariello et al. (2009), while apathy is commonly associated with depression, nearly half of patients with Alzheimer's disease who are apathetic do not present with concomittant depression. This supports the idea that apathy can be a distinct neuropsychatric syndrome, separate from depression (Tagariello et al., 2009).

An early study found that apathy did not correlate with depression in a sample of 30 Alzheimer's disease, 28 Frontotemporal dementia, 40 Parkinson's disease, 34 Huntington's disease and 22 progressive supranuclear palsy patients using The Neuropsychiatric Inventory

(Levy et al., 1998). Additionally, there were non-significant correlations between apathy and depression in the distinct dementia groups. Importantly, the results showed that the presence of apathy did not predict the presence of depression (Levy et al., 1998). However, the Neuropsychiatric Inventory measures both apathy and depression therefore it is limited in adequately differentiating the the two. Similarly, a study examined the course and predicting factors of apathy in older persons with depression (n = 266) found that the severity of depressive symptoms did not predict the onsent or permanence of apathy at 2-year follow-up (Groeneweg-Koolhoven et al, 2016).

Specifically, affective apathy symptoms did not significantly predict depressive symptoms in patients with various acquired brain injuries (Njomboro & Deb, 2014). These results can be explained by the distinct symptoms experienced in individuals with apathy and those with depression. While an apathetic individual may be indifferent, they do not typically present with negative emotions such as guilt and hopelesness which are specific to depression.

However, some studies have found that higher apathy scores are associated with more severe depressive symptoms (Marin et al., 1993; Lampe & Heeren, 2004). One can argue that this is the case due to the overlap in apathy and depression symptomatology. For example, if the individual scores high on a shared symptom such as decreased initiative on apathy and depression assessment scales, the scores increase and because severity of depression is determined by cut-off scores such that the higher the score, the more severe the depression, it can be argued that high scores on shared symptoms of apathy and depression will increase the individual's severity of depression.

### *Apathy and functional impairment*

There is growing understanding of the relationship between apathy and impairments in carrying out activities of daily activities (ADLs). For instance, in Alzheimer's disease it is thought that the combination of memory deficits, executive dysfunction and apathy likely lead to deficits in fulfilling instrumental activities of daily living (IADLs) (Marshall et al., 2019; Martyr & Clare, 2012).

While it is likely that cognitive impairment in Alzheimer's disease mediates functional impairment, results from another study suggest otherwise. The results of the study suggest that apathy is associated with activities of daily living in individuals with very mild or mild Alzheimer's disease (Saari et al., 2020). In Saari et al. (2020)'s study, the individuals are described as cognitively less impaired which gives the impression that cognitive impairment has little to do with the relationship between apathy and activities of daily living in Alzheimer's disease. However, the study does not report on how cognitive capacity was measured therefore it is uncertain if and how cognitive capacity was established.

A review of the literature of the relationship between apathy and functional impairment by van Reekum and collegues (2005) yielded 4 studies which employed either the Apathy Evaluation scale or Apathy scale. The first study was aimed at examining the usefulness and clinical correlates of diagnostic criteria for apathy in a sample of 319 patients with probable Alzheimer's disease, 117 patients with depression without dementia, and 36 healthy individuals. Regarding the association between apathy and functional impairment , the results of the study indicated that apathetic Alzheimer's disease patients with or without depression had significantly more severe impairments in their activities of daily living compared to Alzheimer's disease patients with neither apathy nor depression (Starkstein et al., 2001). The second study examined correlations between the presence of apathy and family complaints with neuropsychiatric symptoms such as withdrawal, loss motivation, or depression. Using a

sample of 58 non-demented elderly people, 132 outpatients with dementia of the Alzheimer's type as well as main caregivers, correlations between various assessment scales in the early dementia group indicated a weak negative relationship between the AES and Iso Resources Group (IRG) scale which is an independence scale that measures both basic and instrumental activities of daily living (Thomas et al., 2001). This is an unexpected result because a moderate to strong negative relationship between apathy and impairment in activities of daily living is warranted, especially when considering that functional impairment is a criterion in the diagnostic criteria for apathy (Robert et al., 2018). However, the finding could be explained by apathy severity in the population that was tested and the type of measurement tool used to assess apathy. Thirdly, in a study to examine the frequency and correlates of apathy following cerebrovascular lesions in a sample of 80 patients, correlational analyses indicated that apathy was significantly associated with deficits in activities of daily living (Starkstein et al., 1993).

Finally, a study which aimed to determine whether the AES (clinician version) or motivation was a predictor of patients' independence following participation in a rehabilitation program in a sample of 102 geriatric patients found that apathy was a significant predictor of the patients' level of functioning at discharge (Resnick et al., 1998). This is due to the fact that apathy may affect the rehabilitation process as patients are neither willing nor motivated to participate in the interventions offered.

There is a paucity of recent studies investigating the association between apathy and functional impairment. Functional impairment is recognized in the literature as an associated outcome of apathy (Johnson & Kumfor, 2018; Fahed & Steffens, 2021) but it is hardly investigated as a primary outcome of apathy. Moreover, studies do not typically differentiate between basic and instrumental activities of daily living when investigating the effects of apathy on an individual's functional capabilities.

### *Apathy and cognitive impairment*

Some studies have found that apathy is associated with cognitive deterioration (McPherson et al., 2002; Montoya-Murillo et al., 2019) as well as low scores on the Mini-Mental State Examination (Clarke et al., 2010; Onyike et al., 2007). A longitudinal study of people with Parkinson's disease found that there is a higher conversion rate from Mild Cognitive Impairment (MCI) to Parkinson's Disease Dementia (PDD) in persons with apathy compared to those with Parkinson's disease without apathy (Martin et al., 2020). Similarly, research suggests that apathy is associated with the severity of executive dysfunction in people with symptomatic Frontotemporal dementia, with primary deficits in working memory, cognitive flexibility and inhibition, among others (Malpetti et al., 2021). In parallel to these findings, another study examined the association between the interaction of apathy and depressive symptoms on executive functioning in Alzheimer's disease and arrived at similar conclusions (Nakaaki et al., 2008). The results of the study indicated that patients with Alzheimer's disease who exhibited both apathy and depressive symptoms had greater deficits in executive functioning compared to patients with Alzheimer's disease who exhibited either apathy or depressive symptoms alone (Nakaaki et al., 2008). Finally, in patients with Parkinson's disease without depression and dementia, apathy has been found to predict cognitive impairment  over time (den Brok et al., 2015). Consequently, patients with apathy need more support and management and this results in a greater caregiver burden or early institutionalisation (Landes et al., 2001).

In summary, there is compelling evidence that apathy is associated with cognitive impairment . Considering the recent conceptualization of apathy as a disorder of executive and emotional functioning , as well as initiation (Fahed & Steffens, 2021), it is expected that the presence of apathy in individuals will associate with cognitive deficits because executive

functions are necessary for selecting and accurately monitoring behaviours that bring about a desired goal. In other words, executive functions mediate the cognitive control of behaviour which may be impaired in individuals with apathy (Levy & Dubois, 2006; Johnson & Kumfor, 2018; Fahed & Steffens, 2021). Beyond that, the simple explanation that cognitive functioning requires motivation and a willingness to engage is convincing on its own. If an individual cannot bring themselves to engage cognitively, their cognition is bound to decline.

**Treatment of apathy**

Regarding the treatment of apathy, there is currently no licensed treatment for the syndrome (Dickson & Husain, 2022) but efforts to manage apathy include pharmacological interventions. These interventions in neurodegenerative disorders include cholinergic, dopaminergic, and glutamatergic agents (Bogdan et al., 2020). Apathetic individuals with Alzheimer's disease have somewhat benefitted from agents such as galantamine, memantine, methylpenidate and rivastigmine (Bogdan et al. 2020).

Further, evidence from studies suggest that combinations of medications target apathy better compared to the use of single agents. For example, a sub-group of individuals with Alzheimer's disease receiving donepezil and choline alphoserate were compared to another sub-group receiving donezepil only and the combined treatment effect of donepezil and choline alphoserate was more effective in reducting apathy levels (Carotenuto et al., 2017). Results from another study showed that the combination of memantine and citalopram reduced apathy levels in a group of individuals with Alzheimer's disease compared to another group who were receiving memantine and a placebo (Zhou et al, 2019).

In Parkinson's disease, dopamine agonists such as piribedil, pramipexole and rotigotine are reported to reduce apathy levels while conflicting evidence exists for the efficacy of levodopa (Bogdan et al., 2020). Conflicting evidence in the literature can be explained by several factors. One consideration is that apathy is not a primary outcome in Parkinson's

disease clinical trials. The primary outcome is usually the motor symptoms of Parkinson's disease which is reasonable as these symptoms are reported to be the most debilitating (Lazcano-Ocampo et al., 2020). However, it is challenging to interpret the direct effect of levodopa on apathy in such studies because it coud be that levodopa has a direct effect on apathy levels, given the dopaminergic pathways involved in apathy, or it could be that patients appear less apathetic due to the effect of the alleviated motor symptoms, if any. A further complication is that the apathy measures used in these studies do not separate non-motor symptoms, i.e., apathy is not separated from other items capturing mood and cognition (Lazcano-Ocampo et al., 2020).

In Frontotemoporal dementia, bupropian which is a norepinephrine-dopamine reuptake inhibitor reportedly reduced apathy levels in a case report of a patient with the behavioural variant of Frontotemporal dementia. The efficacy of dextroamphetamine in reducing apathy levels is supported by preliminary evidence while psychostimulatants are suggested to reduce apathy levels (Bogdan et al., 2020; Johnson & Kumfor, 2018), however, studies with larger samples are necessary to confirm these findings. Interestingly, memantine was not effective in reducing apathy levels in Frontotemporal dementia but was instead associated with worsening cognitive functioning. Similarly, donezepil, galantamine, and rivastigmine also did not reduce apathy levels and were associated with worsening behavioural symptoms such as disinhibition and compulsivity in some patients (Johnson & Kumfor, 2018).

There is limited literature describing the use of pharmacological agents in the management of apathy in Huntington's disease. Bogdan et al. (2020) reported that bupropion was not effective in reducing apathy levels globally or by domain (behavioural, cognitive, and emotional) in Huntington's disease. Regarding apathy management in acquired brain injuries, such as stroke and traumatic brain injury, bupropion was reported to improve apathy levels in a case report of post-stroke (left thalamus hemorrhagic stroke) induced apathy

(Bogdan et al., 2020). According to Tay et al. (2021), antidepressants such as selective serotonin reuptake inhibitors (SSRIs) may be prescribed for post-stroke apathy in clinical practice due to symptoms common to both apathy and depression.

There is however little evidence supporting the efficacy of antidepressants in reducing post-stroke apathy symptoms in the absence of additional depressive symtoms (Tay et al., 2021). As a matter of fact, some antidepressants are reported to worsen effort-based decision making but the evidence suggesting this was obtained in rodent studies and is yet to be verified in studies involving human participants (Yohn et al., 2016).

