ANALYSIS OF DEPRESSIVE SYMPTOMS AND COGNITIVE IMPAIRMENT IN RESIDENTS USING THE interRAI-LTCF IN A LONG-TERM CARE FACILITY IN THE CAPE METROPOLE IN SOUTH AFRICA.

Linda Mayer

Student number: 2613325

Submitted in fulfilment of the degree Magister Nursing at the School of Nursing,

University of the Western Cape, South Africa

Supervisor: Prof. J.A. Chipps

Co-supervisor: Prof. H. Julie

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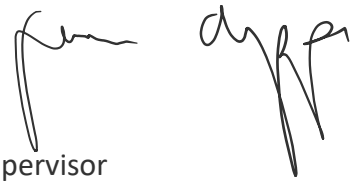
DECLARATION

I, Linda Mayer declare that this thesis entitled: “Analysis of depressive symptoms and cognitive impairment in residents using the interRAI in a long-term care facility in the Cape Metropole in South Africa”, is my own work and has not been submitted for any other degree or examination in any other university other than the University of the Western Cape. I have given complete acknowledgement to the resources referred to in the study.

……. November 2018

Ms. L. Mayer

(Student Number: 2613325)



Supervisor

Prof Chipps

DEDICATION

This study is dedicated to my loving family: my mother, Mushi, for her endless encouragement, motivation, enthusiasm, and her never-ending belief in me; my IT boffin son, Jason, for his enduring help, motivation, and patience; my creative son, Joshua, for his continual inspiration, love and care; my brother, Raymond, for his support; my uncle Fritz, for his sense of humour, and my adorable cockatiel, Giuseppe.

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ABSTRACT

Worldwide concerns have been raised about the presence and association of depressive symptoms, cognitive impairment, and dementia in older adults (60 years and older), which are often unrecognised and untreated in long-term care facilities (LTCF's). The progression of cognitive impairment to dementia reduces quality of life with negative consequences of physical, mental, and psychosocial health. In many LTCF's internationally, the standardised interRAI system is used to capture depressive symptoms and cognitive impairment. However, there is a fragmentation of systems for making evidence-based decisions to plan and manage care for residents with depressive symptoms, cognitive impairment, and dementia. This study, being the first of its kind in South Africa, addressed this gap, by describing a profile of depressive symptoms and cognitive impairment in residents, and analysing their coexistence, using the interRAI-LTCF in a LTCF in the Cape Metropole in South Africa. A quantitative, descriptive, and analytical cross-sectional secondary data analysis was conducted using the records of all 173 resident's medical records of residents with a last interRAI-LTCF assessment from 2014 and 2016. The objectives were to determine the levels of depressive symptoms and cognitive impairment, and to assess variously associated demographics and clinical variables between depressive symptoms and cognitive impairment of the interRAI-LTCF in residents in a LTCF. Secondary data were analysed, using the IBM Statistical Package for Social Sciences (SPSS) software,

version 25, to test any statistically significant relationship between the extracted variables (Significance was set as $p<0.05$).

The prevalence of possible depression, using the Depression Rating Scale (DRS) of the interRAI-LTCF in the residents in this study was 36.4%, of whom 54.3% had a documented clinical diagnosis of depression. The prevalence of cognitive impairment was 39.3%, using the Cognitive Performance Scale (CPS), of whom 34.1% had a documented clinical diagnosis of cognitive impairment/dementia. There were more females than males with the possibility for depression and cognitive impairment, especially in those who were older than 80 years of age, those without partners, and who had ≤12 years of education. The DRS and the CPS were able to predict the possibility for depression and CI. There is a 55.9% risk of possible depression with CI present as compared to a 23.8% risk of possible depression when CI is not present. That means that people meeting criteria for CI on the CPS are 2.3 times more likely to meet the criteria for possible depression on the DRS. Similarly, there is a 60.3% risk of CI with possible depression present as compared to a 27.3% risk of CI when possible depression is not present. That means that people meeting criteria for possible depression on the DRS are 2.2 times more likely to meet the criteria for CI on the CPS. The logistic regression confirmed the coexistence between depressive symptoms and cognitive impairment.

Keywords/phrases: depression; anxiety; cognitive impairment; interRAI; long-term care facility; depression and cognitive impairment coexistence.

ABBREVIATIONS

AD	Alzheimer's disease
AR	Absolute Risk
CAP's	Clinical Assessment Protocols
CI	Cognitive impairment
CPS	Cognitive Performance Scale
DRS	Depression Rating Scale
DSM-5	Diagnostic Statistical Manual-5th edition
interRAI	International Resident Assessment Instrument
LTCF	Long-Term Care Facility
MCI	Mild cognitive impairment
MRI	Magnetic Resonance Imaging
NPV	Negative Predictive Value
PPV	Positive Predictive Value
RR	Relative Risk
SA	South Africa
Se	Sensitivity
Sp	Specificity
SPSS	Statistical Package for Social Sciences
USA	United States of America

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CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 Introduction

Chapter one covers the background information of depressive symptoms, cognitive impairment (CI) and dementia in older adults (over the age of 60 years) in long-term care facilities (LTCF's), and introduces the International Resident Assessment Instrument – Long-Term Care Facilities (interRAI-LTCF). The problem statement highlights the need to identify and address depressive symptoms and CI in LTCF's in the South African context. The significance of the study is also explained from the perspective of practice, education and research, which focuses on the positive impact of the interRAI in LTCF's. The aim, objectives, questions, and hypotheses are described, within the constructs of the conceptual framework supporting the study. The definition of terms clarifies the terminologies used. Chapter one ends with a brief description of the rest of the chapters and main topics to be discussed.

1.2 Background of the study

There are about 50 million older adults globally with dementia (Alzheimer's Disease International, 2018). This is forecasted to increase to 152 million people by 2050. There is limited information from studies about dementia in Sub-Saharan Africa and SA (South Africa), which vary from 2% to 21.6% (De Jager, Joska, Hoffman, Borochowitz, & Combrinck, 2015; Paddick et al., 2013; Prince et

al., 2013; Ramlall, Chipps, Pillay & Bhigjee, 2013), and 8% to 12% in SA (De Jager, Msemburi, Pepper, & Combrinck 2017). The global population of people with depression is 322 million, with an anticipated increase by 18.4% over the next ten years (World Health Organization, 2017). Out of the total population of 4.6 million people in South Africa who are older than 60 years of age (Stats SA, 2017), 4.6% of South Africans have depressive disorders, with 3.4% having anxiety disorders (World Health Organization, 2017).

The paucity of studies in Africa regarding depression, CI and dementia, highlights further initiatives to empower policymakers and government to initiate national plans and strategies to identify and manage these conditions (Alzheimer's Disease International, 2018; De Jager et al., 2017; Masquelier & Kanté, 2017; Narainsamy, Chipps, & Cassim, 2015; Padayachey, Ramlall, & Chipps, 2017). The following section introduces the interRAI, which is the assessment instrument used in this study to identify depressive symptoms and CI. This is followed by the problem statement.

1.3 The interRAI

The International Resident Assessment Instrument – Long-Term Care Facilities (interRAI-LTCF), is a single and specialised comprehensive tool to evaluate health parameters of residents in LTCF's (The interRAI Organization, 2017). It provides a complete personalised appraisal of care requirements and considers their capabilities, weaknesses and their preferences (Heckman, Gray, & Hirdes, 2013).

This affords the opportunity to structure appropriate person-focused care to residents in LTCF's, through informed decision-making processes (Damián, Pastor-Barriuso, Valderrama-Gama, & de Pedro-Cuesta, 2017; Foebel et al., 2013; Heckman et al., 2013; Morley et al., 2015; Morris et al., 2018; Siu et al., 2016; Ulbricht, Rothschild, Hunnicutt & Lapane 2017). The interRAI supports the continuity of assessments and care, which are measured and compared, to evaluate outcomes of improvement or deterioration across time (Carpenter & Hirdes, 2013; Heckman et al., 2013).

Depressive symptoms of the interRAI-LTCF are evaluated according to the Depression Rating Scale (DRS). CI is evaluated according to the Cognitive Performance Scale (CPS) (Burrows, Morris, Simon, Hirdes, and Phillips, 2000; Morris et al., 2011; Pawłucka, Brzyski, Kubicz, & Szczerbińska, 2016). The DRS and the CPS are performed as part of the interRAI (Morris et al., 2011). DRS scores range from 0-14, with greater scores representing greater levels of depressive symptoms. A cut off score for depressive symptoms is ≥ 3 (Burrows et al., 2000; Pawłucka et al., 2016). CPS scores range from 0-6, with greater scores indicating greater CI. A cut off score for CI is ≥ 2 (Morris et al., 1994; Pawłucka et al., 2016). Seminal studies have determined that the DRS and CPS scores are evaluated according to a computerised algorithm, which calculates the scores against predetermined systems and codes, to delineate different levels of impairment and severity (Morris et al., 1994).

1.4 Problem statement

There is a hypothesised coexistence between depression, cognitive impairment (CI), and dementia in older adults (above 60 years of age) (Brewster, Peterson, Roker, Ellis, & Edwards, 2017; Lebedeva et al., 2017; Li et al., 2017; Millikin et al., 2017; Petersen, 2016; Pink et al., 2015; Riddle et al., 2017). These conditions are often unrecognised and untreated in LTCF's (Abrams et al., 2017; Damián et al., 2017; Ibrahim et al., 2017; Simning & Simons, 2017), with added concerns regarding the increased risk by which depression may lead to dementia (Kaser, Zaman, & Sahakian, 2017; Petersen, 2016).

In many LTCF's internationally, the standardised interRAI system is used to capture depressive symptoms and CI (Kim et al., 2015). However, there is a lack of current legislation in South African LTCF's to standardise assessments to identify and manage these conditions (Department of Justice, 2006). There are many disparate and non-standardised instruments to assess depression and CI (Azulai & Walsh, 2015; Morris et al., 2016), which formative studies have recognised to result in the consequent fragmentation of systems for making evidence-based decisions to plan and manage care for residents with these conditions (Carpenter, 2006; Hirdes et al., 1999; Onder et al., 2012).

The recognition of depressive symptoms and CI in residents in LTCF's, and early implementation of therapeutic and preventative strategies, may facilitate improved outcomes of care, and enhanced physical, cognitive and psychosocial well-being and functioning (Abrams et al., 2017; Damián et al., 2017; Desikan et

al., 2017; Ibrahim et al., 2017; Panza et al., 2018; Pawłucka et al., 2016; Simning & Simons, 2017). This may be achieved by the provision of person-focused care, through informed decision-making processes and appropriate care plans (Damián et al., 2017; Foebel et al., 2013; Heckman et al., 2013; Morley et al., 2015; Morris et al., 2017; Siu et al., 2016; Ulbricht et al., 2017).

Most interRAI studies concentrate on the complete comprehensive physical, functional and psychosocial aspects of the assessment, rather than primarily focusing on the association between depressive symptoms and CI (van Lier et al., 2016). This study, being the first of its kind in South Africa, addressed this gap, by describing a profile of depressive symptoms and CI in residents, and analysing their coexistence, using the interRAI-LTCF in a long-term care facility in the Cape Metropole in South Africa.

1.5 Significance of the study

The significance of the study is the positive impact in which the research findings can add value to practice, education and research.

Practice: The association between depressive symptoms and CI, which this study has determined, will add value to the understanding of the extent of their coexistence in the long-term facility in which this research was conducted. This awareness will inform evidence-based decision making to support care-planning and to personalise the care in response to interventions that are required to manage residents with depressive symptoms and CI. These results will also

inform the medical doctors to make informed decisions about medications in response to the levels of severity and impairment of these conditions. The data of the interRAI will enable the facility to track changes in the improvement or deterioration of depressive symptoms and CI over time, thereby facilitating continuity of care. This will allow the facility to make changes to the provision of care where necessary, should there be no positive response to the interventions initiated.

Education: The sharing of the findings of this study with the facility staff in which this research was conducted, is an opportunity to teach them about how to manage residents with depressive symptoms and CI.

Research: The principal advantage of having used the interRAI tool to identify depressive symptoms and cognitive impairment is the consistency in which the information about these conditions was recorded. This permits comparisons to be made about residents across other international long-term facilities so that the facility can benchmark its quality of care provided to the residents. This sharing of the interRAI data will enable the interRAI Organization to utilise the findings of this study to further their research into depressive symptoms and CI.

The following aim, objectives, questions, and hypotheses clarify the general framework in which the problem statement is embedded.

1.6 The study

1.6.1 Aim of the study

The aim of the study was to describe a profile of depressive symptoms and CI in residents using the interRAI-LTCF in a LTCF in the Cape Metropole in South Africa.

1.6.2 Research objectives and questions

The research objectives followed a coherent approach in addressing the research aim, and to delineate the process for analysing depressive symptoms and CI in residents in a LTCF.

Research objective 1

To determine the levels of depressive symptoms, as recorded in the interRAI-LTCF, in residents in a LTCF.

Research questions:

- What are the frequencies of depressive symptoms of the interRAI-LTCF in residents in a LTCF?
- What is the average depression score of the interRAI-LTCF in residents in a LTCF?
- What are the categories of possible depression of the interRAI-LTCF in residents in a LTCF?

Research objective 2

To determine the levels of cognitive impairment, as recorded in the interRAI-LTCF, in residents in a LTCF.

Research questions:

- What are the frequencies of cognitive impairment of the interRAI-LTCF in residents in a LTCF?
- What is the average cognitive impairment score of the interRAI-LTCF in residents in a LTCF?
- What are the categories of cognitive impairment of the interRAI-LTCF in residents in a LTCF?

Research objective 3

To assess variously associated demographics and clinical variables between depressive symptoms and cognitive impairment of the interRAI-LTCF in residents in a LTCF.

Research questions:

- Is there an association between depressive symptoms of the interRAI-LTCF and various demographics in residents in a LTCF?
- Is there an association between depressive symptoms of the interRAI-LTCF and documented diagnosis of depression and anxiety, and medications for depression and anxiety in residents in a LTCF?

- Is there an association between cognitive impairment of the interRAI-LTCF and various demographics in residents in a LTCF?
- Is there an association between cognitive impairment of the interRAI-LTCF and documented diagnosis of cognitive impairment/dementia, and medications for cognitive impairment/dementia in residents in a LTCF?
- Is there an association between depressive symptoms and cognitive impairment of the interRAI-LTCF in residents in a LTCF?

1.6.3 Null hypotheses

- H_0: There is no association between depressive symptoms of the interRAI-LTCF for various demographics or clinical variables in residents in a LTCF.
- H_0: There is no association between cognitive impairment of the interRAI-LTCF for various demographics or clinical variables in residents in a LTCF.
- H_0: There is no association between depressive symptoms and cognitive impairment of the interRAI-LTCF in residents in a LTCF.

The following section describes the definition of terms, which has been operationalised for this study (Table1).

1.7 Definition of terms

Table 1: Definition of terms

Term	Definition
Cognitive impairment (Mild Neurocognitive disorder)	Evidence of *modest* cognitive decline from a previous level of performance in one or more cognitive domains (complex attention, executive function, learning and memory, language, perceptual-motor, or social cognition), which *does not interfere* with capacity for independence in everyday activities (American Psychiatric Association, 2013). *Operational definition:* In this study, cognitive impairment is based on the CPS of the interRAI-LTCF (C1, C2a, D1, and G1j). A CPS score of ≥ 2 indicates cognitive impairment (Morris et al., 1994). In this study the diagnosis of cognitive impairment is documented in the resident's record.
Dementia (Major Neurocognitive Disorder)	Evidence of *significant* cognitive decline from a previous level of performance, which *interferes with* the capacity for independence in everyday activities (American Psychiatric Association, 2013). *Operational definition:* In this study, a diagnosis of dementia is documented in the resident's record.
Depression/depressive symptom	The presence of sad, empty, or irritable mood, accompanied by somatic and cognitive changes that significantly affect the individual's capacity to function (American Psychiatric Association, 2013). A major depressive disorder lasts for at least 2 weeks, involving clear-cut changes in affect, cognition, and neuro-vegetative functions, and inter-episode remissions (American Psychiatric Association, 2013). *Operational definition:* In this study, a depressive symptom is based on the DRS of the interRAI-LTCF (E1a-g), which describes indicators of depressed, anxious, or sad mood. A score of ≥ 3 indicates depressive symptoms (Burrows et al., 2000). In this study, a diagnosis of depression/anxiety is documented in the resident's record.

Term	Definition
Anxiety	An emotional response to the anticipation of a future threat, which is associated with muscle tension and vigilance, in preparation for future danger, with cautious or avoidant behaviours (American Psychiatric Association, 2013). *Operational definition:* Indicators of depressed, anxious, or sad mood, is included in the DRS above (Burrows et al., 2000). In this study, a diagnosis of anxiety is documented in the resident's record.
interRAI-LTCF (International Resident Assessment Instrument for long-term care facilities.	The interRAI-LTCF assesses and monitors the health status in people with care needs (Morris et al., 2011). Computerised data-driven algorithms of the interRAI-LTCF generate outcome scales, clinical assessment protocols (CAPS's), care planning, and quality indicators (Carpenter & Hirdes., 2013).

1.8 Conceptual framework

1.8.1 The interRAI framework

A conceptual framework of the interRAI system uses the Depression Rating Scale (DRS) and the Cognitive Performance Scale (CPS) (Burrows et al., 2000; Morris et al., 1994; Morris et al., 2011). This framework highlights the association between depressive symptoms of the DRS and CI of the CPS, and the levels of impairment and severity. A cut off score for depressive symptoms of the DRS is ≥ 3 (Burrows et al., 2000). A cut off score for CI of the CPS is ≥ 2 (Morris et al., 1994). The framework was formulated to work within the constraints of the objectives and aim of the research study (Figure 1).

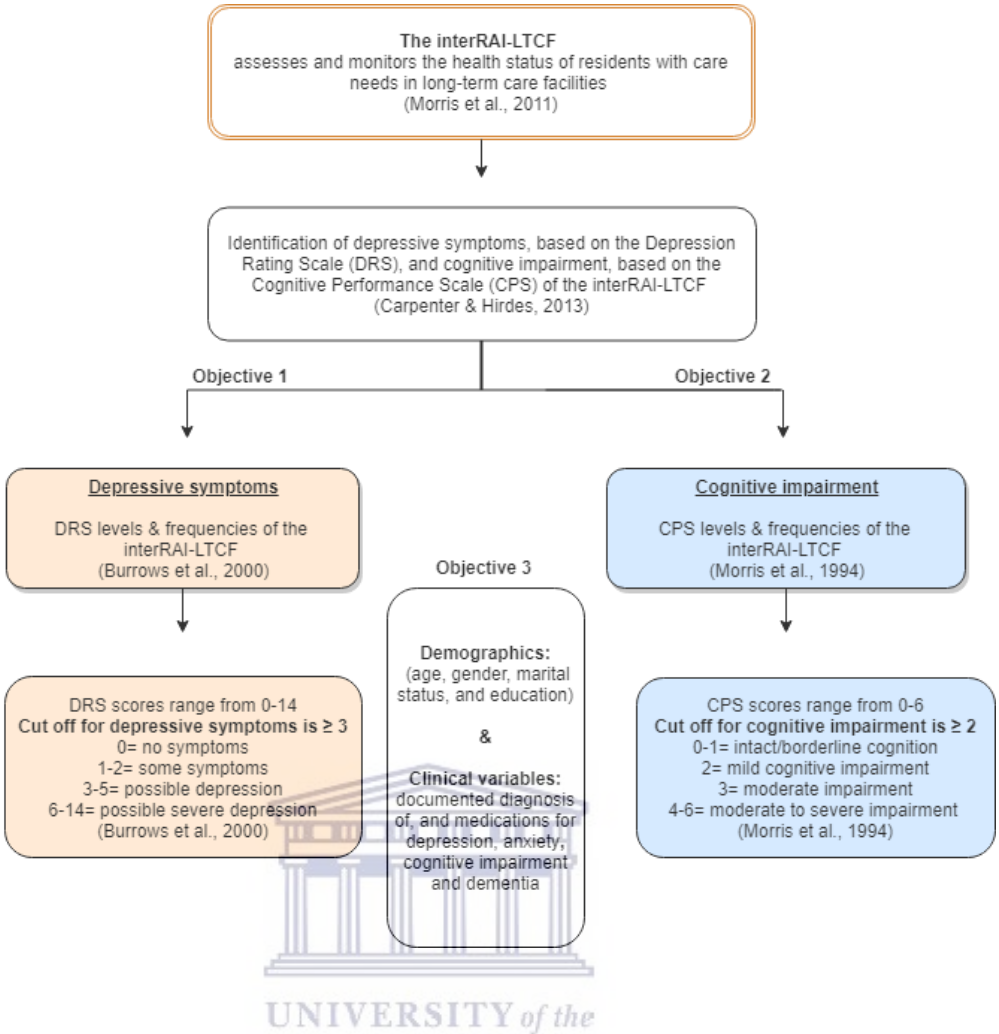


Figure 1: Conceptual framework of the interRAI-LTCF.

1.8.2 Application of the conceptual framework

The application of the conceptual framework followed a tabulated structured approach for easy reference to the study, to describe the theoretical construction against the research objectives, and the application of how these constructs were measured (Table 2).

Table 2: Application of the conceptual framework

Research objectives	Theoretical construction	Application
Objective 1		
To determine the levels of depressive symptoms, as recorded in the interRAI-LTCF, in residents in a LTCF.	The DRS of the interRAI-LTCF is a reliable instrument to assess depressive symptoms in LTCF's, which has been well validated (Burrows et al., 2000).	Measurement of depressive symptoms is based on the DRS of the interRAI-LTCF. *A cut-off score for depressive symptoms is ≥ 3* (Burrows et al., 2000).
Objective 2		
To determine the levels of cognitive impairment, as recorded in the interRAI-LTCF, in residents in a LTCF.	The CPS of the interRAI-LTCF is a reliable instrument to assess CI (Jones et al., 2010), which has been well validated (Morris et al., 1994).	Measurement of CI is based on the CPS of the interRAI-LTCF. *A cut-off score for CI is ≥ 2* (Carpenter & Hirdes, 2013).
Objective 3		
To assess the association between depressive symptoms and cognitive impairment of the interRAI-LTCF for various demographics or clinical variables in residents in a LTCF.	There is a hypothesised coexistence in older adults between depression and cognitive impairment/ dementia (Polyakova et al., 2014).	Frequencies, percentages, average and standard deviation - demographics (age, gender, marital status, and education), or clinical variables (diagnosis of/ medications for depression, anxiety, cognitive impairment or dementia.

1.9 Summary of chapter

Chapter one set out the context of the study, by providing background information of depressive symptoms, CI and dementia, and explained the problem statement. The aim, objectives, questions, and hypotheses were described, within the constructs of the conceptual framework supporting the study. The definition of terms clarified the terminology used. Chapter one

concludes with a brief overview of the rest of the chapters and main topics to be discussed.

1.10 Outline of the thesis

Chapter one: Introduction and background.

Chapter two: Literature review, discussed the key concepts and issues pertaining to depressive symptoms, CI and dementia in older adults, which were investigated, to support the research problem and hypotheses, against the backdrop of the interRAI-LTCF. Opposing viewpoints, controversies and contrary findings were synthesised, to evaluate the salient points of discussion.

Chapter three: Methodology, described the step-by-step methods and procedures used to explain the methodological process supporting the study. This was done in a way that enabled the replicability of the study by future researchers. This included the research setting, research approach, and paradigm, research design, population and sampling. The interRAI instrument was discussed in detail, together with the validity of the DRS and CPS.

Chapter four: Results, presented the research findings of the study.

Chapter five: Discussion, discussed the results of the findings of the study.

Chapter 6: Conclusion and recommendations, discussed the key findings of the study, recommendations, and limitations.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Chapter two begins with an outline of the increase of the older adult population, and the fragmentation of screening for depression, cognitive impairment (CI) and dementia within South African norms and standards. The interRAI system is described from an organisational and practical perspective, with reference to the identification of depression and CI with the DRS and CPS. This is followed by the explanation of cognitive ageing, the brain and cognitive reserve, and episodic and semantic memory. The ensuing literature discusses mild cognitive impairment (MCI), dementia and Alzheimer's disease (AD), depression and anxiety, and depression and CI. This is followed by concluding remarks in the summary of the chapter.

Although the most recent journals have been selected for inclusion in this study, there are a number of seminal studies in journals which are more than five years old. These seminal articles, which included the interRAI, were pivotal by their unique insights into their specific disciplines and fields of expertise, and which helped to shape the background of concepts, constructs, and synthesis of ideas by the authors. Due to the limited published articles on depression and CI of the DRS and CPS of the interRAI in LTCF's, some of those articles reviewed were older than five years.

2.2 The increase of the older adult population

There are currently 962 million people globally who are over the age of 60 years, of whom 68.7 million live in Africa (United Nations, 2017), and 4.6 million live in South Africa (SA), the latter which accounts for 8.1% of the total South African population (STATS SA, 2017). There are about 137 million older adults worldwide over the age of 80 years, which is likely to accelerate threefold by 2050 (United Nations, 2017). In South Africa, more than 492,000 people are above 80 years of age, with nearly three quarters (71.3%) being female (STATS SA, 2017). More than half of South African people (about 58%) over the age of 80 years, are Black Africans; 31.7% are white; 7.2% are coloured; and 3% are Indian/Asian (STATS SA, 2017).

In international and national LTCF's, studies reported that the average age of residents varied between 75-85 years, with the majority being female (66-69%), and living without partners (70-73%) (interRAI New Zealand, 2017; Morris, Berg, Fries, Steel, & Howard, 2013; Neufeld, Freeman, Joling, & Hirdes, 2014; Wellens et al., 2013).

In Sub-Saharan Africa, the rise in population of the elderly is primarily due to low fertility and increased life expectancy (He, Goodkind, & Kowal, 2016; Masquelier & Kanté, 2017). Mortality trends are important markers in establishing the progress of health care, particularly with regard to life expectancy (Masquelier & Kanté, 2017). In Sub-Saharan Africa, mortality levels and trends in older adults are uncertain, as the focus was mainly concerned with maternal and child health,

making projections regarding demographics uncertain (Masquelier & Kanté, 2017). The highest proportion of deaths in South Africa were reported to be among people aged 60-64 years (8%) (STATS SA, 2016). However, a decline was reported in numbers from the age of 59-79 years (7.1%), and 90 years and over (3.7%) (STATS SA, 2016). Furthermore, the majority of male deaths peaked at 60-64 years (8.6%), compared with females, who peaked at 75-79 years (8.3%), and 80-84 years (7.5%). Therefore, older adult females who outlive males will probably be living without partners (United Nations, 2017).

During the preceding twenty years there has been a change in the burden of disease in SA, from communicable (infectious) diseases to non-communicable (chronic) diseases (Mayosi & Benatar, 2014). This has been linked to the rise in the ageing population, and from lifestyle changes, such as reduced exercise and tobacco consumption (Masquelier & Kanté, 2017).

The next section highlights the challenges associated with the fragmentation of screening for depression, CI and dementia in older adults, within the context of norms and standards in South African long-term care facilities (Department of Justice, 2006).

2.3 The fragmentation of screening for depression and cognitive impairment

There are no standardised systems to identify and manage depressive systems and CI in South African LTCF's (Department of Justice, 2006), with the use of many non-uniform and disparate instruments (Azulai & Walsh, 2015; Morris et

al., 2016), which formative studies have recognised to result in the consequent fragmentation of systems for making evidence-based decisions to plan and manage care for residents with these conditions (Carpenter, 2006; Hirdes et al., 1999; Onder et al., 2012). Some assessments used to identify depressive symptoms, such as the Geriatric Depression Scale, and the Cornell Scale for Depression, are long and cumbersome for older adults who have cognitive difficulties (Azulai & Walsh, 2015). Tests to identify CI in LTCF's, such as the Mini-Mental State Examination (MMSE), are reliable and universally recognised (Morris et al., 1994; Wellens et al., 2013); however, it may not be as sensitive as the Montreal Cognitive Assessment (MoCA) (Dong et al., 2012).

2.4 Norms and standards in South African long-term care facilities

The applicability of the interRAI in the international arena, according to the seminal work of Morris et al. (1994), encompasses regulation of LTCF's, and financial reimbursement, resident care, and quality service provision (Morris et al., 1994). However, in the South African setting, there is no regulation from the Older Persons Act (13), 2006, to enforce the introduction and implementation of the interRAI into LTCF's, by which standardised assessments of depressive symptoms and CI can be identified and measured (Department of Justice, 2006), and from which informed decisions can be made about managing residents with these conditions (Kim et al., 2015; Foebel et al., 2013). This Act does stipulate twenty-four-hour nursing support and provision of care to older adults who

require special attention, such as residents with cognitive frailty (Department of Justice, 2006), but it does not have the capacity (minimal state funding) to implement or monitor these norms and standards, other than to provide basic care, food, and shelter (Department of Justice, 2006).

In the South African context, the increasing numbers of the elderly population necessitate changes in policies to cope with the demands for providing health care services (Frisoli, 2016), particularly concerning psychosocial needs (Chipps & Jarvis, 2016). Early screening and interventions to address depressive symptoms and CI in LTCF's, can be achieved with the Depression Rating Scale (DRS) and the Cognitive Performance Scale (CPS) of the International Resident Assessment Instrument (interRAI) – long-term care facility (LTCF) (Burrows et al., 2000; Morris et al., 2011; Pawłucka et al., 2016). The interRAI-LTCF places importance on the well-being of older adults, by promoting decisions for care through clinical assessment protocols, based on computer-driven algorithms, which have been extensively researched (Heckman et al., 2013; Morris et al., 2018).

The interRAI-LTCF was introduced into a South African LTCF in 2013 by Dr Leon Geffen, who is the interRAI fellow, based in the Cape Metropole.

2.5 The interRAI

The interRAI Organization has more than 100 researchers and health/social services professionals from over 35 countries (The interRAI Organization, 2017). It gathers and clarifies data about the health of persons who need care across

different healthcare settings. It implements and evaluates instruments and their related applications, and develops interRAI instruments, which are specific for the setting in which the care is provided (The interRAI Organization, 2017).

2.5.1 The development of the interRAI

The interRAI was initially developed in 1987 in the USA because older adults in LTCF's required a better quality of care than what was provided (Achterberg, van Campen, Pot, Kerkstra, & Ribbe, 1999). The need to structure appropriate care in LTCF's, was incorporated into the development of a standardised, structured, comprehensive and reliable instrument, formally called the Resident Assessment Instrument, to meet the requirements of the Omnibus Reconciliation Act of 1987 (OBRA '87) (Hawes et al., 1997; Morris et al., 1994). This act mandated the regulation of care in all LTCF's in the USA, with computerisation of interRAI information from 1990 onwards (Morris et al., 1994). The act also instructed all LTCF's in the USA to implement the interRAI (and other countries which have been mandated to use the interRAI), and to comply with regulations for the monitoring of care, to participate in research, and, from 1998 onwards, to receive reimbursement from medical aid (Hawes et al., 1997; Morris et al., 1994). As the Resident Assessment Instrument was incorporated into other LTCF's outside of the USA, it has become known as the interRAI - the International Resident Assessment Instrument.

There are three generations of interRAI assessments.

The first-generation instrument: The first instrument used single domain assessments to evaluate specific constructs, namely the MMSE for CI, and the Barthel index for everyday basic tasks, such as bathing and dressing. It was utilised to test the psychometric properties of each construct, for the purpose of evaluating the validity and reliability of each instrument.

The second generation interRAI: This instrument incorporated multi-domain constructs, which were tested in many different settings. The advantage of the second generation interRAI was that it included a comprehensive assessment, which facilitated the introduction of care plans into its algorithm, instead of just focusing on the functioning of particular domains (Carpenter & Hirdes, 2013). In addition, the second generation interRAI enabled the provision for outcome measures and scales, to improve the quality of life of residents in LTCF's (Hirdes et al., 1999).

The third generation interRAI: This instrument is the current one in use, which incorporates many other health care settings, such as home and hospital care (Bernabei, Landi, Onder, Liperoti, & Gambassi, 2008). Whereas the interRAI-LTCF assesses older residents in LTCF's, other health care settings include specific populations which are targeted at the age groups associated with the settings in which the care is provided (The interRAI Organization, 2017).

Standardised systems and protocols were developed for older adults who had similar health concerns and requirements, based on scientific research (Carpenter & Hirdes, 2013; Kim et al., 2015). Morris et al. (1990) stated that all non-uniform assessments should be replaced by the interRAI-LTCF, and it should change the way LTCF's access information to assess residents, for the purpose of integrating data to advise on how care should be provided (Morris et al., 1990). The interRAI was initially commenced in 1990 in all LTCF's in the USA (Carpenter & Hirdes, 2013), which standardised the way in which functional assessments were done (Kim et al., 2015; Morris et al., 1994; Pawłucka et al., 2016).

The interRAI is currently globally operational in more than 35 countries, enabling the identification of the health status of vulnerable, frail or disabled individuals who are in need of care (Carpenter & Hirdes, 2013). International accreditation of the interRAI is attributed to the advance in quality service provision, and Organizational support, to direct policy providers to maintain standardised assessments and methods for care planning (Foebel et al., 2013; Kim et al., 2015). However, the interRAI system not been mandated for the use in South Africa for the purpose of financial reimbursement (Department of Justice, 2006).

2.5.2 The interRAI assessment system

The interRAI assessment system incorporates computerised data-driven algorithms, which generate scales and outcome measures, clinical assessment protocols (CAP's), decision-support, and quality indicators (Carpenter & Hirdes,

2013). Clinical decision support is based on the interpretation of observations and encompasses organising information, planning care, monitoring clinical progress, and re-evaluating care plans (Carpenter & Hirdes, 2013).

2.5.3 Scales and Clinical Assessment Protocols of the interRAI

In the context of this study, scales of the interRAI-LTCF identify the severity in the levels of depressive symptoms of the DRS and CI of the CPS. These scales are incorporated into researched-based, computer-generated algorithms, which rank the scores from the lowest to the highest. Higher scores indicate increased depressive symptoms and CI (Burrows et al., 2000; Morris et al., 2011; Pawłucka et al., 2016). CAP's identify areas where a person is at risk for increased depressive symptoms and CI. CAP's highlight potential areas for improved performance, or areas to either maintain or reduce a decline in functioning (Carpenter & Hirdes, 2013). CAP's clarify the most important issues relating to what care needs can be reasonably achieved (The interRAI Organization, 2017). CAP's point to the most appropriate decisions for care planning, to assist the assessor to explore opportunities to meet the care requirements (Heckman et al., 2013) (See Appendix 4) (Burrows et al., 2000; Carpenter & Hirdes, 2013; Foebel et al., 2013; Morris et al., 2011; Morris et al., 1994), which describes the process of the interRAI system. The provision of quality care, clinical interventions, and supportive services for older adults in LTCF's, is considered to be the cornerstone of health delivery (Hirdes, Mitchell, Maxwell, & White, 2011).

The incorporation of the interRAI into LTCF's has proven that the efficiency of care for residents increased by more than half (Heckman et al., 2013).

2.5.4 The identification of depressive symptoms and cognitive impairment with the interRAI

The Depression Rating Scale (DRS): The DRS identifies residents who may be at risk for depressed, anxious or sad mood (Morris et al., 2011). DRS scores are derived from the observation and reports from caregivers and other sources about the mood state of the resident (Burrows et al., 2000). DRS scores range from 0-14, with a cut-off score for depressive symptoms being ≥ 3 (Burrows et al., 2000; interRAI Corporation, 2016). Increased DRS scores are indicative of more severe depressive symptoms, whereas lower scores indicate less severity (Morris et al., 2011; Neufeld et al., 2014). Residents with DRS scores of 0 do not trigger depressive symptoms. DRS scores of 1 or 2 indicate a medium risk for depression, whereas DRS scores of 3 or more trigger a high probability for depression (interRAI Corporation, 2016; Neufeld et al., 2014; Pawłucka et al., 2016).

The Cognitive Performance Scale (CPS): The CPS was introduced in 1994 in LTCF's in the United States (U.S.) to assess levels of CI (Hartmaier, Sloane, Guess, & Koch, 1994; Jones, Perlman, Hirdes, & Scott, 2010; Morris et al., 2011). CPS scores range from 0-6, with increased scores representing more severe CI. CPS

scores of 0-1 indicate no CI or borderline CI, and CPS scores 2-6 indicate CI (interRAI Corporation, 2016); Morris et al., 1994; Pawłucka et al., 2016).

Cognitive functioning can be better understood through the cognitive ageing theories, cognitive reserve models, and memory systems of the brain.

2.6 Cognitive ageing

Cognitive ageing is concerned with the preservation of cognitive functioning, regardless of pathology in the brain (Cabeza et al., 2018; Chapko, McCormack, Black, Staff, & Murray, 2017). Cognitive functioning is the cornerstone to positive ageing and quality of life, because of its link with functional independence, social connectivity, and positive mood (Castro Rojas, Bygholm, & Hansen, 2018; Cosco, Howse, & Brayne, 2017). The differences in the clinical appearance observed in individuals with varied cognitive pathologies, and how they differ in their coping mechanisms, initiated many studies into how the brain copes with the onslaught of brain damage (Arenaza-Urquijo & Vemuri, 2018; Chapko et al., 2017; Opdebeeck, Martyr, & Clare, 2016).

The following seminal studies present a short summary of the unique insights of the earliest pioneers into cognitive ageing, and brain and cognitive reserve theories, and which include some of the original journal articles which are listed in the references.

The first observations regarding cognitive ageing are recorded as early as the sixth century BC, with greater emphasis being placed on an age-related cognitive decline from the 1930's onwards (Anderson & Craik, 2017). Miles (1933) reported in the 1930's, that the younger adults (less than 60 years of age) showed impairment in motor, perceptual, cognitive functioning and learning (Miles, 1933). Lorge (1940) found that age is not a factor affecting impairment in intelligence, related to the speed at which information is processed in the brain (Lorge, 1940). Rabbitt (1965) reported that there were increased difficulties with avoiding irrelevant information in older adults during task performance (Rabbitt, 1965). Salthouse (1996) reported that changes in some domains of cognitive functioning were affected by age-related alterations in speed processing (Salthouse, 1996). Baltes and Lindenberger (1997) reported that sensory impairment and CI occurred as a result of cerebral changes. Craik & Lockhart (1972) found that the quality of encoding information and its meaning increased memory recall capacity.

Drug and alcohol abuse, poor health and nutrition, and poor sleep hygiene negatively affect the cognitive capacity to withstand physiological/neurological changes in cerebral structures (Vance, Roberson, McGuinness, & Fazeli, 2010). More recent advances in the understanding of cognitive health include better lifestyle choices to improve nutrition, better sleep hygiene, exercise, reduce stress, smoking and alcohol (Bao et al., 2017; Holmquist, Mattsson, Schele, Nordström, & Nordström, 2017; Raichlen & Alexander, 2017; Schaakxs et al., 2017).

Current trends focus on more elaborate neuroimaging and biomarkers, at the earliest stage of CI, so as to identify any pathological changes/neuronal loss in the brain before the presentation of clinical signs and symptoms of dementia (Frisoni et al., 2017; Maass et al., 2017; Park & Festini, 2017). The identification of genetic markers and tracking of gene expression and neurotransmitter actions over time will help to inform new developments in the field of cognitive ageing (Anderson & Craik, 2017; Park & Festini, 2017).

2.6.1 Brain and cognitive reserve

The earliest pioneers in the brain and cognitive reserve studies identified neurophysiological and susceptibility factors which underpin the brain's capacity to sustain pathological cerebral damage before clinical signs and symptoms appear (Satz, Cole, Hardy, & Rassovsky, 2011; Stern, 2003, 2009; Vance et al., 2010). A diagrammatic summary from these former pioneers on the brain and cognitive reserve models are included in the appendix (Appendix 5).

The ageing brain is associated with increased difficulties in performing tasks, due to cognitive decline and reduced processing speed (Kropotov, Ponomarev, Tereshchenko, Müller, & Jäncke, 2016). Task performance is influenced by neural substrates, therefore increased efficiency in utilising brain networks facilitates a better response in retrieving alternative cognitive strategies in response to CI (Darby, Brickhouse, Wolk, & Dickerson, 2017). Brains which are larger are thought to endure greater consequences of clinical brain damage before signs of

clinical CI, as there is enough neural substrate to maintain normal brain functioning (Opdebeeck et al., 2016). However, more efficient interpretation of functional properties of the brain is more recently concerned with patterns of structural connectivity between regions of the brain, rather than brain size, lesion loads and cerebral metabolism (Medaglia, Pasqualetti, Hamilton, Thompson-Schill, & Bassett, 2017).

The efficiency of the brain reserve capacity enables the brain to respond to increased demands, thus maintaining cognitive performance for a longer period during pathological brain changes (Darby, Brickhouse, Wolk, & Dickerson, 2017). Cognitive reserve encompasses a broad perspective of cognitive resources available to respond to demanding tasks, and how efficiently the brain is able to maintain cognitive functioning, and its ability to compensate for cognitive losses (Cabeza et al., 2018; Lavrencic, Churches, & Keage, 2018; Medaglia et al., 2017; Serra, Caltagirone, & Bozzali, 2017). Its construct lies in the brain's capacity to withstand pathological impairment, and to return to its former level of functioning (Summers et al., 2017). Brain reserve is concerned with structural changes in the brain, which include increased neurons and synapses, which facilities increased tolerance of the brain to withstand pathological damage (Darby, Brickhouse, Wolk, & Dickerson, 2017).

A high cognitive reserve is most beneficial in ameliorating symptoms in preclinical dementia, and preserving cognitive performance (Darby et al., 2017; Groot et al., 2018; Lavrencic, Churches, & Keage, 2018). A higher cognitive

reserve has been reported in many studies to be linked to enhanced cognitive functioning (Chapko et al., 2017; Darby et al., 2017; Lavrencic et al., 2018; Soldan, Pettigrew, & Albert, 2018). Higher performing functions of the brain may compensate for deterioration in cognitive functioning by utilising neural processes (Kropotov, Ponomarev, Tereshchenko, Müller, & Jäncke, 2016). Many studies have reported that higher education increases the density of neuronal synapses, thereby increasing cognitive reserve (Cabeza et al., 2018; Gow, Pattie, & Deary, 2017; Kadlec, Dujela, Beattie, & Chappell, 2018; Lavrencic et al., 2018; Thow et al., 2018).