The management of post-traumatic brain injury apathy in clinical settings involves the use of dopamine-based medication. These medications are used to treat various arousal, executive, and motivational disorders following traumatic brain injury, although there is little evidence to support this practice (Worthington & Wood, 2018).

As discussed, literature provides some evidence of the efficacy of using pharmacological agents to manage apathy in various neurological disease processes (Bogdan et al., 2020; Johnson & Kumfor, 2018) but due to methodological limitations such as small sample sizes, lack of robust study designs, as well as the expense, debilitating side effects, and patients' intolerance of these agents (Padala et al., 2018), non-pharmacological interventions are encouraged and preffered as initial management options.

Non-pharmacological apathy interventions include cognitive intervention, conventional rehabilitation and nursing care, music therapy, occupational therapy, and repetitive Transcranial Mangentic Stimulation (rTMS) (Tan et al., 2022). rTMS is a neuromodulation technique which uses magnetic fields to influence electrical activty in the brain. It is popularly used in stroke populations and is also used to treat post-traumatic brain injury depression (Liu et al., 2019).

With regards to efficacy, Tan et al. (2020) reported that rTMS emerged as the most effective non-pharmacological apathy intervention compared to cognitive intervention, music and occupational therapy but this ranking was based on minimal direct comparative studies and should be interpretted cautiously.

Padala et al. (2018) reported evidence for the efficacy of rTMS in improving apathy in older adults with mild cognitive impairment. Theleritis et al. (2018) found several non-pharmacological interventions effective in managing apathy in dementia. These interventions include live music, recreational activities derived from the Need-driven dementia-compromised behaviour-model, reminiscence therapy, Snoezelen (multi-sensory room), and stimulation retreat model (Theleritis et al., 2018). The mechanisms of some non-pharmacological interventions are not explicitly explained in literature. For example, while music therapies are reported to reduce apathy levels, it is unclear how this intervention achieves the reported outcome. The mechanisms of cognitive interventions and occupational therapies are better understood (Bogdan et al, 2020).

A critique of cognitive and occupational interventions, among other non-pharmacological interventions, is that the interventions require the very thing they are attempting to improve in affected individuals, in order for them to have any success. Individuals having to engage in cognitive tasks of orientation, verbal fluency, and memory, for example, firstly require a level of motivation or willingness to carry out the tasks. It is also reported in the literature that individuals with apathy have poor rehabilitation outcomes (Fahed & Steffens, 2021).

Naturally, it can be argued that apathy severity would be an important factor to consider because individuals with mild apathy may gather the willingess to participate in the intervention whereas those with severe apathy would not even attempt the intervention. Further, as apathy is also understood as a disorder of initiation where individuals can engage

in activities and are willing to, clinicians may aid apathetic individuals in initiating the intervention activities which will allow the individuals to benefit from the interventions.

**Rationale**

Apathy is a prevalent and debilitating condition. There is contention in literature regarding apathy dimensions and little is known about the predictors of apathy. Consequently, the factor structure of the Apathy Evaluation Scale remains debated, despite that the scale is one of the widely used measures of apathy in both clinical and research settings . This measure of apathy is preferred due to its adequate psychometric properties, relative ease of administration, as well as the several translations it offers (Lee et al., 2020). Some argue that the AES has a single factor, while there is evidence for two- as well as three-factor models of the Apathy Evaluation Scale (Dickson & Husain, 2022). Beyond the factor structure of the AES, little is understood about the predictors of apathy.

Investigations have focused on associations of apathy with disease-related characteristics such as cognitive and functional impairment (e.g. Nobis & Husain, 2018). Albeit these associations are usually the secondary focus of such investigations and are not extensively reported on in the literature. Understanding the factor structure of the Apathy Evaluation Scale and the predictors of apathy has implications for the identification, management, and treatment of apathy symptoms. There is also an opportunity to mitigate apathy if its predictors are understood and managed accordingly.

**Aims**

I aimed to firstly examine the factor structure of the Apathy Evaluation Scale in a heterogenous patient sample in order to investigate the functional and cognitive correlates apathy in the sample. I decided to use a mixed sample in order to control for the likely relations of apathy symptoms and other variables with a specific disease processes. The majority of studies in this area have only focused on homogenous samples (e.g., Clarke et al.,

2007; Faerden et al., 2008). Specifically, the main aim was to investigate the association of the factors derived from the factor analysis and disease-related characteristics such as difficulties performing activities of daily living, depression, cognitive deterioration and mental status.

**Hypotheses**

Basing on my literature review I proposed the following hypotheses.

***Hypothesis 1.***: The factor structure of the Apathy Evaluation Scale is a three-factor model with behavioural, cognitive, and social sub-domains of apathy.

***Hypothesis 2.***: Cognitive impairment , depression, and functional impairment predict apathy.

***Hypothesis 3.***: Scores on the behavioural sub-domain of apathy are significantly associated with capacity to carry out basic activities of daily living while scores on the cognitive sub-domain of apathy  significant associated with capacity to carry out instrumental activities of daily living.

# Method

## Research Design and Setting

I employed a quantitative cross-sectional exploratory research design to investigate the correlates of apathy symptoms and the factor structure of the informant version of the Apathy Evaluation Scale (AES-I). The data I used in this study were collected from the archival records of patients who presented at the UCT/GSH Memory Clinic between 2012 and 2022 with subjective cognitive impairment . The UCT/GSH Memory Clinic is one of many clinics that offer multidisciplinary management to patients presenting primarily with subjective memory loss. The Memory Clinic is currently based at Groote Schuur Hospital under the Department of Psychiatry and Mental Health (Kalula et al., 2010).

Records from the UCT/GSH Memory Clinic are stored in an office at the Albertina and Walter Sisulu Institute of Ageing in Africa (IAA). The IAA was established at the University of Cape Town in 2001. The institute incorporates the university's division of Geriatric Medicine, the Neurosciences, Neuropsychology, Old Age Psychiatry, and a Gerontology Programme. The UCT/GSH Memory Clinic is one of the products of the IAA. The IAA is located within the Department of Medicine in the Faculty of Health Sciences of the university of Cape Town.

## Participants

I collected 200 participant records from archival data which is collected in an ongoing data collection process at the UCT/GSH Memory Clinic. The participants' mean age was 69 years (*SD* 10.55) and the majority of the sample were female (see Table 1). A prevalent diagnosis in this sample was Alzheimer's disease, followed by mixed Alzheimer's disease/Vascular dementia (see Table 2). There was missing data across various categories.

Table 1 Sample Characteristics

| | N | Mean | SD | Minimum | Maximum | % |
|---|---|---|---|---|---|---|
| Age | 190 | 68.78 | 10.55 | 24 | 90 | |
| Gender | 189 | | | | | 95 |
| Unavailable | 11 | | | | | 6 |
| Female | 111 | | | | | 56 |
| Male | 78 | | | | | 39 |
| Race | 92 | | | | | 46 |
| Unavailable | 108 | | | | | 54 |
| African | 8 | | | | | 4 |
| Coloured | 73 | | | | | 37 |
| Indian | 4 | | | | | 2 |
| White | 23 | | | | | 12 |
| Marital Status | 96 | | | | | 48 |
| Unavailable | 104 | | | | | 52 |
| Divorced | 14 | | | | | 7 |
| Married | 54 | | | | | 27 |
| Never Married | 14 | | | | | 7 |
| Widowed | 22 | | | | | 11 |
| Employment Status | 103 | | | | | 52 |
| Unavailable | 97 | | | | | 49 |

| | N | Mean | SD | Minimum | Maximum | % |
|---|---|---|---|---|---|---|
| Employed | 14 | | | | | 7 |
| Retired | 28 | | | | | 14 |
| Retired (age) | 20 | | | | | 10 |
| Retired (medical reasons) | 13 | | | | | 7 |
| Retired (personal reasons) | 11 | | | | | 6 |
| Retrenched | 7 | | | | | 4 |
| Unemployed | 4 | | | | | 2 |
| Highest Level of Education | 106 | 9.75 | 3.14 | 0 | 16 | |

Table 2 Participant Diagnosis

| | N | % |
|---|---|---|
| Alzheimer's disease (AD) | 9 | 4.5 |
| Early AD query | 1 | 0.5 |
| Possible AD | 3 | 1.5 |
| Probable AD | 5 | 2.5 |
| AD Possible, Mixed AD/Vascular dementia, Alcohol related dementia | 1 | 0.5 |
| AD Possible, Mixed AD/Vascular dementia | 1 | 0.5 |
| AD/Vascular dementia/Pseudo dementia due to depression | 1 | 0.5 |
| Lewy body disease | 1 | 0.5 |
| Major Depressive Disorder | 3 | 1.5 |
| Mild Cognitive Impairment (MCI) | 4 | 2 |
| Amnestic MCI | 2 | 1 |
| MCI query | 1 | 0.5 |
| Vascular MCI | 1 | 0.5 |
| Mixed AD/ Vascular dementia | 7 | 3.5 |
| No dementia | 1 | 0.5 |
| Parkinson's disease | 1 | 0.5 |
| Parkinson's plus dementia | 1 | 0.5 |
| Senile dementia of Alzheimer's type | 1 | 0.5 |
| Somatic delusion | 1 | 0.5 |
| Unspecified dementia | 6 | 3 |
| Vascular dementia | 4 | 2 |
| Vascular dementia, Alcohol related dementia | 1 | 0.5 |
| Missing data | 157 | 78.5 |
| Total | 200 | 100 |

***Inclusion Criteria***

I selected folders of individuals seen at the Memory Clinic between 2012 and 2022. All the folders with data on the Apathy Evaluation Scale were included in the study. In considering the sample size, I noted that the factor analyses require for this study needs a large sample size between 100 and 500 participants (Kyriazos, 2018) . In view of this recommended range of sample sizes in exploratory factor analyses, I aimed to collect data from 300 folders. A sample size of 300 is the midpoint of the range stipulated for exploratory factor analysis. Further, the process of data collection was set to happen over a period of 3 months therefore the aim to collect data from 300 folders was realistic.

I collected data from 200 patient folders. A total of 75 participant folders were excluded from the study because the folders did not contain data for the Apathy Evaluation Scale. To note, 200 folders had data for the Apathy Evaluation Scale but of those 200 folders, there was missing data across categories such as age, gender, diagnosis as well as on the tests and scales administered. While missing data on the tests and scales posed a threat to the internal validity of this study, the missing data on each category or scale did not exceed 30. In addition, because I collected data for individual items on the scales and not the scale total only, the data collected could still be used in a meaningful way.

For example, the Bristol Activities of Daily Living Scale that measures an individual's functional capability contains 17 items which can be grouped into basic and instrumental activities of daily living. Collecting only the total points for this scale does not allow for the grouping of items. Moreover, if there is one data point missing, the total of the scale is affected but not necessarily the total of either basic or instrumental activities of daily living, depending on which item does not have data. In the case where there are many missing data points, the data for that participant would be excluded.