Cognitive reserve revolves around characteristics which facilitate the retention of cognitive functioning, despite damage to the brain (Park & Festini, 2017). It accepts that individuals vary in their capacity to sustain cognitive performance, despite having similar neurocognitive damage (Petrosini, 2017). Individual differences in brain cognitive reserve can determine the point at which people change from intact cognition to impairment in cognitive functioning and dementia, in the normal ageing process and in pathological states (Petrosini, 2017). Individual differences in brain reserve capacity take into consideration how people differ, with respect to age, and the nature and cause of cognitive performance, as well as physiological processes (Salthouse, 2017; Serra et al., 2017). These individual differences are influenced by many factors, including genetic differences, biological makeup, childhood intelligence (IQ), as well as life experiences, which include education, occupation, and recreational, creative and physical activities (Forstmeier & Maercker, 2015; Perry et al., 2017).

Environmental stimuli may increase cognitive performance through increased neuronal connectivity (positive neuroplasticity) (Park & Festini, 2017). These factors are also considered as protective aspects against AD and age-related CI (Perry et al., 2017).

The recognition of the cognitive reserve capacity in individuals clarifies the type of intervention that is most suitable for those who have either low or high reserve functioning (Cespón, Miniussi, & Pellicciari, 2018). Interventions should, therefore, consider whether a person is able to compensate for cognitive losses, by utilising other cognitive resources to complete tasks, or whether other strategies are needed to mobilise cognitive networks (Cabeza et al., 2018).

Interventions to increase cognitive reserve, need to be tailored in accordance with the level of cognitive functioning of the resident, and which may include cognitive, psychosocial (meaningful activities), and physical stimulation (Cespón et al., 2018; Doniger et al., 2018; Park & Festini, 2017; Thow et al., 2018). Cognitively stimulating interventions may improve memory, mood and reduce disabilities associated with CI (Cabeza et al., 2018; Kadlec et al., 2018; Opdebeeck et al., 2016; Yang et al., 2018). Preventive strategies to reduce CI and improve cognitive well-being is paramount in public health initiatives to prevent an adverse decline in physical and psychosocial health (Arenaza-Urquijo & Vemuri, 2018; Cosco, Howse, & Brayne, 2017; Park & Festini, 2017; Soldan et al., 2018). Therefore, national policies to introduce programmes to promote education,

work opportunities, and social and cognitive stimulation, may enhance cognitive reserve (Cosco et al., 2017; Soldan et al., 2018).

Episodic and semantic memory will be the focus of the following discussion.

2.6.2 Episodic and semantic memory

The episodic and semantic memory of the brain are interlinked, as all knowledge must first be gained and learned, while experiences must be understood (Müller et al., 2016).

Episodic memory: This is the retrieval of past events and personal experiences, which include emotions and thought processes, which are time and place specific (Devitt et al., 2017; Nyberg, 2017). The cerebral neocortex and the hippocampus interact with the cortical and subcortical cerebral regions, which enable the encoding and accessing of messages (Nyberg, 2017). Therefore, any changes to these structures, which can be identified on MRI and PET scans, affect episodic memory, which may be one of the first indicators of pre-clinical Alzheimer's disease (Grilli et al., 2018; Nyberg, 2017).

Semantic memory: This is the knowledge gained about the world in general, through culturally learned experiences, which are not time and place specific (Devitt et al., 2017). The knowledge is impersonal in nature and does not include the context of the facts (Devitt et al., 2017). It involves remembering information

that has been learned, but specific facts regarding time and place are not known (Devitt et al., 2017).

In older adults, episodic memory deteriorates, because of cerebral changes, while semantic memory may improve (Meléndez et al., 2018). In older adults with cognitive impairment and dementia, culturally learned experiences, which are not time and place specific, become more relevant than time and place specific retrieval of thought processes (Meléndez et al., 2018). The early detection of impairment in episodic memory enables further tests to be done to elucidate the pre-clinical changes seen in Alzheimer's disease, with preventative strategies to try to preserve cognitive functioning (Grilli et al., 2018; Nyberg, 2017).

The understanding of memory systems of the brain enables specific interventions to be implemented to enhance the memory with cognitive and physical therapies (Nyberg, 2017). Depending on the extent of the deterioration of the episodic memory, interventions may have to be non-time and place specific, which access culturally learned experiences and non-contextualised information (Devitt et al., 2017; Meléndez et al., 2018; Nyberg, 2017).

The following sections describe mild cognitive impairment (MCI) and Alzheimer's disease (AD).

2.7 Mild cognitive impairment

Mild cognitive impairment (MCI) is not a normal feature in ageing, but it is an opportunity to investigate subtle changes in cognitive and functional status at the earliest opportunity (Petersen et al., 2014). According to the American Psychiatric Association (2013), MCI is termed as the mild neurocognitive disorder, which is an impairment in cognitive performance from a prior level of functioning, which does not impair the ability of a person to do basic everyday activities, such as bathing, dressing and eating. MCI is concerned with changes in memory and attention, learning, calculation, decision-making, language, as well as physical and social functioning (American Psychiatric Association, 2013). The estimated existence of MCI in older adults is 15-20%, of whom 8-15% may progress to dementia (Crocco et al., 2018; Knopman & Petersen, 2014; Petersen, 2016).

In the very early stages of MCI, subjective memory complaints of CI by the individual concerned may be of more value in identifying early cognitive changes, than by the informant (Caselli et al., 2014). These subjective memory complaints, including preclinical cerebral changes, may be precursors to preMCI (Crocco et al., 2018). This is a stage before meeting the requirements for MCI, which is an important indicator which increases the possibility to advance to dementia (Crocco et al., 2018). However, in the more advanced stages of a preclinical AD, the informant may be a more reliable respondent in identifying the objective performance of cognitive decline (Caselli et al., 2014).

A diagnosis of preMCI and MCI affords opportunities to review existing medications of residents, which may reduce cognitive performance, especially benzodiazepines, which are used for sleep, anxiety, and depression, as well as pain medication (Knopman & Petersen, 2014).

2.7.1 Subtypes of mild cognitive impairment

MCI subtypes are valuable diagnostic categories, which differentiate the rates at which MCI progresses to dementia (Aerts et al., 2017; Roberts et al., 2014). The two main subtypes will be discussed, namely, the amnestic and non-amnestic MCI.

Amnestic MCI: This presents with a predominant impairment in memory, with a greater likelihood that amnestic MCI may advance to AD (Csukly et al., 2016; Petersen, 2016). Amnestic MCI with multiple cognitive components is the only subtype to confirm that MCI leads to dementia, as well as the speed in which information in the brain is assimilated (Aerts et al., 2017; Göthlin, Eckerström, Rolstad, Wallin, & Nordlund, 2017).

Non-amnestic MCI: This presents with a decline in other areas of cognition, other than memory (Csukly et al., 2016), which may include attention, language, executive and visuospatial deficits (Petersen, 2016). Non-amnestic MCI is usually related to dementia which is not of the Alzheimer's type, such as Lewy Body dementia (Csukly et al., 2016; Yoon, Kim, Moon, Yong, & Hong, 2015).

2.8 Dementia and Alzheimer's disease

Dementia is directly named from the Latin translation, "without mind", as early as the eighteenth century (Cipriani, Dolciotti, Picchi, & Bonuccelli, 2011). Alois Alzheimer was the first person to describe Alzheimer's disease (AD) over one hundred years ago, hence the naming of this disease (Cipriani et al., 2011). AD is a disease of the brain, affecting cerebral structures and neurons, and which has received much attention, particularly concerning individuals at risk (Alzheimer's Association, 2018; Bajpai, Tripathi, Pandey, Dey, & Nehra, 2018). According to the American Psychiatric Association (2013), the term dementia was replaced by a major neurocognitive disorder. In addition, the term mild cognitive impairment (MCI), was changed to a mild neurocognitive disorder. However, for the purpose of this study, a major neurocognitive disorder will be referred to as dementia, and a mild neurocognitive disorder, as MCI. The reasons for maintaining the previous terms of dementia and MCI in this study are because the majority of reported diagnosis of dementia and MCI in the clinical records have not yet been referred to as major or minor neurocognitive disorders.

According to the American Psychiatric Association (2013), dementia is defined as a major neurocognitive disorder, which is classified according to substantial impairment in cognitive functioning when compared to prior functioning. This is concerned with managing the basic tasks of everyday living on their own. The severity of impairment is noted by the following criteria: mild impairment affects the ability of a person to adequately manage more complicated activities, such

as housework and finances; moderate impairment affects the ability of a person to adequately manage basic tasks, such as bathing and dressing; and severe impairment requires full dependence in both complex and basic tasks (American Psychiatric Association, 2013).

An early clinical sign of AD is detected in the impairment of episodic memory (Hirni, Kivisaari, Monsch, & Taylor, 2013), which is considered to be a distinctive feature of AD (El Haj et al., 2016). Other early clinical signs of AD may also include impairment in working memory, sustained attention and executive functioning (Huntley, Hampshire, Bor, Owen, & Howard, 2017). Bessi et al. (2018) reported that problems in tasks relating to long-term memory were seen seven years prior AD (Bessi et al., 2018).

The degree of cognitive functioning is evident in the different subtypes of MCI, which present with diverse attentional deficits and treatment opportunities (Lu, Chan, Fung, & Lam, 2016). The presentation of symptoms of dementia, the progression of AD, and treatment opportunities, depends on the types and stages of dementia.

2.8.1 Types and stages of dementia

The most prevalent type of dementia is AD, which affects 50-75% of older adults (Van Cauwenberghe, Van Broeckhoven, & Sleegers, 2016). Vascular dementia represents 20-30%; Lewy Body dementia at 1.7% to 30.5%, and Frontotemporal dementia at 5% (American Psychiatric Association, 2013). The identification of

clinical characteristics to objectively measure and evaluate biological processes in AD, before the presentation of symptoms, is critical in the understanding of AD (Dubois et al., 2016).

Pre-symptomatic AD: The current interest lies in identifying the preclinical (asymptomatic) stage of AD, with biological and molecular biomarkers of AD pathology (Dubois et al., 2016). This is particularly significant because cognitive changes occur before the presentation of symptoms so that expedient interventions can be implemented (Alzheimer's Association, 2018). A biomarker is a measurable diagnostic parameter which indicates the processes responsible for AD pathophysiological changes (Dubois et al., 2014; Frisoni et al., 2017; Jack & Holtzman, 2013). Biomarkers for AD include amyloid plaque biomarkers, with neuritic plaques and cerebral amyloid angiopathy, and tau biomarkers, with neurofibrillary tangles, both of which may be found together (Jack & Holtzman, 2013). Neuronal loss and loss of neuronal processes signify neurodegeneration (Jack & Holtzman, 2013). MRI (magnetic resonance imaging) is a useful biomarker to detect neuronal loss, protein deposits and functional impairment, and cerebrospinal fluid analysis as a diagnostic measure for AD (Frisoni et al., 2017). Another biomarker test is positron emission tomography, which identifies tau loads in the brain, and which enables early detection and treatment opportunities (Maass et al., 2017).

The cerebral amyloid deposits increase the likelihood for the conversion of the preclinical phase of AD to the symptomatic phase (Burnham et al., 2016).

However, before the formation of plaques, there are alterations in cholesterol and calcium levels, metabolism of phospholipids, mitochondrial changes and decreased bioenergetic functioning (Area-Gomez & Schon, 2017). The first clinical evidence of AD is atrophy in the cerebral cortex (Hirni et al., 2013).

Symptomatic AD: As AD progresses, atrophic changes develop in the cerebral regions of the hippocampus, amygdala, and parietal-temporal-occipital areas (Taoka et al., 2016). This is evident by the formation of neurofibrillary tangles and amyloid deposits, namely apolipoprotein E (El Haj et al., 2016). Amyloid deposits are considered to be the initial and foremost event in the AD pathological cascade (Leal, Landau, Bell, & Jagust, 2017). The manner in which AD is involved in the mechanisms relating to amyloid deposits is unclear (Leal et al., 2017). Amyloid deposits may result from the hippocampal hyperactivity (Leal et al., 2017). Harrington et al. (2017) reported that clinical depressive symptoms had a 4-5 fold increased probability to occur with elevated amyloid plaques in people with a preclinical AD (Harrington et al., 2017).

Neurofibrillary tangles and senile plaques are usually synonymous with AD (El Haj et al., 2016). Previous research by Bateman et al. (2012) reported that amyloid protein deposition and atrophy of the brain may be present 15 years in the cerebrospinal fluid, prior to developing any symptoms of cerebral changes (Bateman et al., 2012). Burnham et al. (2016) confirmed that the existence of these tangles and plaques were present in 50-60% of cognitively normal brains,

thereby validating its presence prior to the development of symptoms (Burnham et al., 2016).

A reduction in the utilisation of glucose in the brain reduces its energy capacity to maintain myelination and neurovascular functioning of the cortical and hippocampal neurons of the brain (Mamelak, 2017). Reduced brain glucose utilisation can occur many years before there are any signs of CI, but which results in pathological changes in the brain over time, which is associated with AD (Mamelak, 2017).

The shrinking of white matter in cerebral structures is present in age-related decline, which affects episodic memory (Bennett et al., 2017), with subsequent loss in information processing speed and executive functioning of the brain, which worsens with progressing age (Habes et al., 2016). Previous studies reported that impairment in episodic memory may occur 10 years prior to any symptomatology, with reduced cognitive functioning as early as 5 years (Bateman et al., 2012).

2.8.2 Risk factors for cognitive impairment and dementia

PreMCI (before the presentation of signs and symptoms of MCI) and MCI are important indicators of cognitive decline, which increases the possibility to advance to dementia (Crocco et al., 2018; Csukly et al., 2016; Knopman & Petersen, 2014). Risk factors for CI and dementia include depression, smoking, alcohol, central obesity, hypertension, obesity, dyslipidaemia, type 2 diabetes,

cardiovascular disease, strokes and cerebral microinfarcts (Alladi & Hachinski, 2018; Baumgart et al., 2015; Ciudin et al., 2017; Gottesman et al., 2017; van Veluw et al., 2017). Cerebral vascular changes in cardiovascular disease accelerate brain ageing, and which may progress to dementia (Wang et al., 2017).

Other contributing factors include females with low education levels, and advancing age (Alladi & Hachinski, 2018; American Psychiatric Association, 2013; Giri, Chen, Yu, & Lü, 2016; Estabrooks, Squires, Hayduk, Cummings, & Norton 2013; Ramlall et al., 2013). In addition, living alone, without partners, and loneliness are also linked with MCI and dementia (Donovan et al., 2017; Gibson & Richardson, 2017; interRAI New Zealand, 2017; Neufeld et al., 2014; Ramlall et al., 2013; Wellens et al., 2013). Other risks include a genetic history of AD, poor physical, psychosocial and cognitive health, reduced mobility and physical inactivity, as well as difficulty with smelling (Alladi & Hachinski, 2018; Hamer, Muniz, Terrera, & Demakakos, 2018; Lipnicki et al., 2017; Rawtaer et al., 2017).

Increased physical activity and healthy lifestyle choices may slow down the decline in neurocognitive functioning in older adults, especially in those at risk for cardiovascular pathology (Blumenthal et al., 2017). Having a good sense of well-being, as well as living in a supportive relationship with a partner, are considered to be protective factors against MCI and dementia (Rawtaer et al., 2017). Because there are multiple associated risk factors in MCI and dementia,

there needs to be a diverse and comprehensive approach to managing CI and dementia (Alladi & Hachinski, 2018; Power et al., 2018).

2.8.3 The global prevalence of dementia and Alzheimer's disease

According to Alzheimer's Disease International (2018), there are a projected 50 million older adults globally with dementia. This is forecasted to increase to 152 million people by 2050. There is an annual global expenditure of a trillion US dollars for dementia care, which is anticipated to double by 2030 (Alzheimer's Disease International, 2018). Despite the projected increase in dementia, many studies have shown an optimistic shift of decline in dementia over the preceding 25 years, particularly in high-income countries, due to healthier lifestyle choices, enhanced medical interventions, and improved cardiovascular care in the treatment of hypertension and hypercholesterolemia (Langa et al., 2017; Prince et al., 2016).

2.8.4 Dementia on the African continent

There is a paucity of information from studies about dementia in Sub-Saharan Africa and SA, with a higher propensity for dementia in the rural regions (De Jager et al., 2015). This may be the result of reduced accessibility to primary health care clinics in the poorer rural communities, unhealthier lifestyle choices and not completing high school education (Alladi & Hachinski, 2018). Malnutrition was also found to be contributing factors towards cognitive

disorders (Pilleron et al., 2015). However, previous studies by Prince et al. (2013) found a lower occurrence of dementia in Sub-Saharan Africa, at 2-4%, compared to 5-5% globally. There are large discrepancies of reported dementia in Sub-Saharan Africa, which varied between 2% to 21.6% (De Jager et al., 2017; Paddick et al., 2013; Ramlall et al., 2013). Paddick et al. (2013) found the greatest variations, at 6.4% to 21.6%, in the prevalence of dementia, in a study of 1,198 older Tanzanian adults in rural Sub-Saharan Africa. Ramlall et al. (2013) reported a prevalence of 7.9% of dementia in 149 residents in five LTCF's in KwaZulu Natal.

De Jager et al. (2017), reported a dementia prevalence of 8% to 12% in a study of 1394 Xosa speaking older adults in a rural setting in SA. Despite the projected rise of dementia in SA, the lack of a national dementia plan suggests that there is a poor awareness of dementia by policymakers, healthcare practitioners, and the community, especially in rural areas (Alzheimer's Disease International, 2018). Community-based projects for dementia care have been developed in Nigeria and Tanzania, which aims to include Zambia, Malawi, and Kenya (Alzheimer's Disease International, 2018)

The following section discusses CI and dementia.

2.9 Cognitive impairment and dementia

Cognitive impairment increases the risk for subsequent decline in cognitive functioning and the development of dementia (Knopman & Petersen, 2014).

2.9.1 The relationship between demographics and mild cognitive impairment and dementia

Age, cognitive impairment and dementia: Increasing age is associated with CI and dementia (De Jager et al., 2017; Power et al., 2018; Ramlall et al., 2013; van der Ploeg, Bax, Boorsma, Nijpels, & van Hout, 2013), primarily because of the higher risk for neurodegenerative and cerebrovascular diseases (American Psychiatric Association, 2013). The American Psychiatric Association (2013) stated that MCI occurred in 2-10% over the age of 65, which increased to 5 to 25% by the age of 85 years. van der Ploeg et al. (2013) reported that dementia increased from 6% in residents aged 65 years to 40% in those older than 90 years of age. With increasing age, there are morphological brain changes from negative neuroplasticity (Bennett et al., 2017; Alladi & Hachinski, 2018). Bennett et al. (2017) reported that in adults who were older than 90 years of age without dementia, white matter changes were not necessarily driven by CI or preclinical signs of dementia.

A typical onset of AD occurs after the age of 65 years, with 2-10% of individuals developing it at a younger age (Van Cauwenberghe et al., 2016). De Jager et al. (2017) reported that, in a study concerning 1394 Xhosa community adults in the Eastern Cape in SA, dementia accelerated with age, from 9.1% to 20% in the different age categories, from 60 years to 85 years. The American Psychiatric Association (2013) reported that dementia occurs within a precise age group (age-related), rather than by the process of ageing itself (ageing-related), which

is demonstrated by the following age groups: 7% for 65-75 years; 53% for 75-84 years; and a levelling off to 40% in the older old (85 years and older). In a study of three community-based cohorts, which examined 1362 autopsies, 44% of those above 89 years of age upon death, had a diagnosis of dementia (Power et al., 2018).

Gender, marital status and MCI and dementia: Females are more likely to present with dementia than males, especially AD, because of the associated comorbidities with increasing age, and the fact that females live longer than males (American Psychiatric Association, 2013; STATS SA, 2016). Therefore, females who outlive males, probably live without partners (United Nations, 2017). Many studies in LTCF's, found that the majority of residents were female (66-69%), and living without partners (70-73%) (interRAI New Zealand, 2017; Neufeld et al., 2014; Ramlall et al., 2013; Wellens et al., 2013).

Living alone without a partner in older adults may cause loneliness, which is a significant factor affecting cognition, because of increased social and emotional isolation and depression (Chipps & Jarvis, 2016; Chipps, Jarvis, & Ramlall, 2017; Donovan et al., 2017). This was evident in a study of 8245 older adults, whereby 54% of those living alone in the community presented with the possibility for dementia (Gibson & Richardson, 2017). Loneliness in LTCF's has been found to vary between 9% in residents who report feeling lonely all the time, to 26%, who felt lonely sometimes (Jansson et al., 2017). Loneliness is related to depression,

poor perception of self-related health, and reduced psychosocial well-being (Jansson et al., 2017).

Education, MCI and dementia: Lower education of fewer than 12 years increases the risk for MCI and dementia (Alladi & Hachinski, 2018; American Psychiatric Association, 2013; Ramlall et al., 2013). The American Psychiatric Association (2013) stated that there are more females than males who have AD, especially in those who have less than 12 years of education. However, as women over the age of 85 years outnumber men at 80% vs 20% (Estabrooks et al., 2013), this may give credence to the aforementioned statement. Ramlall et al. (2013) examined 140 residents in a LTCF in SA and found that 7.9% had dementia and 27.1% had MCI. The authors reported that within this population, 75.7% had less than 12 years of education, with the majority (69.3%) being female, but no connection was found between CI and gender (Ramlall et al., 2013).

Conversely, higher education of more than 12 years was reported to reduce the prevalence of MCI and dementia (Gow et al., 2017; Langa et al., 2017). Langa et al. (2017) added that higher education was related to increased cognitive reserve, which lowered the risk for dementia, from 11.6% to 8.8%. Higher education increases the density of neural synapses in the neocortical region of the brain which may improve cognitive functioning and decrease impairment (Gow et al., 2017). Former studies reported that increased cognitive reserve

capacity utilises neuronal reserve more efficiently and flexibly during cognitive tasks (Satz et al., 2011; Stern, 2002, 2003, 2009).

2.9.2 Cognitive impairment and dementia in long-term care facilities

In LTCF's, mortality is increasing with age, co-morbid disease, and reduced exercise (Navarro-Gil et al., 2014). In determining the different requirements for care needs in residents with and without CI, van der Ploeg et al. (2013) reported that residents with dementia experienced less satisfaction in life than those without dementia, due to unmet psychosocial needs.

2.9.3 The prevalence of cognitive impairment and dementia in long-term care facilities

The average clinical diagnosis of CI and dementia in LTCF's was reported to vary from 40.9% to 70.8% (Björk et al., 2016; De Jager et al., 2017; Estabrooks et al., 2013; Hoffmann, Kaduszkiewicz, Glaeske, van den Bussche, & Koller, 2014; Zimmerman, Sloane, & Reed, 2014). Petersen (2016) estimated the occurrence of MCI in LTCF's to be lower, at 15-20%. The prevalence of CI appeared to be higher in LTCF's than in the community, with CI in the community varying from 2% to 20% (De Jager et al., 2017; Hoffmann et al., 2014; Petersen, 2016). De Jager et al. (2017) reported a prevalence of 2% to 8.5% of dementia cases in the community. Björk et al. (2016) found that 67%, out of a population of 4831 residents, had CI in a Swedish study over 188 LTCF's. This was in sharp contrast to 15-20% of CI, as

seen in the community (Petersen, 2016). Hoffmann et al. (2014) found that 51.8% of over 4584 residents in LTCF's, had dementia, compared to 2.7% in the community. Zimmerman et al. (2014) established from the 2010 US National Survey of LTCF's of over 700,000 assisted living residents, that 29% of residents had MCI, and 42% presented with increased levels of CI.

2.9.4 The identification of cognitive impairment with the interRAI

Many interRAI studies reported high CI in residents in LTCF's, as determined by CPS scores 3-6, which ranged from 56.6% to 73.5% (Gruber-Baldini, Zimmerman, Mortimore, & Magaziner, 2000; Hartmaier et al., 1994; Hartmaier et al., 1995; Morris et al., 1994; van der Steen et al., 2006). Morris et al. (1994), who was the founder of the development of the CPS, reported that an average of 65% of U.S. LTCF's residents, out of a combined multistate sample of 8651 people, showed evidence of CI, according to CPS scores 2-6. Hartmaier et al. (1994) reported that 72.9% of LTCF's residents in North Carolina, out of a sample of 133 people, presented with CI, according to the CPS. In a later study, Hartmaier et al. (1995) ascertained that 73.5% of LTCF's residents in North Carolina, out of a sample of 200 people, had CI with the CPS.

Morris et al. (1994) reported that there was only a 12% agreement for a dementia diagnosis, other than AD, in CPS scores of 0 (intact cognition). There were inconsistencies in the diagnosis of dementia for higher CPS scores (mild to severe CI), which may be due to the limitations of the MMSE to identify severe CI

for the lower MMSE scores. Despite concerns over the sensitivity of the MMSE, it nevertheless reflected an overall good representation of CI with the CPS (Gruber-Baldini et al., 2000; Hartmaier et al., 1995; Paquay et al., 2007). Hartmaier et al. (1995) found that the CPS correlated with MMSE scores to identify CI in a LTCF, with both sensitivity and specificity of 0.94 (Hartmaier et al., 1995). In a later study, Paquay et al. (2007) reported that there was a good association between the CPS and the MMSE in identifying CI in a LTCF, with a sensitivity of 0.81 and 0.97, and a specificity of 0.80 and 0.59, respectively.

In former studies, Gruber-Baldini et al. (2000) concluded that CPS scores moderately correlated with MMSE scores in assessing CI in a LTCF. Gruber-Baldini et al. (2000) reported that 56.6% of LTCF residents in Maryland, out of a sample of 1939 people over 59 LTCF's, presented with CI of the CPS.

Jones et al. (2003) established that in a study of 3,747 residents, over 951 LTCF's, the average CPS scores were 2 in those without dementia, which reflected MCI. In the same study, those residents with dementia had CPS scores of 3.7, which indicated a moderate to severe CI (Jones et al., 2003). Van der Steen (2006) reported that 64.6% of LTCF residents had high CPS scores, indicating severe CI, of whom 83.7% were female, with an average age of 82.7 years.

The CPS has been validated across different settings of health care to assess cognitive performance (Jones et al., 2010). Bartfay et al. (2014) reported higher CI levels in residents in LTCF's, compared to community living, at 29.7% vs 24% (Bartfay et al., 2014). In a later study, Bartfay et al. (2016) reported that

moderate to severe CI, as determined by CPS scores >4, were higher in residents after admission to a LTCF, as compared to older adults who received home care, at 32% vs 13.3%. However, the ability of the CPS to differentiate between mild, moderate and severe CI, compared with the MMSE, is not as accurate in all settings (Wellens et al., 2013). The CPS and the MMSE scores appeared to be generally more consistent in LTCF's (Chodosh et al., 2008; Gruber-Baldini et al., 2000; Hartmaier et al., 1995; Morris et al., 1994; Paquay et al., 2007; Smart, Herrmann, & Lanctôt, 2011), than in acute care hospital settings (Wellens et al., 2013). This may be because the CPS was originally designed for use in LTCF's (Morris et al., 1994).

Residents in LTCF's with depression and CI have been reported to have greater difficulties in managing self-care (Bartfay et al., 2016; Neufeld et al., 2014). In older adults, there is an interrelationship between frailty and depression, with a prevalence of 40.4% (Soysal et al., 2017). The increase in CPS scores was reported in many studies to be directly proportional to higher impairment in physical functioning, with increased dependence in managing the basic tasks of everyday living (Bartfay et al., 2016; Jones et al., 2010; Morris et al., 2016). Yamada et al. (2016) reported that dual sensory impairment, from loss of vision to hearing, increased social isolation, which reduced cognitive performance, as reflected by higher CPS scores.

In former seminal studies, from which the CPS was developed, Morris et al. (1994) understood that loss of independence in how a person eats and drinks is

one of the late loss signs of severe Cl. Many studies reported that there was a correlation between the degree of CI with the CPS, and increased levels of functional disabilities and higher mortality rates (Landi et al., 2001; Morris et al., 2013). McConnell, Pieper, Sloane, & Branch (2002) established that the severity of CI, as reflected by the CPS, increased levels of dependence on activities of daily living over time, without influencing the rate at which CI deteriorates. Carpenter, Hastie, Morris, Fries, & Ankri (2006) established that LTCF residents, who presented with moderate CI, had the highest impairment in managing the basic tasks of everyday living.

Neufeld et al. (2014) reported that impairment in the basic everyday tasks may be related to depression, because of less energy, stamina, and initiative. Studies using the DRS and CPS of the interRAI have shown that more than 90% of residents in LTCF's, out of a total sample of 63,095 people, had depressive symptoms, together with CI and difficulties in managing the basic tasks of living, and 20% presented with daily pain (Neufeld et al., 2014). Morris et al. (2016) reported that 80% of residents were dependent on the basic care by others, with the highest CI seen in residents with full care (those who were not mobile).

The following section focuses on depression and anxiety.

2.10 Depression and anxiety

Clinical depression may be linked to increasing age, but it is not part of the normal process of ageing (Casey, 2017). According to the American Psychiatric

Association (2013), depression in older adults is the second-most prevalent disorder in psychiatry. A depressive disorder includes symptoms of sadness, irritability, and feelings of emptiness, and accompanying somatic and cognitive changes, which can lead to a decline in managing the basic everyday tasks (American Psychiatric Association, 2013). Furthermore, it has a minimum duration of 14 days, with periods of remission in between episodes. A major depressive disorder presents with noticeable variations in cognitive performance, emotional expressions, and general functioning (American Psychiatric Association, 2013).

Older adults are challenged by unique physical, psychosocial and emotional challenges, which will be the focus of the next discussion.

2.10.1 The unique challenges in older adults with depression

Older adults are confronted with unique challenges, which impacts bio-physiological and psychosocial functioning, of which, depression has become a major cause for alarm (McLaren, Ardington, & Leibbrandt, 2014; Narainsamy et al., 2015; Padayachey et al., 2017; Peltzer & Phaswana-Mafuya, 2013; Tomita et al., 2017; World Health Organization, 2017). In older adults, physical complaints (pain, insomnia, loss of weight, poor concentration) often accompany depression, which may the first indicators (Novick et al., 2015). Painful symptoms from chronic disorders, such as arthritis (Peltzer & Phaswana-Mafuya, 2013) may accompany almost half (49%) of depressed individuals (Novick et al., 2015).

In SA, added concerns and unique challenges relate to the HIV and TB epidemics (Meehan et al., 2018), especially for older adults, who have weakened immune systems, which may affect their response to treatment initiatives (Dawood, Hassan-Moosa, Zuma, & Naidoo, 2018). Research has shown that healthcare, socio-economic circumstances, and education affects the subjective well-being of individuals (Ralston, Schatz, Naidoo, & Kowal, 2018), which has been compromised in the South Africa setting, by the remnants of the apartheid era (McLaren et al., 2014).

2.10.2 Risk factors for depression

Negative self-perception and depression may affect cognition, depending on how an individual internalises inner emotions and the environment (Kwak, Yang, & Koo, 2016). There is an increased likelihood for repeated episodes of depression in older adults, especially in those with comorbid conditions (Haigh, Bogucki, Sigmon, & Blazer, 2017). These comorbidities may include diabetes, obesity, cardiovascular disease and cardiovascular and cerebral infarctions (Armstrong et al., 2017; Aziz & Steffens, 2013; Penninx, Milaneschi, Lamers, & Vogelzangs, 2013). Added comorbidities include the metabolic syndrome, which concerns inflammatory processes (Viscogliosi et al., 2013), involving the hypothalamic-pituitary-adrenal axis dysregulation (Penninx et al., 2013). Further risks for depression include poor eating habits, smoking, poor sleeping habits, stress, and insufficient exercise (Holmquist, Mattsson, Schele, Nordström, & Nordström, 2017; Schaakxs et al., 2017). Sleep disorders can result in depression, and

depression may also cause sleep disorders (Bao et al., 2017). Guthrie et al. (2016) added that problems with communicating, as well impairment of eyesight and hearing, also contributed towards depression (Guthrie, Thériault, & Davidson, 2016).

Other risk factors for depression comprise a familial psychiatric history, and early life stressors in childhood, especially in females, where childhood trauma reduces the threshold to stress and depression (Carrière et al., 2017; Saleh et al., 2017). A previous major episode of depression also predisposes to depression in later life (Carrière et al., 2017). Other factors include bereavement, living without a partner, loneliness, poor social support, and reduced social interactions (Aziz & Steffens, 2013; Carrière et al., 2017; Donovan et al., 2017; Narainsamy et al., 2015; Padayachey et al., 2017).

2.10.3 The global prevalence of depression and anxiety

The World Health Organization (2017) reported that the global population of people with depression was 322 million, with an expected increase of 18.4% in the next ten years. Depression is the foremost source of global debility, which equates to 4.4% of the global population (World Health Organization, 2017). The World Health Organization (2017) stated that 264 million people worldwide suffered from anxiety disorders, which has increased by 14.9% from 2005 to 2015. Anxiety disorders are ranked as the 6th cause of global disability, which constitutes 3.6% of the population (World Health Organization, 2017). The global

occurrence of anxiety disorders rose by 36% from 1990 to 2010, to about 272.2 million cases, with similar statistics to that of a major depressive disorder, with an increase of 37%, to 299 million cases during the same time period (Baxter, 2014).

Depression and anxiety disorders result in a considerable loss in health and functioning of people, particularly in view of an estimated 788 000 people worldwide who lost their lives to suicide in 2015 (World Health Organization, 2017). Many studies recognised the coexistence between depression and anxiety, although they differed with respect to the extent to which they occurred together (Baxter et al., 2014). The vast discrepancies in results may be attributed to the increasing size of the population and heightened awareness of depression and anxiety, as well as psychological distress (Baxter et al., 2014). The variability of depression in residents is also influenced by the differences in the methodologies used in studies, as well as the severity of symptoms (Neufeld et al., 2014). Polyakova et al (2014) reported, through a systematic literature review, that minor depression in older adults varied considerably, from 5.2%-18.6%, according to the healthcare environment, physical health, and the diagnostic assessment used. Further, the prevalence of minor depression in primary health care and the community was reported to be 7.7% and 10.4% respectively, and 14.5%, in medical settings (Polyakova et al., 2014). Sharpley, Bitsika, Jesolola, & Agnew (2016) reported that there was a 28.1% probability of a coexistence between depression and anxiety. Kessler et al. (2015) stated that

there was a 45.7% lifetime coexistence between a depressive disorder and anxiety in a population sample of 74045 people.

2.10.4 Depression on the African continent

In the World Health Organization region of Africa, there were 29.19 million people who were reported with depression, which constituted 9% of the global population. On the African continent, there were over 25 million people with anxiety disorders, which comprised 10% of the global population (World Health Organization, 2017). The World Health Organization (2017) reported that depression and anxiety are escalating, especially in lower socio-economic countries, due to the surge of growth, poverty, unemployment, physical illness, and alcohol and drug abuse.

Out of the total population of 4.6 million people in South Africa (Stats SA, 2017), 4.6% of South Africans have been reported to have depressive disorders, with 3.4% having anxiety disorders (World Health Organization, 2017). In SA it is estimated that there was a loss of earnings of $3.6 billion from untreated severe depression and anxiety (Kaminer, Owen, & Schwartz, 2017). Depression in SA was reported to be high in under-resourced communities, at 50.1%, in a study 1008 older adults in eThekwini (KwaZulu-Natal) (Narainsamy et al., 2015), and 40% in a primary health care clinic, involving 300 people (Padayachey et al., 2017). Poor health also increased the odds of severe depression, at 17.1%,

especially with self-reported severe disabilities in 64% of individuals, and 74.2% with malnourishment (Narainsamy et al., 2015).

In Sub-Saharan Africa and in the rural regions of SA, depression is among the main causes of disability, because of the lack of access to health services and treatment, as well as poor economic circumstances (Masquelier & Kanté, 2017). A study in Kwa-Zulu-Natal in SA confirmed that people who lived more than 15kms away from a primary health care clinic, had a greater risk for developing depression, than those who lived within a 6km radius (Tomita et al., 2017). This is especially relevant in remote rural settings in SA, whereby limited access to health care is still reminiscent of the apartheid era (pre-1994), where the majority of healthcare funding was allocated to the white minority group (McLaren, Ardington, & Leibbrandt, 2014).

2.10.5 The relationship between demographics and depression

Age and depression: Increasing age is linked to poorer physical functioning and psychosocial well-being (Giri et al., 2016; Rock, Roiser, Riedel, & Blackwell, 2014). Many studies agreed on the reported increase of depression in older adults above 60 years of age, especially in those over the age of 80 years (Shao, Xu, & Pan, 2017; Zivin, Pirraglia, McCammon, Langa, & Vijan, 2013). Early life stressors and trauma in childhood have been associated with depression in older adults (Frodl & O'Keane, 2013).

Gender and depression: Females have been reported to have a higher predisposition to depression than males (Neufeld et al., 2014; Padayachey et al., 2017; Shao et al., 2017; Sung, 2014), with a reported ratio of 18:12 (American Psychiatric Association, 2013). In LTCF's there are more females than males, particularly over 85 years of age, with depressive symptoms, according to the DRS, ranging from 66.3% to 76.4% (Neufeld et al., 2014; Sung, 2014). Padayachey et al. (2017) reported higher depressive symptoms in females than in males, at 77.2% vs 22.8%, in a study of 255 geriatric outpatients in the primary health care sector (Padayachey et al., 2017). Neufeld et al. (2014) had the view that there were more females than males with depression in LTCF's, because of the ease at which they display their emotions. As the DRS involves the observation of mood items, this may well be true. In LTCF's, depression was regarded by nursing staff to be the second most distressing symptom to manage in South African LTCF's (van Wyk, Manthorpe, & Clark, 2016), which will be the focus of the next discussion.

Marital status and depression: Marital status, especially in older adults without partners/family, or social support, have been shown to affect mood (Aziz & Steffens, 2013; Donovan et al., 2017; Narainsamy et al., 2015; Padayachey et al., 2017; Shao et al., 2017). Shao et al (2017) reported that depression was higher in the general population in those people who lived alone (54.7%), compared to living with a spouse (45.6%).

Loneliness is a significant factor affecting cognition, because of increased social isolation (Aziz & Steffens, 2013; Donovan et al., 2017). Poor social support in older adults, especially those without family, was reported in 51.5% of people with depressive symptoms (Narainsamy et al., 2015). Depression was higher in those after the death of a partner (40%); widowhood (56.3%), divorced (50%), and living alone (48.9%) (Padayachey et al., 2017).

Education and depression: Most studies reported that depression is higher in individuals with lower education, of less than 12 years, across the age spectrum, and not specifically related to older adults (Bauldry, 2015; Bracke, Pattyn, & von dem Knesebeck, 2013; Peytrot et al., 2015; Shao, Xu, & Pan, 2017; Shi et al., 2014). Shao et al. (2017) reported a higher depression, at 63.3%, in illiterate people, and 51.4% in those with an elementary school education, compared to 32% of people with a college diploma or higher education. The reasons posited by the aforementioned authors are thought to relate to people with higher education to have increased resources from better jobs, compared to disadvantaged groups, to make more informed decisions regarding healthy living, mental health promotion, and the ability to cope with stress (Bauldry, 2015; Bracke, Pattyn, & von dem Knesebeck, 2013; Peytrot et al., 2015; Shao, Xu, & Pan, 2017; Shi et al., 2014).

2.10.6 Depression in long-term care facilities

The adjustment to a LTCF is influenced by the length of stay, with reported increases of depressive symptoms after a recent admission (Iden, Engedal, Hjorleifsson, & Ruths, 2014). The first twelve months are regarded as the most difficult in terms of adjusting to the new environment, as it is the most emotionally stressful (Yu, Yoon, & Grau, 2016). During the initial stages, there may be a sense of abandonment and a drastic change in the essential aspects of their lives, which may result in shock and tears (Riedl, Mantovan, & Them, 2013).

Residents who stayed for more than twelve months tended to adjust better than those who were more recently admitted (Yu et al., 2016), as psychosocial interventions, and increased social engagement and forming of social relationships enhance self-esteem and quality of life (Davison, Eppingstall, Runci, & O'Connor, 2017; Smit, de Lange, Willemse, Twisk, & Pot, 2016). Neufeld et al. (2014) reported that depressive symptoms increased by 30%, from the first interRAI assessment, compared to a follow-up one. The authors cited a few reasons for this increase, namely, that staff have had time to observe the mood of the residents and the difficulties which residents had in adjusting to a LTCF, particularly if there are poor support systems (Neufeld et al., 2014).

2.10.7 The prevalence of depression in long-term care facilities

The prevalence of depression in LTCF's varied considerably, between 8% to 24%, which may be contributed by comorbidities and CI (Abrams et al., 2017).

Moreover, there is an insufficient training of the staff to recognise depressive symptoms, which may result in the under-diagnosis and under-treatment of depressive symptoms (Abrams et al., 2017; Morris et al., 2016; Ulbricht et al., 2017). The under-recognition of depression may have its routes in the way in which depression has been classified. The American Psychiatric Association (2013) classified depression based on the characteristics of the general population, and not solely related to older adults, and in those in LTCF's (Neufeld et al., 2014).

2.10.8 The identification of depressive symptoms with the interRAI

Burrows et al. (2000), who developed the DRS of the interRAI-LTCF, reported that the DRS compared favourably with other standardised diagnostic assessments in identifying depressive symptoms. Although the DRS reflected higher depressive symptoms than the clinical diagnosis of depression (8-23%), there were also vast differences in identifying depressive symptoms with the DRS, which varied from 20.3% to 42.5%. (Achterberg et al., 2006; Huang & Carpenter, 2011; Martin et al., 2007; Neufeld et al., 2014; Volicer, Frijters, & van der Steen, 2011). Later studies determined that discrepancies in the DRS in identifying depressive symptoms may have reflected an over-representation of the DRS scores (Penny et al., 2016), or an under-diagnosis of depression (Abrams et al., 2017; Morris et al., 2016; Ulbricht et al., 2017). Further, the DRS scores may not always correlate with clinical depression, which may be better represented by residents without CI (Penny et al., 2016).