## Materials

### *Apathy Evaluation Scale – Informant version (AES-I)*

The Apathy Evaluation Scale (AES) was developed to characterise and measure apathy in adult patients with acquired brain injuries and neurocognitive disorders, among many other disease processes (Lee et al., 2020). The AES follows from the conceptualization of apathy as a syndrome characterized by deficits in the overt behavioural, cognitive and emotional concomitants of goal directed behaviour (Lee et al., 2020). The AES has three versions, namely, clinician observed (AES-C), informant reported (AES-I) and self-reported (AES-S) versions.

The AES-I contains 18 items, rated on a 4-point Likert scale (1= 'A lot', 2= 'Somewhat', 3 = 'Slightly' and 4= 'Not at all') (see Appendix A). Three items on the AES-I are reverse scored. These are items 6, 10, and 11. Scores on the AES-I range from 18 to 72, with higher scores indicating greater apathy severity. The cut-off score for apathy on the AES-I is 41.5 (Clarke et al., 2008).

The AES was found to have internal consistency in the range of 0.86 – 0.94 for the self-rated and clinician versions when replicated in individuals with left or right stroke, Alzheimer's disease and major depressive disorder (Clarke et al., 2011). Further, the AES has been reported to have good test-retest reliability ( $r$ = .76 - .94) and interrater reliability as measured by an intraclass correlation coefficient of .94 (Lee et al., 2020).

Regarding construct validity of the scale, a high correlation ( $r$ = .71) was reported between the AES and the apathy subscale of the Frontal Systems Behaviour Scale. The reported construct validity was tested in a sample of individuals with traumatic brain injury (Lee et al., 2020). The AES demonstrated acceptable convergent validity with the Hamilton Depression Rating Scale ($r$ = .53). Regarding discriminant validity, only the AES-C and AES-

S were reported to discriminate apathy from anxiety ( $r$ = .35 - .42) and depression ( $r$ = .39 - .42) (Lee et al., 2020).

The AES-I is the most psychometrically robust version of the Apathy Evaluation compared to its self (AES-S) and clinician (AES-C) rated counterparts (Njomboro & Deb, 2012). Caregivers and family members are in a position to provide more accurate ratings on the because they observe the patients in their natural environments over extended periods of time compared to clinicians. The self-rated (AES-S) version is compromised in instances where patients lack insight.

***Bristol Activities of Daily Living Scale (BADLS)***

The Bristol Activities of Daily Living scale (BADLS) measures both basic and instrumental activities of daily living and was designed specifically for use in patients with dementia (Sheehan, 2012). It is an informant-rated measure and consists of 20 items which take approximately 15 minutes to administer. Each item has five different statements that refer to a different level of ability. There is a 'Not applicable' statement for each item (Bucks et al., 1996). The BADLS is reported to be sensitive to change in dementia and brief enough to be used in clinical settings (Sheehan, 2012).

A contextually modified version of the BADLS which consisted of 17 out of the 20 items was used to assess patients' activities of daily living (see Appendix B). The scores in the modified version of the BADLS range from 0 to 51, with lower scores representing a higher level of functioning. The scores indicate the degree to which the patient is dependent on the caregiver for assistance in carrying out activities of daily living. The BADLS has good test-retest reliability and good content validity (Bucks et al., 1996).

### *Mini-Mental State Examination (MMSE)*

The MMSE is an instrument used to grade the cognitive state of patients (Upton, 2020) (see Appendix C). The instrument was developed by Folstein & McHugh (1975) and has been widely utilized in clinical and research settings alike. The MMSE is a 30-item screening tool which takes approximately 10 minutes to administer and can be easily administered by clinicians or researchers with minimal training (Sheehan, 2012). The items on the MMSE are scored 0 if failed and 1 if passed. The MMSE measures cognition across a several domains including to Orientation, Registration, Attention and Calculation, Recall, Language, and Basic Motor Skills (Upton, 2020). A score of 9 points and below indicates severe cognitive impairment and moderate cognitive impairment is indicated by a score between 10 and 20 points. A score between 21 and 24 indicates mild cognitive impairment and a score of 25 and above illustrates normal cognition (Upton, 2020). An intraclass correlation for the MMSE was reported to be 0.69 and the instrument was found to be responsive to change.

### *Cornell Scale for Depression in Dementia (CSDD)*

The CSSD is a 19-item screening instrument that was designed to assess whether persons with dementia also have depression (Bellis & Williams, 2008) (see Appendix D). The screening instrument provides a quantitative measure of depressive symptoms across affective, behavioural, cognitive, and somatic domains which are collated into five areas: mood-related signs, behavioural disturbances, physical signs, cyclic function and ideational disturbance (Shankar & Orrell, 2000). The CSSD was designed for implementation by clinicians and is most effective when completed and scored through careful observation rather than an elaborate interview. Due to the Memory Clinic being an outpatient facility rather than an inpatient facility, the CSSD is administered in the format of an interview with the individual's caregiver. The caregiver's observation of the individual fills the gap of the ideal administration of the CSSD where the clinician observes the individual themselves. The

administration of the CSSD with the individual's caregiver takes approximately 20 minutes to complete.

During preliminary testing, the CSDD was found to be reliable, valid and sensitive (Alexopoulos et al., 1988) . The validity of the scale was based on comparisons between the CSDD and the diagnosis given by the psychiatrists using the research diagnostic criteria and the Hamilton Depression Rating Scale. In that study, the information rated was based on information obtained from nursing staff members and a brief interview with the client (Alexopoulos et al., 1988).

***Deterioration Cognitive Observée (DECO)***

The DECO is a 19-item Likert scale caregiver questionnaire which is aimed at evaluating the change in a patient's cognitive functioning over the period of 1 year (Ritchie et al., 2001). Changes in activity level, memory for places, events, procedures and persons, as well as learning of new skills are measured. The screening instrument is administered to individuals who have at least monthly contact with the patient over the past 3 years (Carcaillon et al., 2011). In the current study, the DECO was scored as follows: 0 = no decline, 1= some decline, and 2 = severe decline (see Appendix E). The lowest score on the DECO is 0 and the highest score is 38.

Scores of 19 and above indicated considerable cognitive impairment as observed by the patient's caregiver who could be a spouse, child, friend, or a professional caregiver. The DECO is reported to be highly sensitive to early changes in cognitive functioning due to various causes. Further, it is reported that the DECO has adequate discriminability, with a 79% sensitivity and 90% specificity for detecting dementia using a cut-off score of $\leq$ 24 (Gruters et al., 2019). To note, in this instance, the DECO is scored 2 to indicate no change and 0 to indicate great decline therefore lower scores indicate greater decline which explains the cut-off score of $\leq 24$ for detecting dementia. The DECO does not involve direct

cognitive examination of the patient but has the advantage of indicating the degree of change from former levels of functioning (Ritchie & Fuhrer, 1992; Gruters et al., 2019).

**Procedure**

The data that I used for this study is part of a broader ongoing patient assessment process that is performed as the clinic's standard protocol. The patients at Memory Clinic are seen on a referral basis from other clinicians, as well as various community clinics and hospitals. The reason for referral is generally the patient's reported and subjective memory loss. The patients present at Memory Clinic with persons who can provide collateral information such as family members, friends, or healthcare personnel such as caregivers at nursing homes.

All the patients seen at Memory Clinic are required to complete a 4-stage assessment procedure which takes approximately 3 hours to complete. In the first stage, a medical registrar conducts a history-taking session whereby they collect the demographic, biographical and medical information of the patient. This information is recorded in a white booklet. The registrar would also inquire about the patient's current complaints and changes in their premorbid functioning. These questions are directed to the patient but the individual who has accompanied the patient is encouraged to provide in-depth information about the self-reported concerns.

The second stage involves a physical and neurological examination of the patient while the person who accompanied the patient is taken to a separate room to complete a battery of questionnaires including the Apathy Evaluation Scale – Informant version (AES-I), Bristol Activities of Daily Living Scale (BADLS), Cornell Scale of Depression in Dementia (CSSD), and Deterioration Cognitive Observee (DECO) scale.

This information is captured separately in a blue booklet. In the third stage, the patient undergoes neuropsychological testing which is a battery of tests including the MMSE, MOCA, as well as tests of memory, language, executive functioning, visuospatial and visuo-constructional skills. Another blue booklet is used for this part of the assessment.

Finally, in the last stage of the assessment, a team of medical doctors, neuropsychiatrists, neurologists, and neuropsychologists convene for a case conference where each patient case is presented and diagnosis is attempted. Thereafter, once a conclusion is reached, the registrar will provide feedback to the patient and the individual who accompanied them. All the data collected during the assessment is filed in the patient's booklets and is transferred to the IAA offices where it is both manually filed and stored in electronic databases.

Access to the IAA Memory Clinic offices was requested by my supervisor on my behalf. My supervisor put me in contact with a staff member with whom I liaised with for data collection. The staff member and I decided on a day and time that I would come in to collect data weekly.

I was given access to an office with physical copies of patient assessments. Since one of the aims of this study is to conduct a factor analysis of the Apathy Evaluation Scale, every patient's file was firstly checked to see if it contained scores for all the items on the AES. If the patient's file did not contain the AES or all the scores on the items of the AES, it was excluded from the study.

Patient files that contained all the AES scores were then scanned to see if they contained scores for the following measures: MMSE, CSSD, DECO, and BADLS. For the aforementioned measures, it did not matter if all the items were scored as analyses could still be conducted if some of the items were not scored.

Following that, patient files that met the criteria of inclusion in this study were extracted and scores were recorded on an Excel spreadsheet. The spreadsheet contained columns for: (1) patient's folder number, (2) patient's age, (3) patient's gender, (4) patient's diagnosis (5) MMSE total score, (6) scores for all the 18 items on the AES and the total score for the AES, (7) scores for all the 19 items on the CSDD and the total CSSD score, (8) scores of all the 19 items on the DECO and the total score of the DECO, and finally (9) all the scores on the BADLS and the total BADLS score. Once scores were collected from 200 patient files, the Excel spreadsheet was exported to SPSS version 28 for data analysis. The data collection process spanned over three months.

**Ethics**

Ethical approval was obtained in 2022 from the Department of Psychology at the University of the Cape Town and the letter was sent in January 2023 (see Appendix F). This study adheres to the principles of ethical research outlined by the University of Cape Town.

Patients who present to the UCT/GSH Memory Clinic are well informed that their assessment files will be used for research purposes to ensure informed consent and ethical transparency. Data collection was conducted at an IAA office under supervision of an IAA staff member. The data was collected and stored in a password protected computer that only I have access to, in order to ensure confidentiality of records. Anonymity is not possible when patients present to the UCT/GSH Memory Clinic as identifying information is collected as part of the patient's examination process. However, identifying information of patients such as names, race and ethnic backgrounds, and residential addresses were not included in the Excel spreadsheet to ensure anonymity. Since this project only made use of secondary archival data, patients were exposed to minimal harm in this study.