In earlier studies, Achterberg et al. (2006) reported that more than a third of 562 newly admitted residents to a LTCF, over 65 nursing homes in the Netherlands, had possible depression, at 34.3% (DRS scores 3-14). Martin et al. (2007) reported that the diagnosis of depression may be predicted with DRS scores, and who correctly established that 47.4% of residents without a diagnosis of depression, had DRS scores which did not meet the requirements for possible depression. Moreover, 20.8% of those residents had DRS scores of ≥3 (possible depression) without a clinical diagnosis of depression, which further substantiated the importance of the DRS (Martin et al., 2007). Langlois and Martin (2008) reported that the DRS indicators of sad mood were most represented in the diagnosis of depression.

Although these results give credence to the efficiency of the DRS in identifying depressive symptoms (Burrows et al., 2000), there are contrary studies which dispute its worth (Baller et al., 2009). Baller et al. (2009) identified that the diagnosis of depression may not always be reflected by DRS scores. The reason for this was thought to be that depression may be in remission when the assessment was conducted, or there may be a concomitant advancement in CI, which makes the diagnosis of depression more challenging (Volicer et al., 2011).

Huang and Carpenter (2011) reported that among 499 residents over nine LTCF, 32.3% of those residents presented with possible depression (DRS 3-14). Further, the highest recorded indicator of depressive symptoms was persistent anger with self or others (33.2%), which was present in a third of the residents. This

was followed by sad, pained, or worried facial expression (30.2%), with the least depressive symptom being repetitive health complaints (14.6%), and made negative statements (16.6%) (Huang & Carpenter, 2011). The identification of depressive symptoms with the DRS was found to be especially significant when all the indicators of depressive symptoms were present (Huang & Carpenter, 2011).

Volicer et al. (2011) ascertained that there was a discrepancy between the clinical diagnosis of depression, from medical records, and the DRS criteria for possible depression (DRS scores ≥ 3). This study was performed in eight different LTCF's in the Netherlands, out of a total sample of 1851 residents, which reported that this discrepancy was largely due to the concomitant advancement in CI, which made the diagnosis of depression more challenging. Volicer et al. (2011) established that only 14.4% of residents had a clinical diagnosis of depression, compared to *42.5%* with depressive symptoms of the DRS. Furthermore, only 33.9% of those residents who received antidepressants, were recognised to have depressive symptoms by the DRS.

A clinical diagnosis of depression in older adults was usually synonymous with antidepressants (Joling et al., 2011). Anstey et al. (2007) noticed that depression was reduced in older adults who received antidepressant therapy. In later studies, Neufeld et al. (2014) reported that the DRS reflected an average of 30.4% with depressive symptoms in 48,826 residents in LTCF's, of whom 20%, who had a clinical diagnosis of depression, were not on antidepressants.

Subsequent studies reported that there may be a reduced efficacy in antidepressant response to treatment in older adults, compared to younger people (Haigh, Bogucki, Sigmon, & Blazer, 2017).

The following section focuses on the relationship between depression and CI.

2.11 Depression and cognitive impairment

Depression is a complex and varied disorder of the brain (Davidson, Pizzagalli, Nitschke, & PutnamFerrari & Villa, 2017), which impacts on mood and cognitive functioning (Ferrari & Villa, 2017). There is a hypothesised coexistence between depression, CI, and dementia in older adults (Brewster et al., 2017; Lebedeva et al., 2017; Li et al., 2017; Millikin et al., 2017; Petersen, 2016; Pink et al., 2015; Riddle et al., 2017). However, CI and dementia are not so easily distinguished, as to whether depression is a *prodrome* (early symptom), a *result* (consequence) of CI, or a dementia *risk factor* (Aziz & Steffens, 2017; Brailean et al., 2017; Brewster et al., 2017; da Silva, Gonçalves-Pereira, Xavier, & Mukaetova-Ladinska, 2013; Polyakova et al., 2014; Richard et al., 2013). It should be noted that the American Psychiatric Association (2013) does not allow for the diagnosis of CI or dementia to be made unless there are other psychiatric disorders which may better justify the cognitive deficits, such as major depression.

Studies have suggested that depression is associated with memory problems, reduced concentration, and poor processing speed (Brailean et al., 2017; Richard et al., 2013). During the early stages of CI, there may be additional anxiety and

apathy because of this awareness; however, reduced awareness intensifies apathy, which may, in turn, decrease depression (Jacus, 2017).

Depression and anxiety may be early manifestations in CI and dementia (American Psychiatric Association, 2013; da Silva et al., 2013). The development of early-life depression increases the probability of CI in older adults, because of subsequent repeated episodes of depression (Riddle et al., 2017). Stress and traumatic experiences may precipitate alterations in cognitive neuroplasticity, making a person more vulnerable to depression (Uchida, Yamagata, Seki, & Watanabe, 2018). Saleh et al. (2017) found that there is a link between early life trauma and adult structures of the brain and cognitive functioning, and that evidence of its association with depression differs among individuals. Additionally, childhood stress was reported to be related to a reduced size of the orbitofrontal cortex, with slower processing speed, compared to larger cortical sizes and faster processing speed (Saleh et al., 2017).

Depression in older adults may be associated with the onset of CI and dementia (Lebedeva et al., 2017; Li et al., 2017; Millikin et al., 2017; Riddle et al., 2017), especially with frequent episodes of depression of more than a few months (da Silva et al., 2013; Richard et al., 2013). CI may be associated with moderate to severe depression (Almeida, Hankey, Yeap, Golledge, & Flicker, 2016), particularly when depression develops in older adults (Neufeld et al., 2014). Depression in late life increases with reduced memory functioning (Brailean et al., 2017). Moon et al. (2017) confirmed that the rate at which dementia

progresses is greatly influenced by the presence of depression (odds ratio: 2.63). More specifically, people with MCI, who tested positive for amyloid, were at the greatest risk for conversion to dementia (40.8% vs 19.7%) (Moon et al., 2017).

Gonzales et al. (2017) reported that people with sub-clinical depression (insufficient signs and symptoms), were more highly at risk for CI. Further research by Gonzales et al. (2018) clarified that there was an association between sub-clinical depression and cerebrospinal fluid biomarkers, with heightened risks for developing CI. Impairment in executive functioning (ability to plan and organise tasks) in people with depression in older adults and amnestic MCI, was the highest predictor in determining the advancement to dementia (Liao et al., 2017).

Richard et al. (2013) reported a link between depression, MCI, and conversion to dementia, but that depression did not precede MCI. CI can lead to dementia (Petersen, 2016), and there is a two-fold possibility that depression may occur with dementia (Andreasen, Lonnroos, & von Euler-Chelpin, 2014), and that there is twice the risk for dementia with pre-morbid depression (Pellegrino, Peters, Lyketsos, & Marano, 2013).

As depression increases the risk of CI, and depression may also be an early symptom in CI and dementia, it is a necessity to screen for CI in individuals with depressive symptoms (Aziz & Steffens, 2017).

2.11.1 Depressive symptoms and cognitive impairment of the interRAI

Many interRAI studies reported the presence of depressive symptoms and CI by using the DRS and CPS in residents in LTCF's (Estabrooks et al., 2013; Hirdes, Mitchell, Maxwell, & White, 2011). Hirdes et al. (2011) reported that 50,000 residents in LTCF's, out of a complement of 100,000 older adults over eight Canadian provinces, had dementia. Further, one-third of those residents had the possibility for depression (DRS scores >3), and about a third had CI (CPS scores >2). The authors recognised that older adults with dementia required more complex care, where previous research was limited in its capacity to provide sufficient data to enable person-focused care (Hirdes et al., 2011).

Estabrooks et al. (2013) expanded upon the previous studies of Hirdes et al., (2011), to include national representative samples of residents in LTCF's, rather than limiting the research to provincial levels (Hirdes et al., 2011). Estabrooks et al. (2013) studied a profile of 5196 residents over 30 national urban Canadian LTCF's over four years, in which it was reported that 27.4%-39.8% of the residents had the possibility for depression (DRS scores >3), and 36.1%-41.9% of whom had moderate to severe CI (CPS scores >4). Pawłucka et al. (2016) reported the relationship between CI and depressive symptoms, with 70% of the 290 residents having CI and 33% having depressive symptoms, using the interRAI tool in a LTCF in Poland.

The understanding of the physiological changes which occur in depression highlights the processes involved and their link with CI and dementia.

2.11.2 The neurobiology of depression and cognitive functioning

The physiological origins underlying depression differ with one another, which made it more challenging in previous studies to diagnose depression with biological markers (Fried & Nesse, 2015). However, more recent technological advances have reported that changes in neurophysiological activity and grey matter volume of the brain, from amyloid deposits and neurofibrillary tangles, have been observed on MRI scans in people with depression and AD (Area-Gomez & Schon, 2017; Crary, 2016; Leal, Landau, Bell, & Jagust, 2017). The severity and duration of a major depressive episode have its origins in the presence of limbic and cortical atrophy and reduced hippocampal size, which have also been reported on MRI scans (Uchida et al., 2018).

Smaller hippocampal size has also been reported in many other studies in late-life depression, specifically in the limbic region (the amygdala) of the brain, concerned with the processing of emotions (Frodl & O'Keane, 2013; Geerlings & Gerritsen, 2017; Pink et al., 2017). Depressive symptoms and cerebral vascular disease cause disturbances in the limbic system, thereby affecting mood (van Sloten et al., 2015). Emotional disturbances, including depression and cognitive functioning, have been linked with deterioration in the prefrontal and cerebral orbital cortex (Ferrari & Villa, 2017). This is due to the dysregulation in the neuroendocrine and autonomic nervous systems, which regulate mood (Ferrari & Villa, 2017). Factors which link depressive symptoms and dementia include

amyloid deposits, cerebral inflammation, and alterations in glucocorticoid steroids (Leonard, 2017).

Chronic stress affects the production of hormones in the brain, resulting in depression and CI, with alterations in memory, attention, executive functioning and perception (Chepenik, Cornew, & Farah, 2007; Saleh et al., 2017). This results in low- grade cerebral inflammation, from neuroinflammatory responses and cortisol (Chow et al., 2018; Frodl & O'Keane, 2013; Leonard, 2017). This prevents the hypothalamic-pituitary-adrenal axis feedback control pathway, resulting in reducing brain reserve capacity (Chow et al., 2018; Frodl & O'Keane, 2013; Leonard, 2017). Dysregulation of the hypothalamic-pituitary-adrenal axis is responsible for major depression, because of the relationship between stress and functioning of the brain (Buttenschøn et al., 2017; Frodl & O'Keane, 2013). Abnormalities of the a hypothalamic-pituitary-adrenal axis is believed to be associated with childhood maltreatment and prenatal stress (Frodl & O'Keane, 2013).

2.11.3 The early detection and management of depression and cognitive impairment

As depression and CI in older adults coexist (Polyakova et al., 2014), with the possible progression of CI to dementia (Crocco et al., 2018; Knopman & Petersen, 2014), early identification of depressive symptoms and CI in residents in LTCF's remains a high priority (Li et al., 2017). Pre MCI and the sub-clinical stage of

depression affords opportunities to investigate any underlying risks and contributing factors and to implement prophylactic interventions and treatment (Knopman & Petersen, 2014; Ulbricht et al., 2017). As physical complaints, such as pain, insomnia, loss of weight, and poor concentration, may the first indicators of depression, early treatment of these conditions may help to alleviate depression and improve functional and cognitive status (Novick et al., 2015).

2.12 Summary of chapter

The under-diagnosis and under-treatment of depression and CI in LTCF's (Abrams et al., 2017; Ulbricht et al., 2017), necessitates the early identification of these conditions, with expedient interventions and treatment, to enhance outcomes of health and quality of life of the residents (Morris et al., 2016; Ulbricht et al., 2017). This may be achieved through the provision of person-focused care, appropriate care plans, and informed decision-making processes (Damián et al., 2017; Foebel et al., 2013; Heckman et al., 2013; Morley et al., 2015; Siu et al., 2016; Ulbricht et al., 2017).

Chapter two has laid the foundation for chapter three, in which the methodological process supporting this study, is discussed.

CHAPTER 3: METHODOLOGY

3.1 Introduction

Chapter three describes the step-by-step methods and procedures used to explain the methodological process supporting this study. This is done in a way that enables the replicability. This chapter includes the research setting, research approach and paradigm, research design, and methodology used. The interRAI instrument is discussed in detail, together with the validity of the DRS and CPS. The chapter concludes with ethical considerations.

3.2 Research setting

The setting was a non-profit community-based LTCF in the Cape Metropole, which provided long-term care for Jewish elderly residents, primarily female, between the ages of 61 and 107 years. The facility comprised 214 residents, of whom 146 resided in the cognitively intact section, and 68 residents resided in the Special Care Unit for dementia. The facility offered a broad spectrum of care, based on the physical, psychiatric, and cognitive needs of the residents.

The cognitively intact section was spread over four floors, from the ground floor to the third floor. Residents who required maximum physical care were placed on the third floor, which consisted of more carers to meet their needs. The rest of the floors accommodated residents with moderate physical care needs. Within the cognitively intact section of the facility, there were two pavilions for

residents who were able to afford their own ensuite bathrooms, one of which was on the ground floor, and the other one on the third floor. Residents with psychiatric conditions resided on the psychogeriatric floor, on the second floor of the new wing section, which offered an intimate and caring environment and programme to support their emotional needs.

Residents who were cognitively frail resided over five floors of the Special Care Unit, which was a separate building, but which was joined by an interconnecting indoor bridge from the intact section of the facility. The ground floor comprised the activities section and the dining room, where most of the residents spent their day. The third floor was a closed unit, which cared for residents with behavioural and psychiatric symptoms, associated with advanced dementia. The Special Care Unit consisted of specifically trained carers, who offered specialised care and support for the residents with dementia. Research has shown that dementia care was enhanced, with improved quality of life for the residents when the diagnosis of dementia was known, and appropriate dementia interventions were implemented (Knapp et al., 2014).

3.3 Research approach

The study used a quantitative research approach using a retrospective record review and secondary data analysis. A quantitative approach is a systematic, objective, scientific investigation of data and their relationships, using numerical data (Bryman, 2012). A quantitative research approach was used in this study, to

describe the specific demographic variables (age, gender, marital status and education), and clinical variables (recorded diagnosis of depression, anxiety, and CI/dementia, and medications for depression, anxiety, and CI/dementia, and depressive symptoms and CI for the residents who met criteria for the study by extracting the data from the interRAI-LTCF). Precise measurements of recorded secondary numerical data identified statistical relationships between depressive symptoms and CI, using a structured and validated data-collection instrument of the interRAI-LTCF, from which statistical significance of findings was made.

3.4 Research paradigm

A positivist research paradigm advocates the creation of hypotheses which can be tested, by enabling laws to be assessed and explained through the principle of deductivism (Bryman, 2012). The deductive approach is concerned with research which is focused on the hypotheses, and associations made are deducted from the theory (Bryman, 2012). Deductive reasoning starts with a generalised statement concerning the topic, and through logical arguments, generates a specific conclusion (Walliman, 2011). The justification for using a positivist research paradigm in this study was based on pre-existing knowledge about the theoretical constructs and scientific approaches to depression and CI of the interRAI-LTCF (Chodosh et al., 2008; Gruber-Baldini et al., 2000; Hartmaier et al., 1995; Heckman et al., 2013; Morris et al., 1994; Paquay et al., 2007; Smart, et al., 2011). This paradigm enabled hypotheses to be tested, for the purpose of

analysing and testing any associations between depressive symptoms and CI of the interRAI-LTCF.

3.5 Research design

A quantitative descriptive and analytical cross-sectional retrospective study was used in this study. A research design outlines the plan in which data collection, methodology and analysis are undertaken (Walliman, 2011). The following statistical names explain each component of the methodological process.

3.5.1 Descriptive design

Descriptive research in this study was used to describe the characteristics of residents in a LTCF, that is the frequency with which particular recorded variables occurred. These characteristics and variables consisted of depressive symptoms and CI of the interRAI; the demographic variables (age, gender, marital status and education), and clinical variables (recorded diagnosis of depression, anxiety, and CI/dementia, and medications for depression, anxiety, and CI/dementia, and recorded depressive symptoms and CI of the interRAI-LTCF).

3.5.2 Analytical design

Analytical studies test hypotheses and associations between variables. In this study, the hypotheses concerning the relationship between possible depression and CI of the interRAI-LTCF were described, measured, tested, analysed, and

discussed. The exposure-outcome relationships included residents with possible depression (DRS scores 3-6) and those with no possible depression and those with CI and those with no CI.

3.5.3 Cross-sectional design

A cross-sectional design involves data collection on multiple cases at a single point in time, in order to collect quantitative data on multiple variables, which are then examined to determine associations (Bryman, 2012). In this study, secondary data was collected of cases of depressive symptoms and CI of the interRAI-LTCF in residents in a LTCF, recorded by the assessors at a given point in time, from 2014-2016, which were examined to determine the association between them.

3.5.4 Retrospective design

Retrospective research refers to the investigation of events which have already taken place in a defined population (Cormack, 1991). The researcher is dependent on information which has been recorded by other people, and the accuracy of the information is reliant on the people who recorded it (Cormack, 1991). In this study, depressive symptoms and CI were recorded in the retrospective medical and interRAI records. The researcher was dependent on the accuracy and quality of the data which had already been recorded by the interRAI assessors.

3.5.5 Secondary data

Data are referred to as 'facts or statistics used for reference or analysis' (SA Oxford dictionary, 2002). Secondary data analysis is the analysis of pre-existing data (Koziol & Arthur, 2011). This may, on the one hand, save time and money, but may potentially lack depth, as the methods used to collect the data may be unclear (Koziol & Arthur, 2011). In this study, pre-existing recorded data from the interRAI and medical records were used to capture depressive symptoms and CI.

Secondary data extraction saves time and money (Koziol & Arthur, 2011), as information is readily available and accessible on the interRAI and internal intranet systems. Variables are not able to be manipulated, in that the values cannot be changed to determine the outcomes of the manipulation (Walliman, 2011). There is a uniform data collection process across the spectrum of facilities (Hartmaier et al., 1995), with more efficient training for staff in the understanding and coding of the data, thereby reducing errors (Gruber-Baldini, et al., 2000; Landi et al., 2000). In this study, the interRAI assessors have been trained extensively in the collection and processing of the data.

Disadvantages of secondary data extraction include that the data collected by the assessors rely on observations as a means for collecting data (Walliman, 2011), which may not be reliable. The researcher lacks control over secondary data, as the data were collected by someone else (Koziol & Arthur, 2011). Secondary data may potentially lack depth, and information regarding the study design and data collection procedures may not be readily available (Koziol &

Arthur, 2011). In this study, the training of the assessors in the data collection process minimises any potential errors.

3.6 Research methods

3.6.1 Population

The target population in the LTCF in which the research was conducted, were English speaking older adult residents, between the ages of 60 and 107 years, who have had their last interRAI assessment done from 2014 to 2016 (*n*=173) (Table 3).

Table 3: Demographic profile of the residents (*n*=173)

Demographics	Total (*N* =173) *N* (%)
Age group	
Older old (80 - 107 yrs)	110 (63.6%)
Younger old (61 - 79 yrs)	63 (36.4%)
Gender	
Females	126 (72.8%)
Males	47 (27.2%)
Marital status	
Married	26 (15%)
Never married/separated/ divorced/widowed	147 (85%)
Education	
≤ 12 years education	118 (68.2%)
>12 years education	51 (29.5%)

3.6.2 Sampling

All-inclusive sampling of the records of all 173 residents, who have had their last interRAI-LTCF assessment from 2014 and 2016, were done. The records included both medical records (diagnosis of depression, anxiety, CI and dementia and medications for depression, anxiety, CI and dementia) and interRAI-LTCF (DRS and CPS) records. The records are referred to as residents in the rest of the report.

3.6.3 The instrument

The instrument for the study was an Excel spreadsheet with coding of the DRS and the CPS, ID number, length of stay, location, assessment number, and demographic variables (age, gender, marital status, and education), as well as the clinical diagnosis of depression, anxiety, and CI/dementia, and medications received for these conditions (Appendix 1). The DRS and CPS was used to capture the secondary data which was collected routinely in the LTCF using the interRAI-LTCF. The interRAI-LTCF is a standardised minimum assessment for clinical use (Kim et al., 2015; Morris et al., 2011). The items on the assessment examines the functional capacity and psychosocial functioning of residents in a LTCF. There are 19 domains on the interRAI-LTCF, which encompass all the components of the interRAI assessment (Figure 2), of which depressive symptoms and CI comprised part thereof.

The items on the interRAI-LTCF which concerned *cognitive impairment* of the Cognitive Performance Scale (CPS) included *cognitive skills for daily decision making; short-term memory; making self understood;* and *eating.* The items which concerned *depressive symptoms* of the Depression Rating Scale (DRS) included *made negative statements; persistent anger with self or others; expressions, including nonverbal, of what appear to be unrealistic fears; repetitive health complaints; repetitive anxious complaints/concerns (non-health related); sad, pained, or worried facial expressions; and crying, tearfulness.*

The evaluation of depressive symptoms and cognitive impairment (CI) were performed by the interRAI assessors in conjunction with all the other domains on the interRAI-LTCF, from which automated, computerised algorithms were generated. For the purpose of this study, references will only be made to the DRS and CPS domains of the interRAI records.