## Analysis

Data analysis was conducted using SPSS version 28. To establish the factor structure of the AES-I, I carried out Principle Components Analysis (PCA) with Promax rotation. Promax rotation is a type of oblique rotation since we assume that the components that will be derived from the AES-I are correlated. A factor analysis was the most apt statistical approach to adopt as a data reduction technique. While the study could have used a confirmatory factor analysis due to the well-established 3-factor model by Marin (Santangelo et al., 2014; Raimo et al., 2014; Faerden et al., 2008), I sought to replicate Marin's earlier work to determine the factor structure of the Apathy Evaluation Scale in a heterogenous sample of patients that is different from the one that was originally tested. Additionally, I hypothesize that instead of an emotional sub-domain of apathy, the factor analysis will yield a social sub-domain of apathy as suggested by recent literature (Robert et al., 2018). Further, I tested the internal consistency of the Apathy Evaluation Scale.

The number of factors extracted were determined using *Kaiser'*s criterion which suggests retaining factors with an eigenvalue greater than 1 (Kaiser, 1960). This criterion however has been argued to overestimate the number of factors extracted (Yong & Pearce, 2013) therefore I used a scree test in conjunction *with Kaiser's* criterion to determine the number of extracted factors.

To test hypothesis 2, a multiple linear regression analysis was run to explore whether age, gender, mental status, depression, cognitive deterioration and activities of daily living would predict apathy in the sample. Multiple hierarchical linear regression models were created in order to predict impairment in carrying out activities of daily living in the sample to test hypothesis 3.

# Results

## Apathy Evaluation Scale: factor structure

I determined the suitability of the data for this analysis by inspecting the correlation matrix which revealed that majority of the coefficients were > .3. The Bartlett's test for sphericity was significant (P < .001), and the Kaiser- Meyer-Olkin of sampling adequacy statistic was 0.9 which is > .5, indicating that there is enough variance in the data that can be divided using factor analysis. I inspected scatterplots to check for linearity.

Reliability analysis of the 18-item AES scale revealed excellent reliability with a Cronbach's alpha of .93. All the 18 items had a moderate to strong correlation with the total AES score thus all the items were included for further analysis. Exploratory Factor analyses of the 18 items produced a three factor solution that accounted for approximately 60.4% of the total variance (see Table 3). This solution was supported by visual inspection of the scree plot presented in Figure 1 and Kaiser's rule (Eigenvalues > 1) as shown in Figure 1.

Items that loaded on each of the three factors are presented (see Table 4). For factor 1 (*behavioural*), items 2 ("S/he gets things done during the day"), 3 ("Getting things started on his/her own is important to him/her), 8 ("Seeing a job through to the end is important to him/her"), 16 ("Getting things done during the day is important to him/her) and 17 ("S/he has initiative) exhibited the highest loadings. For factor 2 (*cognitiv*e), item 5 ("S/he is interested in learning new things") exhibited the highest loading. Finally, for factor 3 (*affective/emotional*), item 13 ("Getting together with friends is important to him/her") exhibited the highest loading. Between-factor correlations were moderate. The correlation between behavioural and cognitive factors was largest (r = .66), followed by the correlation between behavioural and affective factors ( r = .50) and between cognitive and affective factors ( r= .47).

Due to the presence of items with double loadings i.e. items 1, 11, 15, 18 and an item with a loading < .30 i.e., item 14, a second principles components analysis was conducted. The analysis was conducted using 13 of the 18 items which excluded items 1, 11, 14, 15, and 18. Reliability analysis of the 13-item AES scale revealed excellent reliability with a Cronbach's alpha of .91. All the 13 items had moderate to strong correlations with the total AES score thus all the items were included for further analysis. Exploratory factor analysis of the 13-item AES scale produced a three factor solution that accounted for approximately 67.14% of the total variance (see Table 5)

Similarly to the first factor analysis, this solution was supported by visual inspection of the scree plot presented in Figure 2 and Kaiser's rule i.e., Eigenvalues > 1. Items that loaded on each of the three factors are presented (see Table 6). For factor 1 (*behavioural*), items 2 ("S/he gets things done during the day"), 3 ("Getting things started on his/her own is important to him/her), 8 ("Seeing a job through to the end is important to him/her"), 16 ("Getting things done during the day is important to him/her"), and 17 ("S/he has initiative") exhibited the highest loadings. For factor 2 (*cognitive*), item 5 ("S/he is interested in learning new things") exhibited the highest loading.

Finally, for factor 3 *(affective/emotional*), item 12 ("S/he has friends") exhibited the highest loading. Between-factor correlations were weak to moderate. The correlation between behavioural and cognitive factors was largest ( r = 0.57), followed by the correlation between behavioural and affective/emotional factors ( r = 0.45) and lastly between cognitive and affective/emotional factors ( r = 0.39).

Table 3 AES-I Factors as Determined by Principle Component Analysis

| | Component 1 (behavioural) | Component 2 (cognitive) | Component 3 (emotional) |
|---|---|---|---|
| Eigenvalue | 8.5 | 1.3 | 1.1 |
| Variance % | 47.2 | 7.1 | 6.1 |

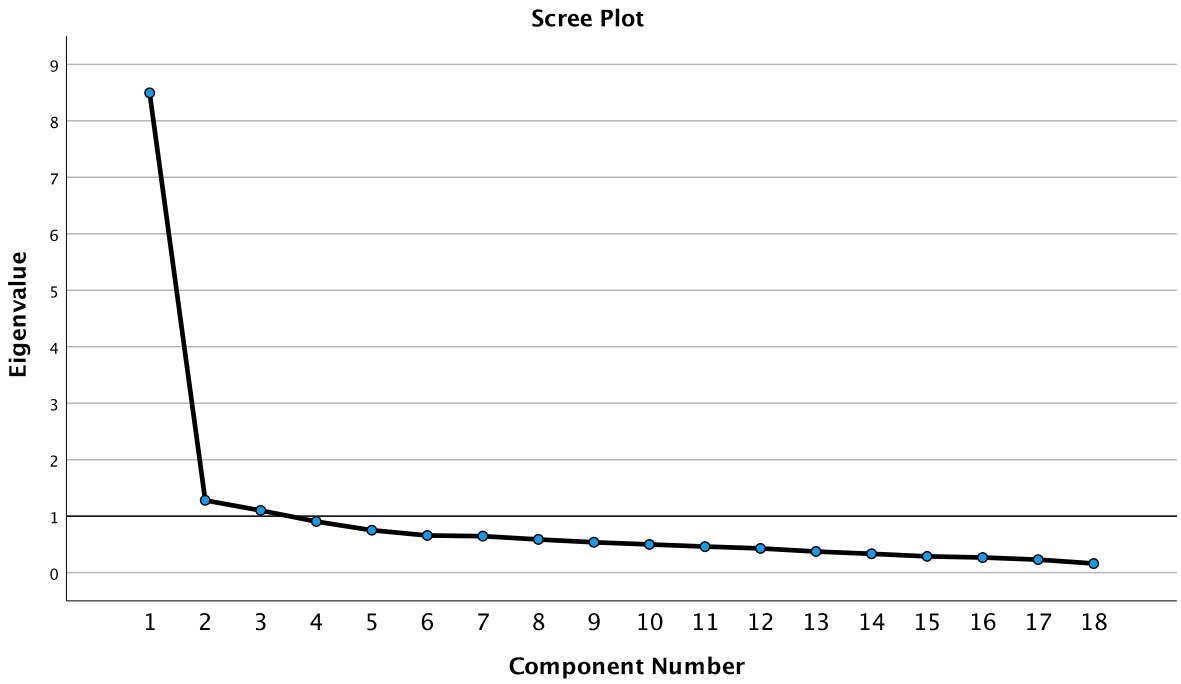


Figure 1 Scree Plot showing number of extracted factors (18 items)

Table 4 Factor loadings of AES-I (18 Items)

| AES-I Item | Factor 1 (behavioural) | Factor 2 (cognitive) | Factor 3 (emotional) |
|---|---|---|---|
| 1 | .38 | | .33 |
| 2 | .98 | | |
| 3 | .74 | | |
| 4 | | .91 | |
| 5 | | 1 | |
| 6 | .64 | | |
| 7 | .52 | | |
| 8 | .88 | | |
| 9 | .57 | | |
| 10 | .67 | | |
| 11 | .37 | .42 | |
| 12 | | | .88 |
| 13 | | | .89 |
| 14 | .29 | | |
| 15 | .33 | .50 | |
| 16 | .91 | | |
| 17 | .75 | | |
| 18 | .59 | .30 | |

Table 5 Principle Component Analysis of AES-I (13 Items)

| | Component 1 | Component 2 | Component 3 |
|---|---|---|---|
| Eigenvalue | 6.44 | 1.23 | 1.06 |
| Variance % | 49.53 | 9.45 | 8.17 |

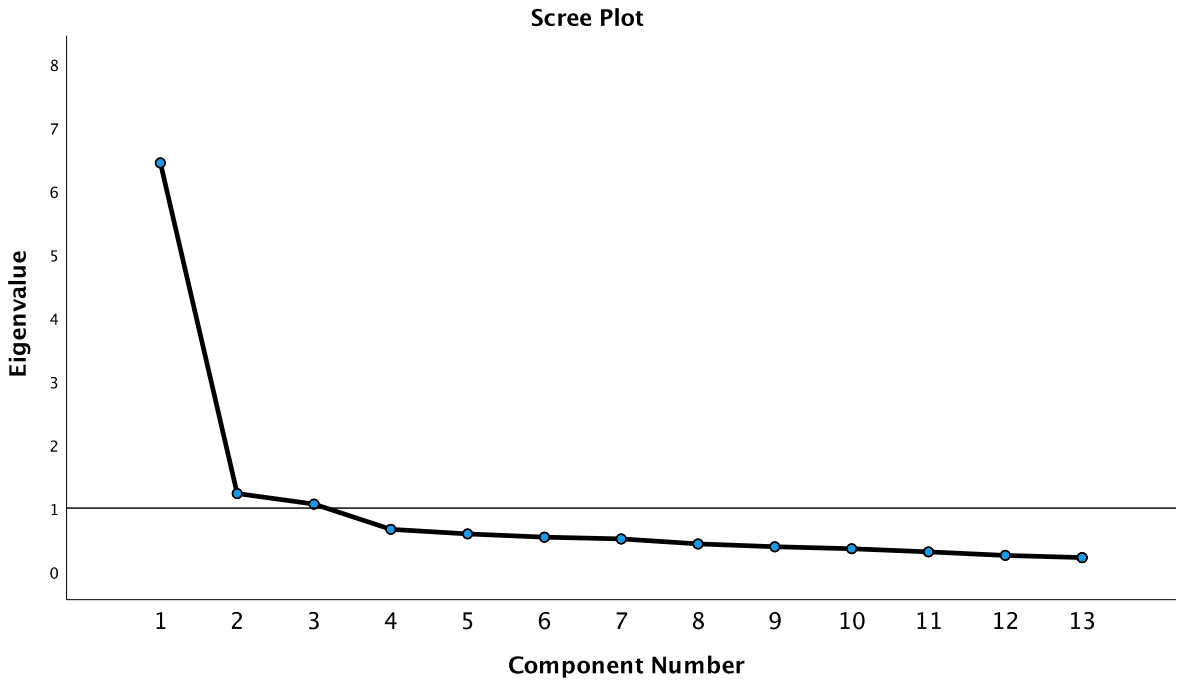


Figure 2 Scree plot showing extracted factors (13 items)