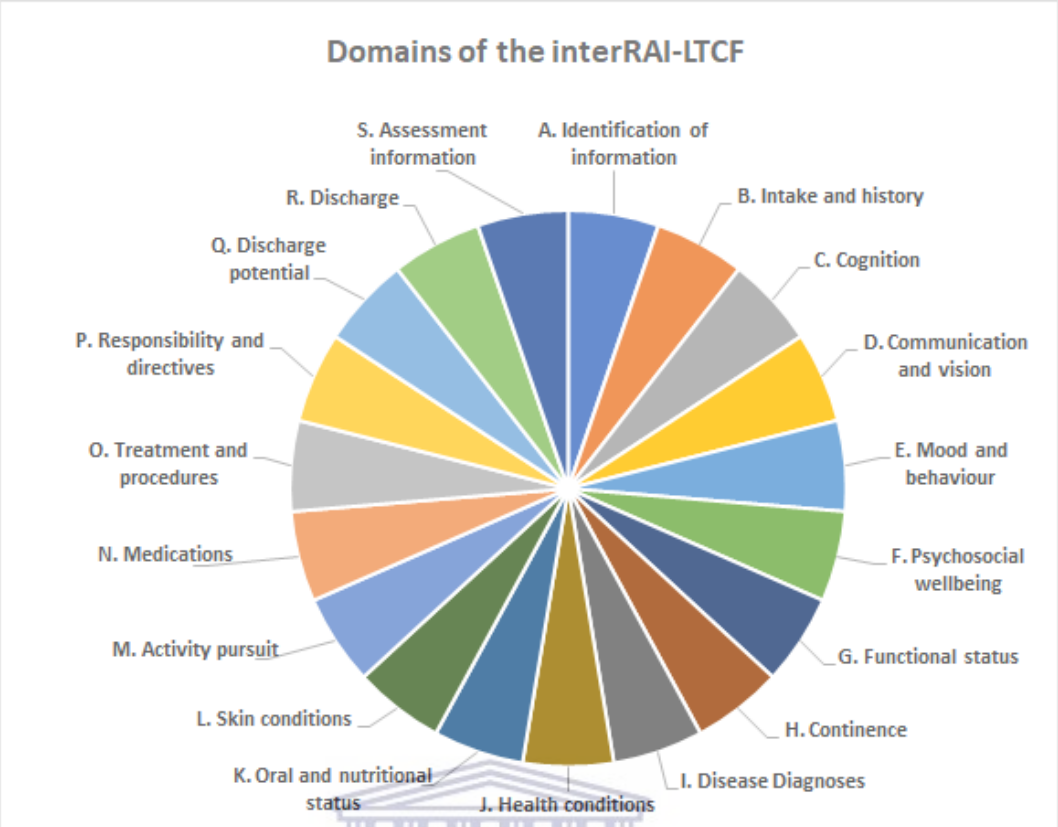


Figure 2: Diagrammatic representation of the domains of the interRAI-LTCF.

3.6.4 The CPS of the interRAI-LTCF

The frequencies of CI were determined by four items of the Cognitive Performance Scale (CPS) (Figure 3).

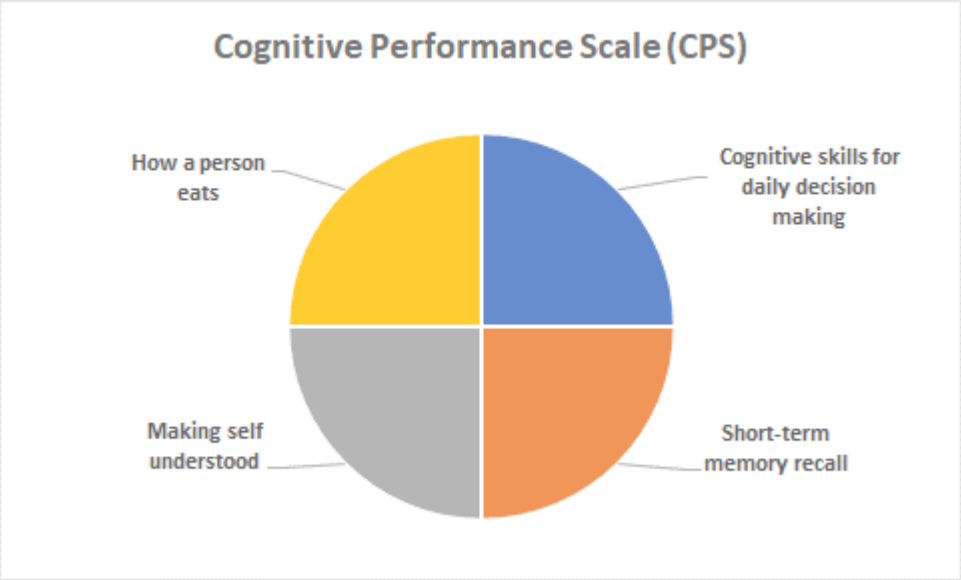


Figure 3: Diagrammatic representation of the CPS domains.

The CPS identified CI according to a computerised algorithm, which calculated the scores against predetermined systems and codes, to delineate different levels of CI. (Morris et al., 1994). *How a person eats* was only calculated as part of the CPS if cognitive skills for daily decision making were severely impaired (CPS 4 or 5). The reason for including how the person eats and drinks as part of the CPS calculation for severe impairment, was because this aspect of activities of daily living (eating), was lost at a relatively advanced stage of CI. The CPS of the interRAI-LTCF is highlighted below (Table 4), which describes all the items of the CPS and codes for scoring of the levels of severity of CI (Morris et al., 1994).

Table 4: CPS domains and coding of the interRAI-LTCF

Cognition	
	Cognitive skills for daily decision making
	Making decisions regarding tasks of daily living.
	When to get up or have meals; which clothes to wear; activities to do.
Code for scoring	
0	**Independent**
	Decisions consistent, reasonable, and safe
1	**Modified independence**
	Some difficulty in new situations only.
2	**Minimally impaired**
	In specific recurring situations, decisions become poor or unsafe; cues/supervision necessary at those times.
3	**Moderately impaired**
	Decisions consistently poor or unsafe; cues/supervision required at all times.
4	**Severely impaired**
	Never or rarely makes decisions.
5	**No discernable consciousness, coma**
Memory/Recall Ability	
	Short-term memory
	Code for recall of what was learned or known during 5 minutes.
	Ask person directly to repeat back, and to recall all 3 items.
	Seems/appears to recall 3 items after 5 minutes.
Code for scoring	
0	**Memory OK**
1	**Memory problem**

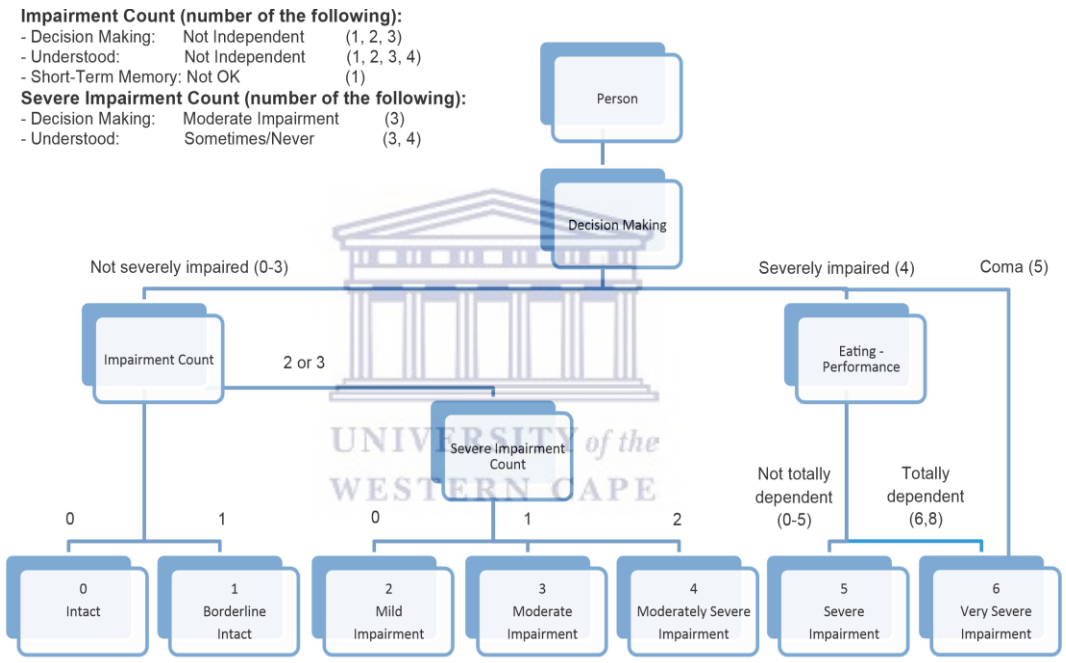
Expressive communication item	
	Making self understood (Expression)
	Expressing information content - verbal and non-verbal.
Code for scoring	
0	**Understood**
	Expresses ideas without difficulty.
1	**Usually understood**
	Difficulty finding words or finishing thoughts; but if given time, little or no prompting required.
2	**Often understood**
	Difficulty finding words or finishig thoughts, and prompting is usually required.
3	**Sometimes understood**
	Ability is limited to make concrete requests.
4	**Rarely or never understood**
Functional Status - eating item	
	Eating
	How a person eats and drinks (regardless of skill). Includes intake of nourishment by other means e.g., tube feeding, or total parenteral nutrition (intravenous).
Code for scoring	
0	**Independent**
	No physical assistance, set up, or supervision in any episode.
1	**Independent, set up only**
	Article or device provided or placed within reach; no physical assistance/supervision in any episode.
2	**Supervision**
	Oversight/cuing
3	**Limited assistance**
	Guided manoeuvring of limbs; physical guidance without taking weight.
4	**Extensive assistance**
	Weight-bearing support (including lifting limbs) by 1 helper.
5	**Maximal assistance**
	Weight-bearing support (including lifting limbs) by 2 + helpers.
6	**Total dependence**
	Full performance by others during all episodes.

3.6.5 Calculation of the CPS scores

Morris et al. (1994) developed the interRAI system to calculate CPS scores, which range from 0-6, with higher scores representing increased levels of CI (Morris et al., 1994; Pawłucka et al., 2016). The *cut-off score for CI is ≥ 2.* The scores have

been categorised into four levels of impairment, as follows: no CI (CPS 0); borderline CI (CPS 1); mild cognitive impairment (MCI; CPS 2), and moderate to severe CI (CPS 3-6). The severity of CPS scores is described below (Figure 4), which highlights the hierarchical structure and coding of the CPS. As figure 4 was copied directly from the source, the references were included within the caption (Morris et al., 1994).

Cognitive Performance Scale



Source: Morris JN, Fries BE, Mehr DR, Hawes C, Philips C, Mor V, Lipsitz L. (1994) MDS Cognitive Performance Scale. Journal of Gerontology: Medical Sciences 49 (4): M174-M182.

Figure 4: Impairment counts of the CPS.

3.6.6 The relationship between the CPS scores and the MMSE

The CPS differentiated between the different levels of cognitive functioning. A CPS score of ≥ 2 corresponded to the Mini-Mental State Examination (MMSE) of

≤ 23/30, which indicated CI (Wellens et al., 2012). However, limitations of the MMSE included a poor indicator of severe CI for the lower scores (Morris et al., 1994). The CPS scores are compared with MMSE scores, as described below (Table 5). This table describes how CPS scores relate to the average equivalent MMSE scores.

Table 5: Relationship between the CPS scores and the MMSE

CPS score	Description	Average MMSE equivalent scores out of 30	Cognitive impairment (MMSE scores ≤ 23/30)
0	Intact cognition	25	No (MMSE ≥ 24)
1	Borderline intact cognition	22	No
2	Mild cognitive impairment	19	Yes (MMSE ≤ 23)
3	Moderate cognitive impairment	15	Yes
4	Moderate/severe cognitive impairment	7	Yes
5	Severe cognitive impairment	5	Yes
6	Very severe cognitive impairment	1	Yes

3.6.7 The DRS of the interRAI-LTCF

The frequencies of the indicators of possible depressed, anxious or sad mood were determined by seven items of the Depression Rating Scale (DRS) (Figure 5).

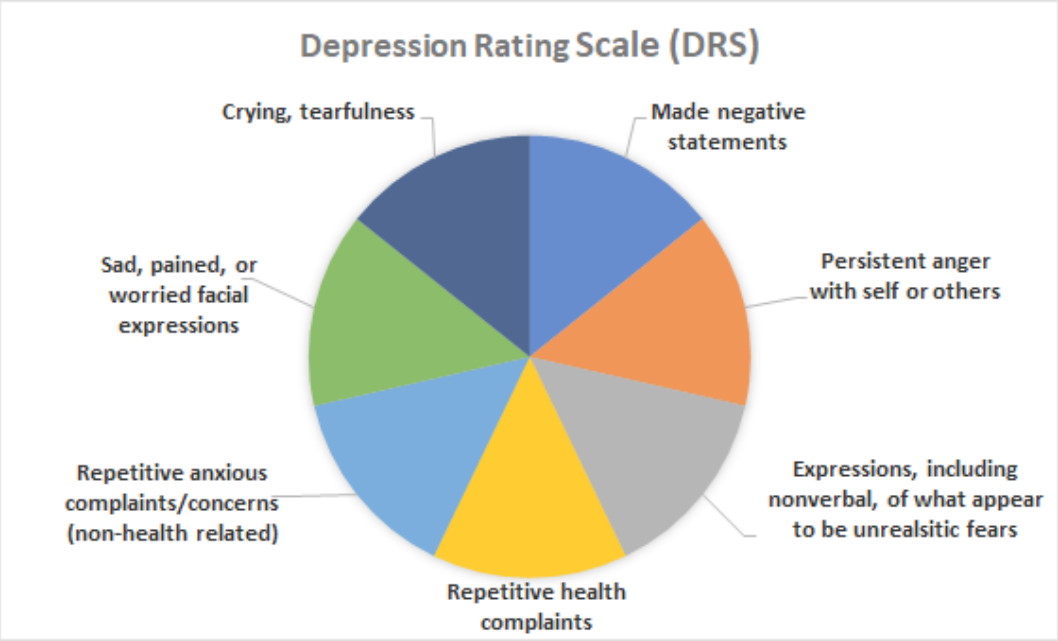


Figure 5: Diagrammatic representation of the DRS domains.

The DRS items on the interRAI-LTCF identified depressive symptoms, according to an automated computerised algorithm, which calculated the scores against set systems and codes (Burrows et al., 2000). The DRS describes all seven items of the DRS and coding levels of the severity of depressive symptoms, from 1-3 (Table 6).

Table 6: DRS domains of the interRAI-LTCF

Indicators of possible depressed, anxious, or sad mood			
Scoring codes for all items			
0	1	2	3
Not present	Present but not exibited in last 3 days	Exibited on 1-2 of last 3 days	Exibited daily in last 3 days
Made negative statements Nothing matters; would rather be dead; what's the use; regret having lived so long; anger at care received			
Persistent anger with self or others Easily annoyed; anger at care received			
Expressions, including nonverbal, of what appear to be unrealistic fears Fear of: being abandoned; being left alone; being with others; intense fear of specific objects or situations			
Repetitive health complaints Persistently seeks medical attention; incessant concern with body functions			
Repetitive anxious complaints/concerns (non-health related) Persistently seeks attention/reassurance regarding schedules, meals, laundry, clothing, or relationships			
Sad, pained, or worried facial expresion e.g., furrowed brow; constant frowning			
Crying, tearfulness			

3.6.8 Calculation of the DRS scores

The DRS scores range from 0-14, with greater scores representing more severe levels of depressive symptoms (Burrows et al., 2000; Pawłucka et al., 2016). A *cut off score for depressive symptoms is ≥ 3.* The DRS scores classified the different levels of severity of depressive symptoms as follows: no symptoms of depression (DRS 0); some symptoms of depression (DRS 1-2); possible depression (DRS 3-5); and possible severe depression (DRS 3-14) (Burrows et al., 2000; Pawłucka et al., 2016) (Table 7).

Table 7: Description of the severity of DRS scores

DRS score	Description
0	No symptoms of depression
1 - 2	Some symptoms of depression
3 - 5	Possible depression
6 - 14	Possible severe depression

The presence of depressed, anxious or sad mood, as well as the number of days in which they were exhibited, were calculated and coded, regardless of how often they were exhibited per day (Table 8).

Table 8: Coding levels of the DRS

DRS code	Severity levels
0	Not present
1	Present, but not exhibited in last 3 days
2	Exhibited on 1-2 of last 3 days
3	Exhibited daily in last 3 days

3.7 Data capturing for the InterRAI and standardisation of data collection

Although this study was a retrospective one, having used secondary data from the interRAI and clinical records, a brief synopsis of the process of gathering the data will be briefly explained. The interRAI-LTCF assessment, version 9.1, is normally conducted over a three-day lookback period by the interRAI assessors, who, during this period, communicated with the resident and familiar caregivers on all the different shifts. Where necessary, the interdisciplinary team and family members were also consulted to validate or clarify information, and clinical

judgement was always used to determine the best responses (Morris et al., 2011).

The process of recording the diagnosis of depression, anxiety, CI and dementia in the medical records included the clinical expertise of medical doctors to diagnose these conditions. However, the diagnostic criteria which were used to make the diagnoses were not always elucidated in the medical records. Some of the records indicated that the diagnosis of depression was made according to the Geriatric Depression Rating Scale scores of >18/30 (Li et al., 2015). Similarly, the diagnosis of CI and dementia were not always elucidated in the medical records. The diagnosis of cognitive impairment did not appear to be made by using any particular diagnostic criteria. Some of the records indicated that the diagnosis of dementia was made according to the Mini-Mental State Examination (MMSE) scores of ≤24/30, and ≤20/30 on the Montreal Cognitive Assessment (MoCA) (Godefroy et al., 2011).

A standardised and uniform data collection process facilitates effective and efficient screening of depressive symptoms with the DRS, and CI with the CPS (Kim et al., 2015; Hartmaier et al., 1995). In this regard, regular and specialist training was conducted for interRAI assessors in the understanding of the philosophical principles, assessment, and evaluation of the interRAI tool (Gruber-Baldini, et al., 2000; Landi et al., 2000). Training was done by local and international trainers, to facilitate reliability and competency in completing the assessment. The assessors communicated regularly with one another about the

assessments, as and when necessary, to confirm or validate findings and/or uncertainties.

3.8 Validity and reliability

The interRAI tool was created in collaboration with many researchers who are experts in their field, together with Organizations who are affiliated with the associated health-related domains (Hirdes et al., 1999). The researchers critically assessed all aspects of the interRAI, including planning guidelines, assessment and treatment protocols (Hirdes et al., 1999). The interRAI-LTCF has established validity and reliability, having been used extensively in many studies and settings (Chodosh et al., 2008; Gruber-Baldini et al., 2000; Hartmaier et al., 1995; Heckman et al., 2013; Morris et al., 1994; Paquay et al., 2007; Smart, et al., 2011; Wellens et al., 2013).

3.8.1 Validity and reliability of the interRAI tool

The accuracy of measurement is directly related to validity and reliability (Muijs, 2011). A valid instrument is reliable, but a reliable instrument does not necessarily mean that it is valid (Hirdes et al., 1999). The interRAI tool was created in collaboration with individual professionals who are experts in their field, as well as related Organizations who are affiliated with the associated health-related domains (Hirdes et al., 1999). These experts critically assessed all aspects of the interRAI, including planning guidelines, assessment and treatment

protocols (Hirdes et al., 1999). The interRAI-LTCF has established validity and reliability, having been used extensively in many studies and settings (Chodosh et al., 2008; Gruber-Baldini et al., 2000; Hartmaier et al., 1995; Heckman et al., 2013; Morris et al., 1994; Paquay et al., 2007; Smart, et al., 2011).

The DRS is a reliable and effective screening tool for depressive symptoms in LTCF's (Burrows et al., 2000). The DRS was tested by other gold standard instruments, including the Cornell Scale for Depression, the Hamilton Rating Scale, the Geriatric Depression Scale, and the Calgary Depression Scale (Burrows et al., 2000; Koehler et al., 2005). It has shown a strong correlation with depression in people who have CI (Koehler et al., 2005).

The CPS is a valid screening tool to assess CI, as tested by other gold standard instruments, including the Mini-Mental State Examination (MMSE) and the Test for Severe impairment (TSI), as well as the Montreal Cognitive assessment and the Global Deterioration Scale (Hartmaier et al., 1994; Jones et al., 2010; Morris et al., 1994; Paquay et al., 2007). The CPS was found to have good correlations between the MMSE and the TSI (Hartmaier et al., 1995; Paquay et al., 2007).

Construct validity: This is concerned with the degree to which one measure or concept correlates with another measure or concept (Muijs, 2011). For example, a depression question correlates with a DSM diagnosis. Construct validity also relates to the internal structure of an instrument and the concept that it is measuring (Muijs, 2011). The interRAI validated the performance of the DRS and CPS against other validated gold-standard measures and constructs, relating to

depression and CI (Burrows et al., 2000; Hartmaier et al., 1994; Jones et al., 2010; Koehler et al., 2005; Morris et al., 1994; Paquay et al., 2007). The concepts of the interRAI ensure that the concepts that relate to each other, are relevantly associated with each other. For example, there is an association between increased behavioural disturbance with increased CI (Hirdes et al., 1999).

Predictive criterion validity: This compares the measures with an outcome, which is assessed at a later point in time (Muijs, 2011) to predict future outcomes (Glenny & Stolee, 2009). This refers to whether or not the instrument predicts the outcomes which one would expect it to (Muijs, 2011). Measures and outcomes of the DRS and CPS can be compared and monitored across time (Hirdes et al., 1999), to predict future outcomes, because of the consistency in which information is recorded (Carpenter & Hirdes, 2013). The interRAI evaluates the capacity to measure adverse outcomes of risks, in order to predict future trends in health-related areas of concern, such as mortality or hospitalisation (Hirdes et al., 1999). This potentially reduces unnecessary suffering and enables a more expedient delivery of service, and the allocation of resources according to the needs of the population group (Hirdes et al., 1999).

Reliability: This is referred to the level in which the recurrent use of a measure yields equal values when no change has occurred (Muijs, 2011). It is an indicator of an instrument's consistency (Glenny & Stolee, 2009). Reliability refers to the degree to which the interRAI tool produces stable and consistent results, which are free of measurement error (Muijs, 2011). The DRS is a reliable screening

instrument to assess depressive symptoms in residents in LTCF's (Burrows et al., 2000). The CPS is a reliable screening instrument to identify CI in residents in LTCF's (Jones et al., 2010). Reliability of the interRAI entails using competently trained assessors who are directly involved in the person's care (Hirdes et al., 1999). The interRAI tool confirms that the description of the individual on the actual test remains the same when there have not been any clinical health changes (Hirdes et al., 1999).

Reliability across cultures: Cross-national psychometric testing of the interRAI has demonstrated good reliability (Hirdes et al., 1999), (Table 9). This table highlights the validity and reliability of the DRS and CPS, with respect to the test results' accuracy and consistency (Burrows et al., 2000; Carpenter & Hirdes, 2013; Frederiksen et al., 1996; Hartmaier et al., 1995; Jones et al., 2010; Morris et al., 1994; Penny et al., 2016; Wellens et al., 2013).

Internal consistency: This refers to how homogenous the items are on an instrument, or how well they will measure a single construct (Muijs, 2011). Internal consistency refers to item ratings of similar items which are consistent with one another (Muijs, 2011). Individual items of the interRAI tool, including the DRS and CPS, have been tested and measured, to ensure that they relate to each other and that they compare with the total scale score (Hirdes et al., 1999). Cronbach's alpha scores of 0.80 show excellent levels of internal consistency (Hirdes et al., 1999). Inter-rater reliability refers to the degree to which different raters get the same rating to a situation (Muijs, 2011), which infers the

consistency of the tool (Glenny & Stolee, 2009). The interRAI tool has achieved very good reliability, with Kappa scores of 0.45 and 0.75 (Hirdes et al., 1999).

The psychometric properties of the DRS and CPS of the interRAI-LTCF are highlighted below (Table 9).

Table 9: Psychometric properties of the DRS and CPS of the interRAI-LTCF

Tool	Description	Validity	Reliability
The Depression	The DRS assesses possible depression	**Diagnostic accuracy**	**MDS 2.0 - LTCF**
Rating Scale (DRS)	in long-term care facilities	AUC: 0.68 [CI 95% 0.57 - 0.77]; Se= 0.60 [CI 95 % 0.42 - 0.76]	Indicators of depression, anxiety and sad mood:
of the interRAI-LTCF	over a 3-day lookback period.	Sp= 0.70 [CI 95% 0.57 - 0.82 (Penny et al., 2016).	κ= 0.72; N = 187. Reliability is good (Morris et al., 1997).
	This is done by observing 7 items of		
	possible depressed, anxious or sad	**Moderate biserial correlation between depression**	**Spearman-Brown intraclass correlation coefficient**
	mood:	**diagnosis and the DRS:** rb = 0.34. [95 % CI = 0.09 - 0.55],	**MDS + mood state** = 0.44. Adequate reliability
	1. Made negative statements;	n = 92 (Penny et al., 2016).	(Frederiksen et al., 1996).
	2. Persistent anger with self or others;		
	3. Expressions, including nonverbal, of	**Moderate biserial correlation with no CI or MCI:** rb = 0.41.	**MDS and Mood vs Brief Psychiatric Rating Scale Factor 1**
	what appear to be unrealistic fears;	[95 % CI = 0.06 - 0.70], n = 48 (Penny et al., 2016).	Correlation coefficient (*P* value) = <.001
	4. Repetative health complaints;	**Good biserial correlation with dementia:** rb = 0.63.	(Frederiksen et al., 1996).
	5. Repetitive anxious complaints or	[95 % CI = 0.24 -0.93], n = 44 (Penny et al., 2016).	
	concerns (non-health related);	Depression Rating Scales.	**Factor analysis of mood items and identification of**
	6. Sad, pained, or worried expressions;		**DRS rating sclae items:**
	7. Crying, tearfulness.	**Concurrent and criterion validity**	**IC:** α = 0.75. N = 108 (Burrows et al., 2000).
	Burrows et al., 2000).	MDS mood items of the Hamilton and Cornell	
		Depression Scale Rating Scales.	
	Scores range from 0 - 14.	**DRS correlations:** Hamilton = 0.70, and Cornell = 0.69	
	Cut off scores ≥ 3 = depressive	(Burrows et al., 2000).	
	symptoms:	Pearson correlation with Hamilton is 0.15-	
	0 (no symptoms of depression);	0.54, with 13 out of 16 items ≥ 0.05, and with Cornell is	
	1-2 (some symptoms of depression);	0.12 – 0.54, with 11 items ≥ 0.05. n = 108 from 2 LTCF	
	3- 5 (possible depression);	(Burrows et al., 2000). **DRS:** Hamilton Se= 94%; Cornell is	
	> 6 (possible severe depression)	78%. Hamilton Sp= 72%; Cornell Sp= 77%. **Geriatric**	
	(Burrows et al., 2000).	**Depression Scale diagnostic depression** Se= 91%, and Sp=	
		69% n =82 (Burrows et al., 2000).	
		Hamilton = 0.71, and Cornell = 0.71 (Burrows et al., 2000).	

Tool	Description	Validity	Reliability
The Cognitive Performance Scale (CPS) of the interRAI-LTCF	The CPS measures cognitive performance in a range of different settings of care, by assessing 4 items of cognition over a 3-day lookback period. 1. Cognitive skills for daily decision making; 2. Memory recall; 3. Making self understood; 4. How a person eats (Morris et al., 1994). Scores range from 0 - 6: Cut off scores ≥ 2 = cognitive impairment: 0 (intact cognition); 1 (borderline intact cognition); 2 (mild cognitive impairment); 3 (moderate cognitive impairment); 4 (moderate/severe impairment); 5 (severe cognitive impairment); 6 (very severe impairment) **Diagnostic accuracy** CPS cut off is ≥2 for CI. κ = 0.54, z = 6.01, *p* < 0.0001 [95% CI: 0.36 –0.72], AUC: 0.77. Se= 0.68); Sp= 0.86 (Wellens et al., 2013).	**Correlation between CPS + MMSE** **Spearman correlation coefficient:** r = -.863 (*p* < .001). Se= .94 [95% CI: .90, .98]. Sp= 94 [95% CI: .87, .96]. **Reproducibility:** k = .85 [95% CI: .72, .98], and k = .76 [95% CI: .53, .99] for high and low education respectively. **Diagnostic accuracy:** ROC: .96. [95% CI: .88, 1.0]. **Prevalence of positive diagnosis:** 76% impaired; **negative diagnosis:** 24% not impaired). Excellent diagnostic accuracy for the CPS to identify CI. PPV= .97 [95% CI: .93, 1.0]. NPV= .80 [95% CI: .69, .91]. N = 200 from 8 LTCF's (Hartmaier et al., 1995). **Construct validity** **CPS + MMSE:** r = -0.65. **CPS + MDS-COGS:** r = 0.92. N = 1939 from 59 LTCF's (Gruber-Baldini et al., 2000). **Convergent validity CPS + MMSE** Tests were two-sided and p < 0.05 was used as a level of significance. **Moderate association and agreement between CPS + MMSE** (before education adjustment): n = 129 older adult patients in a hospital geriatric ward. Spearman r = – 0.60, p < 0.0001 (Wellens et al., 2013). **Moderate agreement in defining cognitively impaired subjects** (before education adjustment) Po = 68%; κ = 0.41, z = 5.33, p < 0.0001. [95% CI: 0.26–0.55]. Prevalence index: 0.06 Bias index: 0.28. CPS + MMSE have different classification patterns. (Wellens et al., 2013).	**IC** - α = .70 - .80 (with and without comatose item, respectively). N = 1939 from 59 LTCF's (Gruber-Baldini et al., 2000). **IC: CPS, MMSE + TSI** = .80; n = 272 (Morris et al., 1994). **Interrater reliability for cognitive items on CPS** Average = .85; n = 272. Short-term memory: .81; cognitive skills for decision making: .88; making self understood: .77; eating: .94 (Morris et al., 1994). **Variance/covariance** **CPS** = 0.161; n = 5174 from 206 LTCF's (Wu, Mor, & Roy, 2009). **MDS 2 .0 - LTCF** Memory and decision making: κ = 0.92 Communication: κ= 0.92; N = 187. Reliability is excellent (Morris et al., 1997). **Spearman-Brown intraclass correlation coefficient** **MDS+ Cognition/dementia** = 0.66-0.88. Excellent reliability (Frederiksen et al., 1996) **MDS + MMSE** = 0.82 -0.83. Excellent reliability. Correlation coefficient (*P* value) = <.001. Statistically high significance (Frederiksen et al., 1996).

Key: AUC = Area under the curve; CI = Confidence interval; IC = Internal consistency; k = Cohen's kappa coefficient; MDS = Minimum Data Set; n = Subsample; N = Total sample size; NPV = Negative predictive value; PPV = Positive predictive value; r = Correlation coefficient; ROC = Receiver operating characteristics; Se = Sensitivity; Sp = Specificity.

3.8.2 Validity and reliability of the data extraction tool

Validity is the degree to which an evaluation is an accurate representation of the concept it is intended to operationalise (Muijs, 2011).

Content validity: This refers to the extent to which the measurements of an instrument reflect the full domain of the phenomena being investigated (Muijs, 2011). Content Validity in this study was enhanced by ensuring that the aims and objectives were clearly defined and operationalised. The DRS and CPS items of the interRAI-LTCF measured depressive symptoms and CI. In this study, the contents of the interRAI-LTCF were correct to evaluate the concepts of depressive symptoms of the DRS and CI of the CPS (Burrows et al., 2000; Hirdes et al., 1999; Morris et al., 1994).

Face validity: This refers to the ability of an instrument to measure its proposed concepts and phenomena (Glenny & Stolee, 2009). It denotes the approval of the assessment tool by experts (Muijs, 2011). The data extraction tool was assessed by the supervisor and the research committee of the university.

Pilot study for reliability: A pilot study of data extracted from 10 records was performed, to test the data for accuracy, and to enable adjustments and labelling of variables to be made. These records are included in the overall study. The following data were cleaned and corrected: Spelling errors; naming of codes and labels; types of variables; missing values added and values; grouping of code

numbers to indicate severity levels was added; and measures of variables. The data from the pilot study were included with the total extraction of data.

3.9 Data Collection (extraction)

Data are referred to as 'facts or statistics used for reference or analysis' (SA Oxford dictionary, 2002). Secondary data were collected, that is data collected by someone other than the researcher (Koziol & Arthur, 2011). In this study, secondary data were collected from the interRAI and medical records. Secondary data extraction is based on existing fields in the database, and the quality of completeness and accuracy is high. The data is readily available but is restricted to what is collected at the time (Koziol & Arthur, 2011). The interRAI assessors received extensive training on how to conduct interRAI assessments, therefore the data is considered to be very reliable.

3.9.1 Data extraction process

Data were extracted using an audit review of the interRAI-LTCF and medical records, from 2014 to 2016. Data extracted from the interRAI-LTCF included the following:

- The Depression Rating Scale items (made negative statements; persistent anger with self or others; expressions, including nonverbal, of what appear to be unrealistic fears; repetitive health complaints; repetitive anxious

complaints, non-health related; sad, pained or worried facial expression, and crying, tearfulness).

- The DRS score (a cut off score for depressive symptoms is ≥ 3).
- The Cognitive Performance Scale items (cognitive skills for daily decision making; short-term memory recall; making self-understood, and how a person eats).
- The CPS score (a cut off score for cognitive impairment is ≥ 2).
- ID number, last assessment number, location, age, gender, marital status, and education.
- From the intranet of the facility, the following data were extracted: the diagnosis of depression, anxiety, CI and dementia, and medications for depression, anxiety, CI and dementia. Data were captured on an excel spreadsheet, which was imported into the IBM SPSS software, version 25, for analysis.

3.9.2 Variables

Variables are measurable factors, characteristics, or attributes of an individual, or objects, events, or systems that can take on different values or amounts (Bryman, 2012). Measures of variables in this study include nominal, ordinal and scale, as follows:

Nominal variables: These are also referred to as categorical variables, which are classified according to types or characteristics, but which *cannot be ranked in any*

order and cannot be compared with one another (Walliman, 2011). In this study, nominal variables include residential section, demographic data (age, gender, marital status, and education), and recorded diagnosis of depression, anxiety, CI and dementia, and medications for depression, anxiety, CI and dementia.

Ordinal variables: These are also referred to as interval or ratio variables, as they comprise categories that *can be rank ordered,* but not all the range of categories are equal (Bryman, 2012). Ordinal measurement infers a general indication of the size and strength, as examples, of the data, without an exact measurement of the properties (Walliman, 2011). In this study, ordinal variables include length of stay, age categories, and DRS and CPS categories. The DRS and CPS categories are divided into various groups, which classify levels of severity of symptoms and impairments, from lowest to highest. A scale is referred to as a multiple-indicator measure, in which the score which is assigned for each component indicator, is used to provide a compound score (Bryman, 2012). In this study, scales include age in years, and CPS and DRS score.

Dependent and independent variables: To test the hypotheses, the researcher has to identify the dependent and the independent variables**.** A dependent variable is influenced by the independent variable, the latter which has a causal impact on the dependent variable, thereby affecting it (Bryman, 2012). In this research, the dependent variables were either depressive symptoms or cognitive impairment, as either of these variables may affect each other.

The following research aim, objectives and questions have been included again (from chapter 1), so as to re-orientate the reader, before describing how the data collection process and data analysis was conducted.

3.10 Data analysis

3.10.1 Coding and recoding of data

A codebook was developed to describe the variables and values of depressive symptoms and CI of the DRS and CPS of the interRAI-LTCF, as well as the demographic variables (age, gender, marital status and education), from the records. The clinical variables were also included in the codebook (diagnosis of depression, anxiety, CI and dementia, and medications for depression, anxiety, CI, and dementia), according to medical records. The codebook was used as a reference to enable the coding of the variables into the IBM SPSS software, version 25, for the analysis of the data (Appendix 6).

The recoding was done to narrow down the presence of symptoms/impairments. The original coding (Appendix 6) included many different levels of symptoms/impairments (e.g. usually, often, sometimes, and rarely), which would make the analysis and interpretation of data complicated. For ease of data analysis, some of the variables were recoded (Table 10).

Table 10: Recoding of the codebook

Variable	Variable recoded	Values
Length of stay category	LOS.CAT2	1=12 months or less length of stay 2=More than12 months length of stay
Age category	Age.GR	1=Younger old 61-79 years of age 2=Older old 80-107 years of age
Marital status	Mar.2	1=married 2=never married, separated, divorced/widowed
Education	Edu.2	1-12 years or less education 2=More than12 months education
Cognitive Performance Scale cognitive impairment	CPS.CI	1=Cognitive impairment present (CPS) 2=No cognitive impairment present (CPS)
Cognitive skills for daily decision making	C1.2	0=No impairment in cognitive skills for daily decision making 1=Cognitive skills for daily decision making problems
Making self understood (expression)	D1.2	0=Able to make self understood 1=Making self understood difficulties
Eating – how a person eats/drinks	G1j.2	1=Independent/set up help only/supervision, with eating 2=Eating - assistance needed
Made negative statements	E1a.2	0-No negative statements made 1=Negative statements made
Persistent anger with self or others	E1b.2	0=Persistent anger with self or others not present 1=Persistent anger with self or others present
Expressions, including nonverbal, of what appear to be unrealistic fears	E1c.2	**0=Expressions, including nonverbal, of what appear to be unrealistic fears not present** **1=Expressions, including nonverbal, of what appear to be unrealistic fears present**
Repetitive health complaints	E1d.2	0=Repetitive health complaints not present 1=Repetitive health complaints present
Repetitive anxious complaints/concerns (non-health related)	E1e.2	0=Repetitive anxious complaints/concerns (non-health related) not present 1=Repetitive anxious complaints/concerns (non-health related) present
Sad, pained, or worried facial expressions	E1f.2	0=Sad, pained, or worried facial expressions not present 1=Sad, pained or worried facial expressions present
Crying, tearfulness	E1g.2	0=Crying, tearfulness not present 1=Crying, tearfulness present
Depression Rating Scale possible depression	DRS.Dep	1= Possible depression present (DRS) 2=No possible depression present (DRS)

3.10.2 Descriptive and inferential data analysis

Statistics is referred to as 'the collection and analysis of numerical data in large quantities' (SA Oxford dictionary, 2002). The IBM SPSS software, version 25, was used to analyse numerical data, collected from the interRAI and medical records.

3.10.3 Data analysis of depressive symptoms and cognitive impairment

Although the recorded diagnosis of depression, anxiety, CI and dementia is regarded as the gold standard in determining the presence of the conditions, the diagnostic methods used in this study were possibly not the same as the rigorous criteria of the DSM-5 (Diagnostic and Statistical Manual of Mental Disorders). Therefore, the validated tools of the DRS and CPS of the interRAI were used to determine possible depression and CI. As the interRAI is a screening tool and not a diagnostic measure, the possibility of having depression, rather than a diagnosis of depression, was measured. As moderate to severe CI is not considered to be a diagnosis of dementia, the same measures applied.

The analysis of depressive symptoms and CI of the interRAI-LTCF included the following data:

Sample description: This described the demographics (mean age), the gender (frequency), marital status (numeric), the years of education (numeric), the medical profile (frequency of medical conditions, namely, depression, anxiety, CI, and dementia), and medications for depression, anxiety, CI, and dementia (numeric).

Depressive symptoms: These symptoms reported the frequencies of individual depressive symptom scale items, mean summary domains for depressive symptoms, and frequencies of depressive symptom categories, based on interRAI-LTCF cut-off scores (a cut-off score for depressive symptoms is ≥ 3).

Cognitive impairment: This reported the frequencies of individual CI scale items, mean summary domains for CI symptoms and frequencies of CI categories, based on interRAI-LTCF cut-off scores (cut off score for CI is ≥ 2).

3.10.4 Data analysis of the clinical profile

A data analysis profile described the clinical profile of residents, with and without CI, and with and without depressive symptoms, and the different levels of impairments and severity of the CPS and DRS of the interRAI (Figure 6).

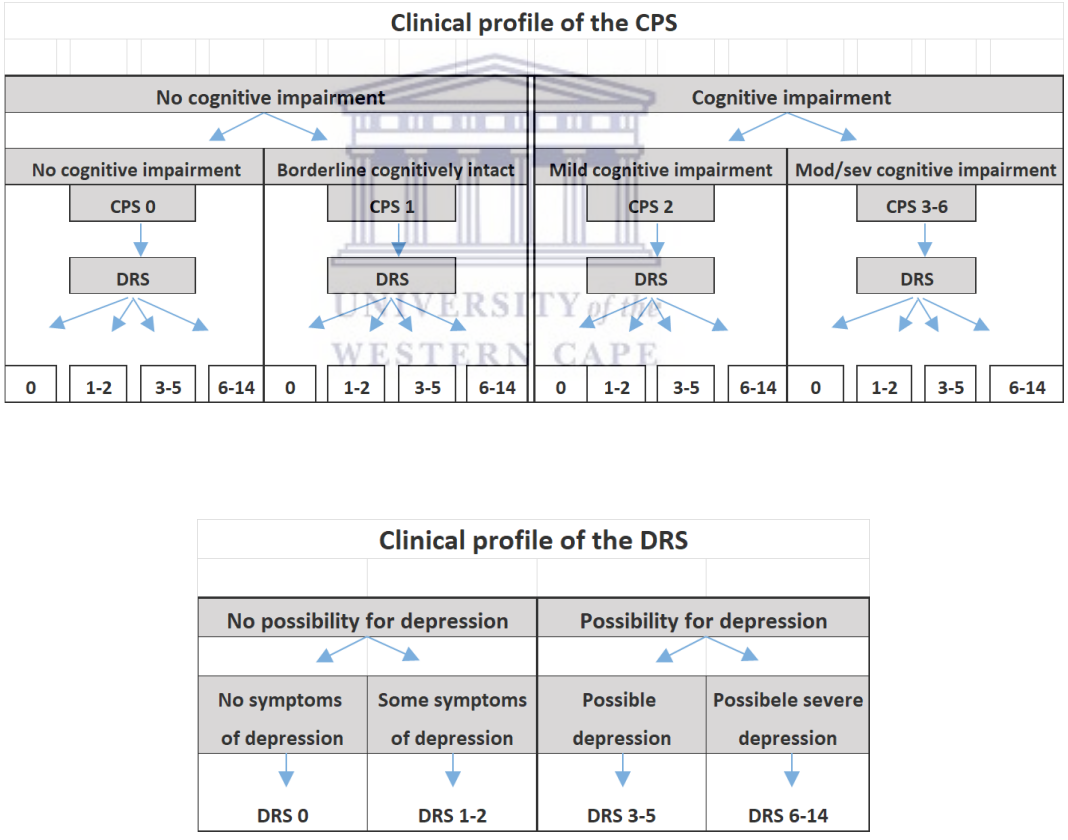


Figure 6: **Data analysis profile.**

No cognitive impairment was determined by the CPS scores 0 (no CI) to CPS scores 1 (borderline cognitively intact). Cognitive impairment was determined by CPS scores 2 (mild cognitive impairment) to CPS scores 3-6 (moderate to severe CI). Residents with CI and without CI were compared against those with the possibility for depression and without the possibility for depression. No possibility for depression was determined by DRS scores 0 (no symptoms of depression) to DRS scores 1-2 (some symptoms of depression). The possibility for depression was determined by DRS scores 3-5 (possible depression) and DRS scores 6-14 (possible severe depression).