Table 6 Factor loadings of AES-I (13 Items)

| AES- I Item | Component 1 (behavioural) | Component 2 (cognitive) | Component 3 (social) |
|---|---|---|---|
| 2 | .93 | | |
| 3 | .74 | | |
| 4 | | .91 | |
| 5 | | .95 | |
| 6 | .62 | | |
| 7 | .53 | | |
| 8 | .88 | | |
| 9 | .60 | | |
| 10 | .68 | | |
| 12 | | | .90 |
| 13 | | | .88 |
| 16 | .90 | | |
| 17 | .76 | | |

**Apathy: functional correlates and predictors**

Before conducting a multiple linear regression, the following assumptions were tested: to test for multicollinearity across predictor variables a Pearson correlation coefficient matrix was performed. All coefficients in the matrix were below .70 and -.70, showing that the assumption of multicollinearity was not violated. Tolerance values were above 0.1 and variance inflation factor values were below 10, further indicating that the assumption of multicollinearity was not violated. I performed a Durbin-Watson statistic to assess for the assumption of independence of the values of the residuals. The obtained statistic was 2.2 which is between 1 and 3 indicating that this assumption was not violated.

A scatterplot was created to test the assumption that the variance of the residuals was constant i.e. homoscedasticity. The plot did not indicate a violation of this assumption. A P-Plot was created to assess the assumption that the values of the residuals were normally distributed. The plot did not indicate a violation of this assumption. Cook's Distance values were calculated to ensure that no influential cases were biasing the model. The value was below 1, suggesting that no cases were biasing the model. The assumptions above were met for all subsequent multiple linear regression analyses conducted.

A multiple linear regression analysis using the enter method was calculated to examine whether age, gender, highest level of education, MMSE scores, DECO scores, CSSD scores, and BADLS scores can predict AES-I total scores in this sample (see Table 7). A significant equation was found ($F(7, 85) = 7.45$, $p < .001$), explaining 38% ($R^2 = .38$) of the variance in apathy. Only capacity to carry out activities of daily living ($B= .32$, $t= 3.51$, $p < .001$) and depression ($B = .33$, $t =3.41$, $p < .001$) contributed significantly to the model.

Table 7 Predictors of Apathy as indicated through Multiple Linear Regression

| Variable | Beta | SE | 95 % CI | | β | p |
|---|---|---|---|---|---|---|
| | | | LL | UL | | |
| Age | -.15 | 0.13 | -0.409 | 0.100 | -.11 | .23 |
| Gender | -.75 | 2.45 | -5.609 | 4.112 | -.03 | .76 |
| Highest Level of Education | .27 | 0.38 | -0.496 | 1.026 | .06 | .49 |
| Mental Status (MMSE) | -.01 | 0.30 | -0.608 | 0.592 | -.00 | .98 |
| Cognitive Deterioration | .22 | 0.15 | -0.079 | 0.524 | .16 | .14 |
| Depression | .80 | 0.23 | 0.332 | 1.259 | .33 | < .001* |
| Activities of daily living | .46 | 0.13 | 0.198 | 0.718 | .32 | .001* |

Notes: p = .05* CI = Confidence Interval. LL = Lower Limit. UL = Upper Limit. SE = Standard Error.

Based on Marin's conceptual framework and subsequent research on apathy (e.g., Marin, 1991), a hierarchical regression was conducted to analyse the effect of apathy sub-domains (cognitive, behavioural, emotional) on basic activities of daily living. However, upon examining the correlation matrix (see Table 8), the sub-domains were strongly correlated which indicates issues with multicollinearity that result in less reliable statistical inference. As a result, that analysis is not included as it does not aid to answer hypothesis 3. A second matrix was run to establish the association between the sub-domains of the 13-item Apathy Scale to inspect for multicollinearity. Weak to moderate correlations were found between the Apathy sub-domains (see Table 9) and I proceeded to conduct the multiple hierarchical regression to test hypothesis 3.

Table 8 Pearson Correlations of Marin's Apathy Sub-domains

| Apathy sub-domains | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1.Behavioural | - | .80 | .67 | .74 |
| 2.Cognitive | .80 | - | .74 | .80 |
| 3.Emotional | .67 | .74 | - | .65 |
| 4.Other | .74 | .80 | .65 | - |

Table 9 Pearson Correlations of 13-Item Apathy Sub-domains

| Apathy sub-domains | 1 | 2 | 3 |
|---|---|---|---|
| 1. Behavioural | - | .57 | .44 |
| 2. Cognitive | .57 | - | .32 |
| 3. Social | .44 | .32 | - |

To determine the predictive effect of the apathy sub-domains resulting from the 13-item factor analysis on activities of daily living, a hierarchical multiple regression was conducted to analyse the effect of the sub-domains identified from the 13-item factor analysis on basic activities of daily living (BADLs) and instrumental activities of daily living (IADLs). BADLs here is distinct from the Bristol Activities of Daily Living Scale (BADLS). Regarding BALDs, I firstly put in behavioural apathy scores into the model followed by cognitive apathy scores, and finally, social apathy scores . The overall regression model predicted approximately 21% of variance in BADLs ($R^2 = 0.21$, $F(3, 196) = 16.95$, $p < .001$) (see Table 10). Behavioural apathy scores predicted approximately 20% of variance in BADLs scores, step 2 predicted approximately 1% of variance in BADLs although only behavioural apathy was a significant predictor, with greater scores in behavioural apathy items resulting in higher scores on BADLs items (see Table 11). Step 3 did not predict any variance in BADLs.

Table 10 AES sub-domains as predictors of BADLs: Model Summary

| | | | | | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | R Square Change | F Change | df 1 | df 2 | Sig. F change |
| 1 | .449 | .202 | .198 | 4.23 | .202 | 50.03 | 1 | 198 | < .001 |
| 2 | .454 | .206 | .198 | 4.23 | .004 | 1.02 | 1 | 197 | .313 |
| 3 | .454 | .206 | .194 | 4.24 | .000 | .04 | 1 | 196 | 846 |

Notes.

Model 1: Constant, Behavioural apathy scores

Model 2: Constant, Behavioural apathy scores, Cognitive apathy scores

Model 3: Constant, Behavioural apathy scores, Cognitive apathy scores, Social apathy scores

Table 11 Coefficients of Model: BADLs

| | | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| Model | Predictors | B | Std. Error | Beta | t | p | Tolerance | VIF |
| 3 | (Constant) | -2.49 | 1.04 | | -2.39 | .018 | | |
| | Behavioural Apathy | .28 | .05 | .49 | 5.95 | < .001 | .60 | 1.66 |
| | Cognitive Apathy | -.18 | .18 | -.08 | -1.02 | .308 | .67 | 1.49 |
| | Social Apathy | .03 | .17 | .01 | .19 | .846 | .80 | 1.23 |

Regarding the predictive effect of the apathy sub-domains resulting from the 13-item factor analysis on IADLs, a final hierarchical multiple regression was conducted to compare to results using Marin's (1991) sub-domains. The first step of the model was cognitive apathy, the second step was behavioural apathy and the final step was social apathy. The overall model predicted approximately 32% of variance in IADLs ($R^2$ =0.32, F(3, 196) = 30.04, $p < .05$) (see Table 12). Cognitive apathy predicted approximately 8% variance in IADLs, step 2 predicted approximately 23% variance in IADLs although behavioural apathy was the only significant predictor, with greater scores in behavioural apathy predicting greater impairment in carrying out IADLs ( see Table 13). Step 3 did not predict any variance in IADLs. Similar to our earlier results, behavioural apathy is the only significant predictor of both BADLs and IADLs.

Table 12 AES sub-domains as predictors of IADLs

| | | | | | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | R Square Change | F Change | df 1 | df 2 | Sig. F Change |
| 1 | .289 | .083 | .079 | 4.27 | .083 | 18.03 | 1 | 198 | < .001 |
| 2 | .558 | .312 | .305 | 3.71 | .228 | 65.36 | 1 | 197 | < .001 |
| 3 | .559 | .312 | .302 | 3.71 | .001 | .19 | 1 | 196 | .666 |

Notes.

Model 1: Constant, Cognitive apathy scores

Model 2: Constant, Behavioural apathy scores

Model 3:Constant, Cognitive apathy scores, Behavioural apathy scores, Social apathy scores

Table 13 Coefficients of Model 3: IADLs

| Model | Predictors | Unstandardized Coefficients | | Standardized Coefficients | t | p | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Tolerance | VIF |
| | (Constant) | -.70 | .91 | | -.77 | .442 | | |
| 3 | Cognitive | | | | | | | |
| | Apathy | -.09 | .15 | -.04 | -.61 | .546 | .67 | 1.49 |
| | Behavioural | | | | | | | |
| | Apathy | .30 | .04 | .57 | 7.47 | < .001 | .60 | 1.66 |
| | Social | | | | | | | |
| | Apathy | .06 | .15 | .03 | .43 | .666 | .80 | 1.26 |

## Discussion

The main aim was to investigate the association of the factors derived from the factor analysis and disease-related characteristics such as difficulties performing activities of daily living, depression, cognitive deterioration and mental status. To examine these correlates, I firstly ran an exploratory factor analysis of the informant version of the Apathy Evaluation Scale. I performed the factor analysis in light of the persisting contention surrounding the conceptualization of apathy and its dimensions (Dickson & Husain, 2022).

The results of the present study partially support a three-factor structure of the AES, similar to what was established by Marin (1991). Guided by the following criteria: (1) Kaiser's criterion i.e. factors with Eigenvalues < 1 are dropped and those > 1 are included, (2) factor loadings > 0.30 are included and, (3) visual inspection of scree plots, the three-factor structure which emerged from the current study resembled that established by Marin (1991). The factors that emerged could be grouped as behavioral, cognitive, and social sub-domains of apathy. The first two sub-domains are similar to what Marin (1991) identified but the social sub-domain of apathy is consistent with apathy dimensions reported in the current diagnostic criteria of apathy (Robert et al., 2018).

A considerable difference between Marin's earlier work and the current study is that not all the items in the AES had significant loadings on the extracted factors i.e., Item 14 ('When something good happens, s/he gets excited') had a loading of 0.29 on the behavioral apathy factor. Several items loaded significantly on 2 factors: Item 1 (S/he is interested in things) loaded significantly on behavioral and affective apathy factors, Item 11 (S/he is less concerned about their problems than s/he should be) loaded significantly on behavioral and cognitive apathy, Item 15 (S/he has an accurate understanding of her/his problems) loaded significantly on behavioral and cognitive apathy, and Item 18 (S/he has motivation) loaded significantly on behavioral and cognitive apathy.

These differences can be explained by the recognized inconsistencies in the definition of apathy and how it is operationalized (Cummings et al., 2015). For example, items with significant loadings across two factors could be a result of wording the items in a way that overlaps between 2 domains of apathy. Item 18 (S/he has motivation) is an excellent example of how challenging it is to produce precisely worded items that fall neatly within a particular domain. For example, motivation can be defined as a process that that initiates, guides, and maintains goal-oriented behavior and this definition at face value lends itself more to the behavioral dimension. Upon further examination, one realizes that there is a cognitive demand in initiating, guiding, and maintaining goal-directed behavior. Finally, this same process of carrying out goal-directed behavior can be fueled and maintained by affective states therefore Item 18 could fall into all the dimensions of apathy.

Due to items with double loadings and the item that did not have a significant loading on any of the factors, a second principal components factor analysis was run excluding 5 factors. The 13-item AES factor analysis favored a three-factor structure that resembled the factor structure identified by Marin (1991). Similar to Marin's earlier work, the 13-item AES consisted of predominantly one factor which captured general apathy. Out of the 13 items, nine loaded significantly on this single factor which mainly represented the behavioral dimension of apathy. The resulting cognitive factor consisted of 2 items, namely item 4 (S/he is interested in having new experiences) and item 5 (S/he is interested in learning new things) which emphasize intellectual curiosity and can be considered to reflect the cognitive dimension of apathy. The affective factor also consisted of 2 items, namely item 12 (S/he has friends) and item 13 (Getting together with friends is important to her/him) which can be considered to reflect the affective dimension of apathy.

Interestingly, what Marin (1991) considered an affective domain, is most consistent with a social dimension of apathy as the items emphasize interpersonal relationships and the importance thereof. The social domain of apathy was introduced recently in the proposed revised diagnostic criteria of apathy which was compiled by experts from various fields (Robert et al., 2018). Stuss et al (2000) defined apathy as a disorder of initiative, manifesting lack of self-initiated action, which may be affective, behavioral, or cognitive and includes "social apathy" – a disorder of sense of self and social awareness and this is the only definition to date which captures the social dimension of apathy. The current study supports the existence of this dimension as one that is separate from affective apathy.

This finding from the current study that favors a social dimension of apathy over an affective apathy dimension is congruent with recent literature that has called into question the dimensions of apathy identified by Marin (1991). While Marin's conceptualization of apathy as a multidimensional syndrome itself is not the point of contention, literature has scrutinized the three-dimensional model of apathy i.e., affective, behavioral, and cognitive, particularly the evidence for distinct behavioral and cognitive dimensions (Dickson & Husain, 2022).

Dickson & Husain's (2022) critique of classical apathy frameworks highlights that a three-dimension model of apathy was based on observations of patients with neurological conditions (Marin, 1991) as well as insights from cognitive neuroscience and lesion data (Levy & Dubois, 2006) rather than empirical evidence supporting clearly dissociable domains of apathy. Further, the authors argue that Marin's evidence was not sufficient to support a three-dimensional model of apathy as the principal components factor analysis conducted by Marin on all versions of the AES predominantly produced a single factor for the AES which was general apathy.

As mentioned earlier, the initial principal components factor analysis of the AES conducted in the current study also revealed a predominately single factor for the AES which accounted for 47% of the variance. Similarly, the second principal components factor analysis of the AES revealed a predominantly single factor of the AES, which accounted for 50% of the variance. Evidence from other studies reported 2 factors of the AES (clinician and informant versions) that represented general apathy and interest which accounted for approximately 51% and 54% of the total variance respectively (Clarke et al., 2007).

Another consideration that favors a single factor of the AES is the rule that a subscale consists of a minimum of 3 items (Clarke et al., 2007). Considering the results of the current study, the affective and cognitive domains only consisted of 2 items each and do not meet the requirement to be considered subscales. In parallel to other studies, using the rule, the current study supports the shortening of the AES-I to fewer items. Evidence from studies have shown that the AES can be shortened without losing its specificity (Clarke et al., 2007).

Regarding my main aim, which was to investigate the functional correlates and predictors of apathy, I was specifically interested in the relationship between apathy symptoms and cognitive as well as functional deficits. Results from a multiple linear regression investigating whether age, gender, highest level of education, depression, mental status, cognitive deterioration, and capacity to carry out activities of daily living were predictors of apathy, indicated that only depression and capacity to carry out activities of daily living were significant predictors of apathy. In line with my hypothesis, depression was a predictor of apathy in this sample. This finding was also replicated in a study that investigated predictors of apathy in first-episode psychosis and healthy controls (Lyngstad et al., 2020). High baseline depression scores in participants with first-episode psychosis predicted higher apathy scores over the follow-up period (Lyngstad et al., 2020).

These findings can be explained by the common symptoms in apathy and depression. For instance, if a depressed individual is presenting with symptoms of sadness and a loss of pleasure in previously enjoyed activities, one can argue that such symptoms can lead to indifference or apathetic states as the individual's mood negatively impacts their motivation to perform as they previously did.

Symptoms of depression and apathy are so similar that three out of the 15 items on the Geriatric Depression Scale are generally thought to measure apathy (van Wanrooij et al., 2019). The three items, i.e. ("Have you dropped many of your activities and interests?"), ("Do you prefer to stay at home, rather than going out and doing new things?"), and ("Do you feel full of energy?") loaded on a single factor and have been used to assess apathy in various study populations (van Wanrooij et al., 2019). This commonality of symptoms may explain why depression predicts apathy in this sample.

To note, instruments such as the Geriatric Depression Scale have some limitations in that while they are acurately measuring one construct e.g. depression, they are also screening for another, e.g. apathy which would affect investigations about causations and predictions. If individuals are not careful to delineate the items that measure the different constructs, imprecise conclusions are a likely outcome.

To note, separate measures were used to assess apathy and depression in this study and the study which investigated predictors of apathy in first-epsiode psychosis (Lyngstad et al., 2020) therefore the findings are not affected by the limitation of using one instrument to measure mutiple constructs.

There is a lack of literature that aims to address depression as a predictor of apathy. Studies have either investigated whether apathy and depression are independently associated with incident dementia (van Dalen et al., 2018) or whether apathy and depression predict financial capacity in some neurodegenerative conditions (Giannouli & Tsolaki, 2021) while

some studies focus on the role apathy and depression play in predicting capacity to carry out activities of daily living (Green et al., 2021). As a result, it is not possible to compare my findings with those in previous literature.

I also hypothesized that functional impairment would predict apathy in this sample. The findings suggest that impaired capacity to carry out activities of daily living is a predictor of apathy. However, literature points to apathy as a predictor of functional impairment , not vice versa. For example, apathy was found to be a predictor of impairment in carrying out both basic and instrumental activities in a sample of individuals with the behavioral variant of Frontotemporal dementia (Musa Salech et al., 2022).

In another study, researchers examined the unique effects of apathy and depression on cognition and functional independence in a sample of 90 individuals characterized as having amnestic mild cognitive impairment. They found that apathy was associated with greater functional impairment, specifically in instrumental activities of daily living (Zahodne & Tremont, 2013). Similar associations were found between apathy and functional impairment in individuals with Alzheimer's disease (Zhu et al., 2019).

I expected impairment in ability to carry out activities of daily living to predict apathy in this sample because neurological and psychiatric illnesses may impair an individual's functionality which in turn can lead to apathetic states. This argument is relevant specifically to apathy as a symptom where apathetic states occur as a consequence of a disease process and its sequelae, for example, functional impairment .

It can be argued that individuals experiencing functional impairment  are entitled to feeling apathetic to some degree. For instance, an individual who is losing independence of their ability to care for themselves may begin to lose motivation to do activities that require them to interact with others or engage in activities which they previously enjoyed.

I also acknowledge that apathy may indeed predict functional impairment , as reported in previous literature ( Musa Salech et al., 2022; Zahodne & Tremont, 2013; Zhu et al., 2019). Individuals who lack motivation to initiate activities or are uninterested in things may neglect to carry out their basic and instrumental activities of daily living due to their apathetic states. These findings are not just specific to individuals with neurological illnesses as a study found that apathy predicted disability in non-demented older adults which would negatively affect their ability to carry out their activities of daily living (Ayers at al., 2017).

There is some consensus in literature regarding the association between apathy and functional impairment . While literature focuses on apathy as a predictor of functional impairment , the findings of this study suggest that functional impairment is a predictor of apathy. More studies are needed to test whether functional impairment predicts apathy. As functional impairment is a common consequence of neurological and psychiatric conditions, it would be useful to target it during interventions and rehabilitation so that it does not produce apathetic states which are equally debilitating.

Contrary to what I hypothesized, in this sample, age, gender, and cognitive impairment were not predictors of apathy. Similar to this finding, a study conducted to compare apathy across three types of dementias and explore factors affecting apathy in each type of dementia did not find a statistically significant association between age, gender and apathy (Akyol et al., 2020). Without a significant relationship established, age and gender would not predict apathy.

This was an unexpected finding as other studies have shown that older age and male gender are associated with apathy (Groeneweg-Koolhoven et al., 2017; Jao et al., 2019). Due to these established associations, one would expect that characteristics such as age and gender would predict apathy because the presence of apathy symptoms in an individual cannot predict whether they are male or old, for example.

The association between age, gender, and apathy has also been studied in healthy individuals. For example, a longitudinal study in which researchers aimed to explore the levels, rates, and progression of apathy in heathy older persons found that apathy levels increased over a 5-year period and that the change was more pronounced in the male gender and persons aged 65 and above (Brodaty et al., 2010). Currently the evidence regarding the relationship between age, gender, and apathy is inconclusive.

Regarding the association between apathy and cognitive impairment , the findings suggest that cognitive impairment  is not a predictor of apathy. There is some evidence that suggests that a higher apathy score correlates with a lower MMSE score in Alzheimer's disease (Ishii et al., 2009), dementia (Onyike et al., 2007) and stroke (Starkstein et al., 1993). While I found a negative correlation between apathy and MMSE scores, the correlation was negligible.  This finding is consistent with studies that did not find a correlation between cognitive deficits measured by MMSE scores and apathy across different diagnoses (Aharon-Peretz et al., 2000; Feil et al.,2003; Rosen et al., 2005; Starkstein et al., 1992). These findings may be explained by the MMSE's inability to assess frontal lobe function which apathy is associated with (Ishii et al., 2009).

I had also hypothesized that cognitive deterioration over a one-year period would predict apathy. The results did not support the hypothesis that cognitive deterioration predicts apathy. A plausible explanation for the different finding is that cognitive deterioration was measured over a one-year period. As cognitive impairment can be insidious in different types of dementia (Korczyn, 2002; Nguyen & Lee, 2020), it is possible that mild cognitive impairment does not predict apathy but severe cognitive impairment does. In support of this explanation, although apathy was the predictor variable, researchers tested whether apathy developed in presymptomatic genetic Frontotemporal dementia and its association with

cognitive impairment and found that baseline apathy predicted cognitive impairment over two years (Malpetti, et al., 2021).

I hypothesized that apathy dimensions would predict capacity to carry out acitivities of daily living differently. Considering that the apathy sub-domains identified by Marin (1991) are different from those of the 13-item AES scale derived from the factor analysis, I evaluated both the interaction between Marin's (1991) apathy dimensions on activities of daily living and that of apathy dimensions indentified in this study on activities of daily living.

Firstly, I hypothesized that Marin's (1991) apathy subscales would affect capacity to carry out basic and instrumental activities of daily living differently. Due to a threat of multicollinearity as suggested by high correlations between the apathy subscales and VIF figures in the regression output, the regression models testing this hypothesis were not included in the Results chapter. However, due to the similarities between the findings using Marin's (1991) apathy subscales and the subscales resulting from the 13-item Apathy Evaluation Scale, I briefly discuss those findings for comparative purposes.

The findings suggest that Marin's (1991) apathy subscales affect capacity to carry out basic and instrumental activities of daily living differently. This was supported by multiple regression models where the amount of variance explained in the models for basic and instrumental activities of daily living were different. Secondly, I hypothesized that behavioural apathy is a significant predictor of capacity to carry out basic activies of daily living and that cognitive apathy is a significantly predictor of capacity to carry out instrumental activites of daily living. Interestingly, behavioural apathy was the only signficant predictor across both basic and instrumental activities of daily living. This can be explained by the fact that Marin's (1991) behavioral sub-domain of apathy consists of items that reflect both behavioral and cognitive dimensions of apathy. For example, item 2 (S/he

gets things done during the day) reflects a behavioral dimension of apathy and item 9 (S/he spends time doing things that interst her/him reflects a cognitive dimension of apathy yet both items are clustered under the behavioural sub-domain of apathy.

Similarly, I hypothesized that the subscales resulting from the 13-item Apathy Evaluation Scale predicted capacity to carry basic and instrumental activties of daily living differently. This hypothesis was supported by multiple hierarchical regression models. I also hypothesized that behavioural apathy would significantly predict capacity to carry out basic acitvities of daily living and cognitive apathy would significantly predict capacity to carry out instrumental activities of daily living.

Similar to the results obtained using Marin's apathy subscales, behavioural apathy was the only significant predictor of both basic and instrumental activities of daily living. This finding was only expected for basic activities of daily living. The study hypothesized that cognitive apathy would predict impairment in instrumental activties of daily living given the cognitive demand involved in carrying out such tasks.

A plausible explanation of this finding is that the 13-item AES only had 2 items loading on the cognitive apathy subscale instead of a minimum of 3 items that are considered to make up a subscale. Another explanation of this finding is the suggested inability of the AES to differentiate between behavioural and congitive apathy subscales as discussed by Dickson & Husain (2022). Their investigations suggest that the cognitve subscale is imbedded within the behavioural subscale and that there is a lack of robust evidence that supports the cognitive subscale as a separate subscale of the AES.

**Limitations and directions for future research**

I used a relatively smaller sample size (n = 93) to investigate my main aim which was to determine the functional correlates and predictors of apathy in the sample. This was due to missing data across the variables of interest in the patients' folders. I only had access to the

physical copies of patients' folders and not the electronic database. I did not collect data from all the participant records between the years 2012 and 2022 due to time constraints and a predetermined sample size. This is a threat to the internal validity of this study.

The measures I used in this study were completed based on the subjective information offered by informants on behalf of the patients who presented at the UCT/GSH Memory Clinic. As such, responses on these measures were subject to bias. However, it was appropriate to use the informants' responses as they observe the patients in their natural environments of extended periods of time thereby affording some accuracy in responses.

Most diagnoses of patients were unknown or not recorded in the folders at the time of data collection. As a result, I was unable to investigate the functional correlates and predictors of apathy in specific disease processes and compare these findings between groups. Future research should examine predictors of apathy and its functional correlates in different disease processes so that comparisons may be drawn between groups.

**Summary and Conclusion**

I investigated the predictors of apathy and the factor structure of the Apathy Evaluation Scale in a UCT/GSH Memory Clinic sample. The findings of this study suggest that depression and functional impairment are predictors of apathy. Contrary to what I hypothesized, age, gender, and cognitive impairment did not predict apathy in this sample. Regarding the factor structure of the Apathy Evaluation Scale, the findings supported a three-factor structure of the scale similar to Marin's (1991) factor analysis of the scale. However, instead of the behavioural, cognitive, and emotional subdomains of apathy identified by Marin (1991), the findings suggest that the Apathy Evaluation Scale has behavioural , cognitive and social subdomains.

Regarding predictors of apathy, more research needs to be conducted in this area because literature focuses on apathy as a predictor of disease-related characteristics but gives

minimal attention to the predictors of apathy. It is crucial to examine the predictors of apathy because it is a debilitating condition which impacts the patients' quality of life, amenability to treatment and interventions, likelihood of institutionalization, as well as burden on caregivers.

While there is still contention on the factor structure of the Apathy Evaluation Scale, a three-factor structure of the scale is currently the most supported model. It is unclear what these three factors are as there is evidence for a social subdomain over an emotional subdomain, and preference for a cognitive-behavioural subdomain over the separate behavioural and cognitive subdomains.

Since items on the cognitive subdomain have been shown to be embedded in the behavioural sub-domain, the three apathy subdomains are possibly behavioural, emotional and social subdomains. Moreover, the Apathy Evaluation Scale may be improved by reducing the number of items on the scale down to 13 items, as done in this study. This ensures that items are not loading on more than one subdomain of apathy and that all the items meet the criteria to load on an apathy subdomain. Several studies have used abbreviated versions of the Apathy Evaluation Scale and these versions were shown to maintain good sensitivity and specificity.

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Appendix A: Apathy Evaluation Scale (Informant)

Name: Date:
Informant's name: Relationship:

For each statement, circle the answer that best describes the subject's thoughts, feelings, and activity in the past 4 weeks.

1. **S/he is interested in things**.
   NOT AT ALL SLIGHTLY SOMEWHAT A LOT
   (4) (3) (2) (1)

2. **S/he gets things done during the day.**
   NOT AT ALL SLIGHTLY SOMEWHAT A LOT
   (4) (3) (2) (1)

3. **Getting things started on his/her own is important to him/her.**
   NOT AT ALL SLIGHTLY SOMEWHAT A LOT
   (4) (3) (2) (1)

4. **S/he is interested in having new experiences.**
   NOT AT ALL SLIGHTLY SOMEWHAT A LOT
   (4) (3) (2) (1)

5. **S/he is interested in learning new things.**
   NOT AT ALL SLIGHTLY SOMEWHAT A LOT
   (4) (3) (2) (1)

6. **S/he puts little effort into anything.**
   NOT AT ALL SLIGHTLY SOMEWHAT A LOT
   (1) (2) (3) (4)

7. **S/he approaches life with intensity.**
   NOT AT ALL SLIGHTLY SOMEWHAT A LOT
   (4) (3) (2) (1)

8. **Seeing a job through to the end is important to him/her.**
   NOT AT ALL SLIGHTLY SOMEWHAT A LOT
   (4) (3) (2) (1)

9. **S/he spends time doing things that interest him/her.**
   NOT AT ALL SLIGHTLY SOMEWHAT A LOT
   (4) (3) (2) (1)

10. **Someone has to tell him/her what to do each day.**
    NOT AT ALL SLIGHTLY SOMEWHAT A LOT
    (1) (2) (3) (4)

**11. S/he is less concerned about her/his problems than s/he should be.**

| NOT AT ALL | SLIGHTLY | SOMEWHAT | A LOT |
|---|---|---|---|
| (1) | (2) | (3) | (4) |

**12. S/he has friends.**

| NOT AT ALL | SLIGHTLY | SOMEWHAT | A LOT |
|---|---|---|---|
| (4) | (3) | (2) | (1) |

**13. Getting together with friends is important to him/her.**

| NOT AT ALL | SLIGHTLY | SOMEWHAT | A LOT |
|---|---|---|---|
| (4) | (3) | (2) | (1) |

**14. When something good happens, s/he gets excited.**

| NOT AT ALL | SLIGHTLY | SOMEWHAT | A LOT |
|---|---|---|---|
| (4) | (3) | (2) | (1) |

**15. S/he has an accurate understanding of her/his problems.**

| NOT AT ALL | SLIGHTLY | SOMEWHAT | A LOT |
|---|---|---|---|
| (4) | (3) | (2) | (1) |

**16. Getting things done during the day is important to her/him.**

| NOT AT ALL | SLIGHTLY | SOMEWHAT | A LOT |
|---|---|---|---|
| (4) | (3) | (2) | (1) |

**17. S/he has initiative.**

| NOT AT ALL | SLIGHTLY | SOMEWHAT | A LOT |
|---|---|---|---|
| (4) | (3) | (2) | (1) |

**18. S/he has motivation.**

| NOT AT ALL | SLIGHTLY | SOMEWHAT | A LOT |
|---|---|---|---|
| (4) | (3) | (2) | (1) |

The Apathy Evaluation Scale was developed by Robert S. Marin, M.D. Development and validation studies are described in RS Marin, RC Biedrzycki, S Firinciogullari: “Reliability and Validity of the Apathy Evaluation Scale,” Psychiatry Research, 38:143-162, 1991.

Total score

Appendix B: Bristol Activities of Daily Living Scale (modified)

Instruction: Circle the response that best describe the patient's level of ability to perform that activity. Only one box should be marked for each activity. Where in doubt, choose the level of ability which represents the patient's average performance over the past two weeks.

| | |
|---|---|
| 1. Food | |
| a Selects and prepares food | 0 |
| b Able to prepare food only if ingredients are set out | 1 |
| c Able to prepare food only if shown step by step | 2 |
| d Unable to prepare food | 3 |
| e Not applicable | 0 |
| 2. Eating | |
| a Eats as previously | 0 |
| b Eats appropriately if food is made manageable and/or uses a spoon | 1 |
| c Needs someone to help guide food to mouth | 2 |
| d Needs to be fed | 3 |
| e Not applicable | 0 |
| 3. Drink | |
| a Able to make tea/coffee as previously | 0 |
| b Able to make tea/coffee only if ingredients are set out | 1 |
| c Unable to make tea/coffee only if shown step by step | 2 |
| d Unable to make tea/coffee | 3 |
| e Not applicable | 0 |
| 4. Dressing | |
| a Dresses as previously | 0 |
| b Puts clothes on incorrectly or inappropriately | 1 |
| c Unable to dress self but moves limbs to assist | 2 |
| d Has to be dressed | 3 |
| e Not applicable | 0 |
| 5. Hygiene | |
| a Washes self as previously | 0 |
| b Able to wash self if given soap, towel, and water | 1 |
| c Able to wash self but needs help | 2 |
| d Has to be washed | 3 |
| e Not applicable | 0 |
| 6. Teeth | |
| a Cleans teeth as previously | 0 |
| b Cleans teeth only if given water and toothpaste or gargle | 1 |
| c Able to clean teeth but needs help | 2 |
| d Unable to clean teeth | 3 |
| e Not applicable | 0 |

| | |
|---|---|
| 7. Toilet | 0 |
| a Uses toilet as previously | 1 |
| b Able to use toilet (or bucket) if helped | 2 |
| c Incontinent of urine | 3 |
| d Incontinent of urine and faeces | 0 |
| e Not applicable | |

| | |
|---|---|
| 8. Transfers | 0 |
| a Able to get in/out of a chair as previously | 1 |
| b Able to get in a chair but needs help to get out | 2 |
| c Needs help getting in/out of a chair | 3 |
| d Has to be lifted in/out a chair | 0 |
| e Not applicable | |

| | |
|---|---|
| 9. Mobility | 0 |
| a Walks independently | 1 |
| b Walks with assistance, i.e., furniture, arm for support | 2 |
| c Uses aid to walk, i.e., cane, frame | 3 |
| d Unable to walk | 0 |
| e Not applicable | |

| | |
|---|---|
| 10. Orientation - Time | 0 |
| a Fully orientated to time/day/date, etc. | 1 |
| b Unaware of time/day/date but seems unconcerned | 2 |
| c Repeatedly asks for the time /day/date | 3 |
| d Mixes up night and day | 0 |
| e Not applicable | |

| | |
|---|---|
| 11. Orientation – Space | 0 |
| a Fully orientated to surroundings | 1 |
| b Orientated to familiar surroundings only | 2 |
| c Gets lost in home, needs reminding where toilet is | 3 |
| d Does not recognize own home | 0 |
| e Not applicable | |

| | |
|---|---|
| 12. Communication | 0 |
| a Able to hold appropriate conversation | 1 |
| b Understands others and tries to respond verbally with gestures | 2 |
| c Can make self understood but has difficulty understanding others | 3 |
| d Does not respond to or communicate with others | 0 |
| e Not applicable | |

| | |
|---|---|
| 13. Telephone | 0 |
| a Uses telephone appropriately | 1 |
| b Uses telephone with help | 2 |
| c Answers telephone but does not make calls | 3 |
| d Unable/unwilling to use telephone | 0 |
| e Not applicable | |

14. Housework/gardening

| | |
|---|---|
| a Able to do housework/gardening to previous standard | 0 |
| b Able to do housework/gardening but not to previous standard | 1 |
| c Limited participation in housework/gardening | 2 |
| d Unwilling/unable to participate in previous housework/gardening activities | 3 |
| e Not applicable | 0 |

15. Shopping

| | |
|---|---|
| a Shops to previous standard | 0 |
| b Only able to shop for 1 or 2 items without a list | 1 |
| c Unable to shop alone, but participates when accompanied | 2 |
| d Unable to participate in shopping even when accompanied | 3 |
| e Not applicable | 0 |

16. Finances

| | |
|---|---|
| a Manages own finances as previously | 0 |
| b Recognizes money values and can sign name | 1 |
| c Does not recognize money values but can sign name | 2 |
| d Unable to sign name or recognize money values | 3 |
| e Not applicable | 0 |

17. Transport

| | |
|---|---|
| a Able to drive, cycle or use public transport independently | 0 |
| b Unable to drive but uses public transport, bike, etc. | 1 |
| c Unable to use public transport alone | 2 |
| d Unable or unwilling to use public transport even when accompanied | 3 |
| e Not applicable | 0 |

Score : Add encircled numbers for 17 activity domains

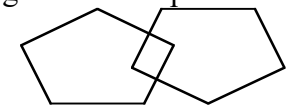
Maximum score: 51 [ ]

Total ‘not applicable’ activities [ ]

Appendix C : Mini-Mental State Examination (MMSE)

Patient's Name: _____ Date: _____

***Instructions: Score one point for each correct response within each question or activity.***

| Maximum Score | Patient's Score | Questions |
|---|---|---|
| 5 | | "What is the year? Season? Date? Day? Month?" |
| 5 | | "Where are we now? State? County? Town/city? Hospital? Floor?" |
| 3 | | The examiner names three unrelated objects clearly and slowly, then the instructor asks the patient to name all three of them. The patient's response is used for scoring. The examiner repeats them until patient learns all of them, if possible. |
| 5 | | "I would like you to count backward from 100 by sevens." (93, 86, 79, 72, 65, …)<br>Alternative: "Spell WORLD backwards." (D-L-R-O-W) |
| 3 | | "Earlier I told you the names of three things. Can you tell me what those were?" |
| 2 | | Show the patient two simple objects, such as a wristwatch and a pencil, and ask the patient to name them. |
| 1 | | "Repeat the phrase: 'No ifs, ands, or buts.'" |
| 3 | | "Take the paper in your right hand, fold it in half, and put it on the floor."<br>(The examiner gives the patient a piece of blank paper.) |
| 1 | | "Please read this and do what it says." (Written instruction is "Close your eyes.") |
| 1 | | "Make up and write a sentence about anything." (This sentence must contain a noun and a verb.) |
| 1 | | "Please copy this picture." (The examiner gives the patient a blank piece of paper and asks him/her to draw the symbol below. All 10 angles must be present and two must intersect.)<br>  |
| 30 | | TOTAL |

Appendix D: Cornell Scale for Depression

Instruction: Tick the appropriate box for each item

| | Unable to evaluate (U) | Absent (0) | Mild or Intermittent (1) | Severe (2) |
|---|---|---|---|---|
| A. Mood-related signs | | | | |
| 1. Anxiety (anxious expression, ruminations, worrying) | | | | |
| 2. Sadness (sad expression, sad voice, tearfulness) | | | | |
| 3. Lack of reactivity to pleasant events | | | | |
| 4. Irritability (easily annoyed, short-tempered) | | | | |
| B. Behavioral disturbances | | | | |
| 5. Agitation (restlessness, hand-wringing, hair pulling) | | | | |
| 6. Retardation (slow movements/ speech / reaction) | | | | |
| 7. Multiple physical complaints (score 0 if GI symptoms only) | | | | |
| 8. Loss of interest (less involved in usual activities; score only if changed occurred acutely, i.e. in less than one month) | | | | |
| C. Physical signs | | | | |
| 9. Appetite loss (eating less than usual) | | | | |
| 10. Weight loss (score 2 if greater than 2 kilos in one month) | | | | |
| 11. Lack of energy (fatigues easily, unable to sustain activities; score only if change occurred acutely, i.e. in less than one month) | | | | |

| | Unable to evaluate (U) | Absent (0) | Mild or intermittent (1) | Severe (2) |
|---|---|---|---|---|
| D. Cyclic Functions | | | | |
| 12. Diurnal variation of mood (symptoms worse in the morning) | | | | |
| 13. Difficulty falling asleep (later than usual for this individual) | | | | |
| 14. Multiple awakenings during sleep | | | | |
| 15. Early morning awakening (earlier than usual for this individual) | | | | |
| E. Ideational disturbance | | | | |
| 16. Suicide (feels life is not worth living, has suicidal wishes, or makes suicide attempts) | | | | |
| 17. Poor self-esteem (self-blame, self-deprecation, feelings of failure) | | | | |
| 18. Pessimism (anticipation of the worst) | | | | |
| 19. Mood-congruent delusions (delusions of poverty, illness or loss) | | | | |

Score: Add the number received for each item.
Score < 6 : Absence of depressive symptoms
Score > 10 : Probable major depression
Score > 18 : Definite major depression

Maximum Score: 38 ☐

Total unable to evaluate: ☐

Appendix E: Deterioration Cognitive Observee (DECO)

Instruction: Say to the relative: We would like you to tell us how your relative was a year ago. The following questions ask about a number of everyday situations. We would like you to tell us whether in these situations he/she is doing about the same, not as well, or much worse than a year ago.

Tick the appropriate box for each item.

| | Better or about the same | Not as well | Much worse |
|---|---|---|---|
| 1. Does he/she remember as well as before which day of the week and which month it is? | | | |
| 2. When he/she goes out of the house, does he/she know his/her way as well as before? | | | |
| 3. Have there been changes in his/her ability to remember his/her own address or telephone number? | | | |
| 4. In the house, does he/she remember as well as before where things are usually kept? | | | |
| 5. And when an object is not in its usual place, is he/she capable of finding it again? | | | |
| 6. In comparison with a year ago, how well is he/she able to use household appliances (washing machine, etc.…)? | | | |
| 7. Has his/her ability to dress and undress changed at all? | | | |
| 8. How well does he/she manage his/her money, for example, doing the shopping? | | | |
| 9. Apart from difficulties due to physical problems, has there been a reduction in his/her activity level? | | | |
| 10. How well can he/she follow a story on television, in a book or told by someone? | | | |
| 11. And writing letters for business or to friends; does he/she do this as well as a year ago? | | | |
| 12. How well does he/she recall a conversation you had with him/her a few days ago? Has this changed over the past year? | | | |
| 13. And if you remind him/her of this conversation, does he/she still have difficulty remembering it in comparison to a year ago? | | | |
| 14. Does he/she forget what he/she wanted to say in the middle of a conversation? Has this changed over the past year? | | | |
| 15. In a conversation, does he/she sometimes have difficulty finding the right word? | | | |
| 16. In comparison with a year ago, how well does he/she recognize the faces of people he/she knows well? | | | |
| 17. And how well does he/she remember the names of these people? | | | |
| 18. In comparison with a year ago, how well does he/she remember other details concerning people he/she knows well; where they live, what they do? | | | |
| 19. Over the past year, have there been changes in his/her ability to remember what has happened recently? | | | |

Appendix F: Ethical Approval

**UNIVERSITY OF CAPE TOWN**


Department of Psychology

University of Cape Town  Rondebosch 7701 South Africa

Telephone (021) 650 3417

Fax No. (021) 650 4104

31 January 2023

Katlego Sebolai

Department of Psychology

University of Cape Town

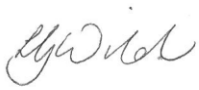
Rondebosch 7701

Dear Katlego

I am pleased to inform you that ethical clearance has been given by an Ethics Review Committee of the Faculty of Humanities for your study, *An investigation of the dimensionality of apathy symptoms***.** The reference number is PSY2022-050.

I wish you all the best for your study.

Yours sincerely



Lauren Wild (PhD)

Associate Professor

Chair: Ethics Review Committee