3.10.5 Testing hypotheses

The relationship between two phenomena may be a loose link at one extreme, or a direct link when one phenomenon cause another, which is referred to as levels of associations (Walliman, 2011). In this study, using the numerical data, associations were compared between depressive symptoms and CI and evaluated how they influenced each other.

Non-parametric tests: These tests were used to analyse the two independent groups: to test whether the distribution of CPS scores was the same across categories of the DRS possible depression; and to test whether the distribution of the CPS score was the same across categories of the DRS category.

C*hi-square tests* (X^2)*:* These tests were used to test associations between two nominal (categorical) variables, and *Fisher Exact tests* were used as an alternative

to the chi-square tests where the cells had values <5. These variables included the demographic categories (age group, gender, marital status and education), and the categorical outcome (dependent) variables of DRS categories (as coded on the SPSS for analysis), as follows: 0=no depressive symptoms (DRS 0); 1=some symptoms (DRS 1-2); 2=possible depression (DRS 3-5), and 3=possible severe depression (DRS 6-14). The associations were also tested between the demographic variables and the categorical outcomes (dependent) variables of the CPS categories (as coded on the SPSS for analysis), as follows: 0= no CI (CPS 0); 1=borderline cognitively intact (CPS 1); 2=mild CI (CPS 2), and moderate to severe CI (CPS 3-6). Chi-square tests were also used to test associations between the DRS categories (0-14) and the scale outcome (dependent) variables of the CPS score.

The Mann-Whitney U Test: This test was used to test associations between the demographic categories (age group, gender, marital status, and education) and the numerical outcome (dependent) variables of DRS score & CPS Scores.

The Kruskal-Wallis Test (K) was used when there were two or more variables to be tested, which included the four levels of severity of the DRS and CPS categories, which were tested against the frequencies of depressive symptoms and CI.

Measures of association: This measure in analytical research, such as the Two by Two table, determined the relationship between two variables (Sauerbrei & Blettner, 2009), namely cases of depressive symptoms and CI. These cases were

compared to cases with and without depressive symptoms and CI, which established causal relationships. Measures of association evaluated the significance of an association between exposure (depressive symptoms and CI) and the outcome of this association. This indicated how more or less likely a group was to develop depressive symptoms and/or CI, as compared to another group. Key measures of outcome determined the likelihood that people who met the criteria for possible depression on the DRS or CI on the CPS were more likely to meet the criteria for possible depression or CI.

Outcome measures for possible depression: This measures the risk of possible depression when CI is present; the risk of possible depression when CI is not present; the *Absolute Risk (AR);* and the *Relative Risk* (*RR*) i.e. the rate of possible depression or CI.

Outcome measures for CI: This measures the risk of CI when possible depression is present; the risk of CI when possible depression is not present; the *AR*; and the *RR.*

The data were displayed on a two-by-two table, and the null hypothesis was used to test if there was no association between depressive symptoms, CI, and the various demographics (age, gender, marital status, and education), or clinical variables (documented diagnoses of depression, anxiety, CI or dementia, and medications used). The null hypothesis was also used to test if there was no association between depressive symptoms of the DRS and CI of the CPS.

The significance of the findings in this study of depressive symptoms of the DRS, and CI of the CPS, were determined by analysing the descriptive statistics of the IBM SPSS software, version 25, and comparing the crosstabulation of the demographic variables (age, gender, marital status, and education), and the clinical variables (recorded diagnosis of depression, anxiety, CI and dementia and medications depression, anxiety, CI and dementia, and depressive symptoms of the DRS and CI of the CPS). The significance of the findings was set at $p<.05$.

3.10.6 Sensitivity and Specificity analysis

The Sensitivity (Se): This test indicates that the test is able to correctly identify people in the population who have a particular disease or condition (Lalkhen & McCluskey, 2008). The *Se* in this study correctly identified residents with possible depression and CI, using the DRS and CPS of the interRAI-LTCF.

The Specificity (*Sp*)*:* This test refers to individuals who do not have the disease (Lalkhen & McCluskey, 2008), and who have a negative result (Akobeng, 2007). The *Sp* in this study correctly identified residents without possible depression and CI, using the DRS and CPS of the interRAI-LTCF.

The Positive Predictive Value (*PPV*)*:* This is a test to identify how likely it is for a person to have the condition when the results of the test are positive (Lalkhen & McCluskey, 2008).

The Negative Predictive Value (*NPV*)*:* This is a test to identify how unlikely it is for a person to have the condition when the results of the test are negative (Lalkhen & McCluskey, 2008).

The *PPV* in this study identified how likely it was for a resident to have possible depression and CI when the results of the DRS and CPS tests were positive. The *NPV* identified how likely it was for a resident not to have possible depression and CI when the results of the DRS and CPS tests were negative. The *Se, Sp, PPV,* and *NPV* were tested on an internet-based clinical calculator (Lowry, 2018).

The RR (Relative Risk): This is the rate (ratio) of the probability of an outcome in an exposed group to the probability of an outcome in an unexposed group (Andrade, 2015). In this study, the *RR* was tested by comparing the risks for possible depression with CI present and with CI was not present, and by comparing the risks for CI with possible depression present and with possible depression was not present. The *RR* determined the risk of having possible depression with and without CI, and the risk of having CI with and without possible depression. Associations between depressive symptoms, depressive categories, possible depression and CI symptoms, CI categories and possible CI, was tested using the conceptual framework of the interRAI (Burrows et al., 2000; Morris et al., 1994; Morris et al., 2011).

The risk of having possible depression with CI, and the risk of having CI when depressed, were tested by calculating the *RR* from an internet-based clinical calculator (MedCalc Software, 2018). The formula for the *RR* used was:

$$RR = \frac{a/(a+b)}{c/(c+d)}$$

3.11 Ethical considerations

Ethical standards are specific rules and obligations that promote ethical principles (Adams & Lawrence, 2015). These principles and moral values and ideals of the Declaration of Helsinki are adhered to, in order to ensure that the individual takes precedence (Adams & Lawrence, 2015). Although the principles of the right to self-determination; a right to full disclosure; principles of beneficence and justice, and informed consent are understood (Adams & Lawrence, 2015), the retrospective study design and the use of secondary numeric data, did not require an information sheet or informed consent from the residents. Responsibility to scholarship and science was respected by ensuring that rigour was maintained, by the use of the validated and reliable interRAI instrument, and obtaining accurate research results (Claydon, 2015).

Confidentiality and anonymity of data and residents were ensured with password-protected access to data, and ID codes of the residents (Adams & Lawrence, 2015). However, as there is only one Jewish LTCF in the Cape Metropole, this facility may be identified by the inclusion of the Jewish population. The research facility has been made aware of this in their acceptance of their approval for this research. Ethics approval was obtained from UWC, as per the ethical clearance application form (Humanities and Social Sciences

Research Ethics Committee) (Appendix 3). Consent was granted by the research facility for this research to be conducted (Appendix 2).

After the research study was completed, the researcher submitted the study to Turnitin, to ensure academic integrity and in accordance with the UWC Plagiarism Policy. The report concluded an acceptable 10% Similarity index (Appendix 8).

3.12 Summary of chapter

This chapter described the step-by-step methods and procedures used to explain the methodological process supporting this study. This methodology can be applied to other facilities in South Africa and internationally, to analyse depressive symptoms and CI in residents in a LTCF. A quantitative descriptive and analytical cross-sectional retrospective study design was described, underpinned by a positivist approach. The detailed description of the DRS and CPS of the interRAI-LTCF instrument highlighted the parameters of depressive symptoms and CI. These results are described in the following chapter.

CHAPTER 4: RESULTS

4.1 Introduction

The aim of the study was to describe a profile of depressive symptoms and CI in residents using the interRAI-LTCF in a LTCF in the Cape Metropole in South Africa. This chapter will present the findings of the study by presenting the demographic (age, gender, education and marital status) and clinical data (documented diagnoses of depression, anxiety, and CI/dementia, and medications for depression, anxiety, and CI/dementia); the depressive symptoms of the DRS, the CI symptoms of the CPS, and the associations between the DRS and the CPS scores. For ease of reference, the statistical significance of the *p*-values by the variables concerned is underlined in italics in the tables.

4.2 Sample realisation

All 173 residents' medical and interRAI-LTCF records, who have had their last interRAI-LTCF assessment from 2014 and 2016, were extracted. More than three quarters (133; 76.9 %) of the residents resided in the cognitively intact section of the LTCF, compared to less than a quarter (40; 23.1%) who resided in the Special Care Unit for dementia.

4.3 Demographics

The records indicated that the residents in the study were white Jewish, English speaking older adults, with ages ranging from 61 to 107 years (average age of 82.7 years, *sd* 8.6). Nearly three-quarters of the residents were female (126; 72.8%). Female ages ranged from 62-107 years (average age of 82.8 years, *sd* 8.4), compared to males (61-99 years, average age 82.3, *sd* 9.1). Most of the residents had no partners (never married, separated, divorced or widowed), with less than a third who were recorded as married (147; 85% vs 26; 15%). More than half of the residents had 12 years or less education, with less than a third with more than 12 years (118; 68.2% vs 51; 29.5%).

There were significant differences in *gender* (126; 72.8% vs 47; 27.2%) in terms of *marital status,* with most of the 126 female residents (115; 91.3%) being *without a partner,* compared to over 50% of the 47 male residents (32; 68.1%), (X^2=14.4; p<.001) and *education,* with almost three quarters (93; 73.8%) of females having *≤ 12 years education*, as opposed to more than half (25; 53.2%) of the males (X^2=10.2; p=.006) (Table 11).

Table 11: **Demographics by gender**

Demographics	Gender		Total (*N* =173) *N* (%)	Chi-Square X^2	*p* -value *p*
	Males *n* =47 (27.2%)	Females *n* =126 (72.8%)			
Marital status				14.4	<.001*
No partner	32 (68.1%)	115 (91.3%)	147 (85%)		
Married	15 (31.9%)	11 (8.7%)	26 (15%)		
Education (*n* =169)				10.2	.006*
≤ 12 years education	25 (53.2%)	93 (73.8%)	118 (68.2%)		
> 12 years education	22 (46.8%)	29 (23%)	51 (29.5%)		
Differences in gender by demographic variables were tested using Chi-square tests or Fisher Exact Tests.					
*Significance was set as *p* <.05.					

Over half of the residents were the older old that is between 80 and 107 years, compared to just over a third in the younger old (61-79 years) category (110; 63.6% vs 63; 36.4%). There were no significant differences between the younger old and the older old in terms of: *gender,* with more than half of the younger old (44; 69.8%) being *female*, compared to just under three quarters (82; 74.5%) in the older old (X^2=0.5; *p*=.503); *marital status,* with more than three quarters of the younger old (51; 81%) *being without a partner,* compared to (96; 87.3%) in the older old (X^2=1.3; *p*=.263); and *education*, with less than three quarters of the younger old (45; 71.4%) having *≤ 12 years education,* as opposed to more than a half (73; 66.4%) in the older old, (X^2=0.6; *p*=.746) (Table 12).

Table 12: **Demographics by age group**

Demographics	Age groups: Younger old 61-79 years of age *n* =63 (36.4%)	Age groups: Older old 80-107 years of age *n* =110 (63.6%)	Total (*N* =173) *N* (%)	Chi-Square X^2	*p* -value *p*
Gender				0.5	.503
Female	44 (69.8%)	82 (74.5%)	126 (72.8%)		
Male	19 (30.2%)	28 (25.5%)	47 (27.2%)		
Marital status				1.3	.263
No partner	51 (81%)	96 (87.3%)	147 (85%)		
Married	12 (19%)	14 (12.7%)	26 (15%)		
Education (*n* =169)				0.6	.746
≤ 12 years education	45 (71.4%)	73 (66.4%)	118 (68.2%)		
> 12 years education	17 (27%)	34 (30.9%)	51 (29.5%)		
Differences in age groups by demographic variables were tested using Chi-square tests or Fisher Exact Tests.					
Significance was set as $p < .05$.					

There was a significant difference between the number of residents in the residential section of the LCTF, compared to the Special Care Unit for Dementia, in terms of *age groups*, with over half of the 133 residents (77; 57.9%), in the section for the cognitively intact being older old (≥80 years) compared to only 40 residents (33; 82.5%) in the Special Care Unit for dementia being older old (X^2=8.4; p=.005) (Table 13).

Table 13: **Demographics by residential section**

Demographics	Residential section: Cognitively intact section *n* =133 (76.9%)	Residential section: Special Care Unit for dementia *n* =40 (23.1%)	Total (*N* =173) *N* (%)	Chi-Square X^2	*p* -value *p*
Age group				8.04	.005*
Older old (80 - 107 yrs)	77 (57.9%)	33 (82.5%)	110 (63.6%)		
Younger old (61 - 79 yrs)	56 (42.1%)	7 (17.5%)	63 (36.4%)		
Differences in location by demographic variables were tested using Chi-square tests or Fisher Exact Tests.					
*Significance was set as $p < .05$.					

4.4 Clinical characteristics of residents

Over half of the residents have resided in the LTCF for longer than 12 months (95; 54.9%); however, there were no significant demographic differences between the longer stay (>12-month group), as opposed to the shorter stay group (1-12 months). More than half of the longer stay residents were older old (63; 66.3%, vs 47; 60.3%, X^2=0.7; p=.410), and more than three quarters were female (73; 76.8% vs 53; 67.9%, X^2=1.7; p=.191) (Table 14).

Table 14: Demographics by the length of stay

Demographics	Length of stay category		Total (N =173)	Chi-Square X^2	p -value p
	1-12 months	> 12 months			
	n =78 (45.1%)	n =95 (54.9%)	N (%)		
Age group				0.7	.410
Older old (80 - 107 yrs)	47 (60.3%)	63 (66.3%)	110 (63.6%)		
Younger old (61 - 79 yrs)	31 (39.7%)	32 (33.7%)	63 (36.4%)		
Gender				1.7	.191
Female	53 (67.9%)	73 (76.8%)	126 (72.8%)		
Male	25 (32.1%)	22 (23.2%)	47 (27.2%)		

Differences in length of stay by demographic variables were tested using Chi-square tests or Fisher Exact Tests.
Significance was set as p <.05.

4.5 Depression and anxiety

Depressive symptoms in this population were analysed by comparing the categories of possible depression of the DRS, the frequencies in which depressive symptoms occurred (indicators of depressed, anxious or sad mood), and testing for associations between these and resident demographics. The frequencies of indicators of depressed, anxious, or sad mood are determined by the presence of

possible depression, according to the Depression Rating Scale (DRS), as discussed in chapter 3, from the interRAI-LTCF instrument (Appendix 1).

4.5.1 Depressive symptom categories of the DRS

Less than a quarter (40; 23.1%) of the residents had ratings of possible depression, with more than a tenth (23; 13.3%) with ratings of possible severe depression recorded. This indicated that more than a third (63; 36.4%) of all residents met the criteria for the *possibility for depression* as per the DRS. The rest of the residents had either no depressive symptoms (48; 27.7%) or some depressive symptoms (62; 35.8%) recorded. Thus, nearly two thirds (110; 63.5%) of the residents did not meet the criteria for the possibility for depression (Table 15).

Table 15: **Categories and frequencies of depressive symptoms of the DRS**

Depressive symptom categories of the DRS	Frequencies of depressive symptoms	Total (*N* =173) *N* (%)
No possible depression		110 (63.5%)
No symptoms - DRS 0	48 (27.7%)	
Some symptoms - DRS 1-2	62 (35.8%)	
Possibility for depression		63 (36.4%)
Possible depression - DRS 3-5	40 (23.1%)	
Possible severe depression - DRS 6-14	23 (13.3%)	

Categories and frequencies of depressive symptoms of the DRS were tested using Chi-square tests or Fisher Exact Tests. Signficance was set at $p < .05$.

Comparing the proportion of residents by different demographics (age, gender, marital status, and education) across the four (4) depression categories (Table

15), it was found that there was a noticeable non-significant decrease across all demographics as the severity of depression increased, except for *gender,* which had significantly more females in the possible severe depression categories compared to males (16.7% vs 4.3%; X^2=9.3; p=.025) (Table 16).

Table 16: Depressive symptom categories by demographic variables

Demographics	Categories of depressive symptoms of the DRS				Total (*N* =173) *N* (%)	Chi-square X^2	*p* -value *p*
	No symptoms of depression DRS 0 *n* =48 (27.7%)	Some symptoms of depression DRS 1-2 *n* =62 (35.8%)	Possible depression DRS 3-5 *n* =40 (23.1%)	Possibe severe depression DRS 6-14 *n* =23 (13.3%)			
Age group						6.3	.097
Older old (80 - 107 yrs)	24 (21.8%)	45 (40.9%)	27 (24.5%)	14 (12.7%)	110 (63.6%)		
Younger old (61 - 79 yrs)	24 (38.1%)	17 (27%)	13 (20.6%)	9 (14.3%)	63 (36.4%)		
Gender						9.3	.025*
Females	39 (31%)	39 (31%)	27 (21.4%)	21 (16.7%)	126 (72.8%)		
Males	9 (19.1%)	23 (48.9%)	13 (27.7%)	2 (4.3%)	47 (27.2%)		
Marital status						3.4	.330
No partner	42 (28.6%)	51 (34.7%)	32 (21.8%)	22 (15%)	147 (85%)		
Married	6 (23.1%)	11 (42.3%)	8 (30.8%)	1 (3.8%)	26 (15%)		
Education						5.9	.427
≤ 12 years or less	34 (28.8%)	42 (35.6%)	27 (22.9%)	15 (12.7%)	118 (68.2%)		
> 12 years	11 (21.6%)	19 (37.3%)	13 (25.5%)	8 (15.7%)	51 (29.5%)		

Differences in depression categories of the DRS by demographic variables were tested using Chi-square tests or Fisher Exact tests. *Significance was set as p <.05.

Comparing the proportion of residents in the different depressive categories by the length of stay, no significant differences in the proportion of residents in the longer stay (>12-month group) compare to the shorter stay facility (≤12months) (X^2=1.1; p=.783). Significant differences were found between the proportion of residents by residential section, in the different depressive categories of residents in the Special Care Unit for Dementia section vs the cognitively intact

section, with more than a third (14/40; 35%) of the residents in the Special Care Unit for Dementia having possible depression, compared to less than a one fifth (26/40; 19.5%) of the residents in the cognitively intact section having possible depression (X^2=10.2; p=.017) (Table 17).

Table 17: Depressive symptoms by the length of stay and residential section

Demographics	Categories of depressive symptoms of the DRS				Total (N=173) N (%)	Chi-square X^2	p-value p
	No symptoms of depression DRS 0 n=48 (27.7%)	Some symptoms of depression DRS 1-2 n=62 (35.8%)	Possible depression DRS 3-5 n=40 (23.1%)	Possibe severe depression DRS 6-14 n=23 (13.3%)			
Length of stay						1.1	.783
≤12 months	21 (26.9%)	31 (39.7%)	17 (21.8%)	9 (11.5%)	78 (45.1%)		
> 12 months	27 (28.4%)	31 (32.6%)	23 (24.2%)	14 (14.7%)	95 (54.9%)		
Residential section						10.2	.017*
Cognitivey intact section	41 (30.8%)	52 (39.1%)	26 (19.5%)	14 (10.5%)	133 (76.9%)		
Special Care Unit for Dementia	7 (17.5%)	10 (25%)	14 (35%)	9 (22.5%)	40 (23.1%)		

Differences in location by demographic variables were tested using Chi-square tests or Fisher Exact Tests.
*Significance was set as p<.05.

4.5.2 Depressive symptom items of the DRS

The highest rated depressive symptom items recorded were *persistent anger with self or others* (n=64; 37%), followed by *repetitive health complaints* (*n*=63; 36.4%), and the lowest rated symptom item was *expressions, including anger, of what appear to be unrealistic fears* (*n*=15; 8.7%). No significant differences were found between depressive symptom items and younger and older old residents, with repetitive anxious complaints/concerns (non-health related) approaching significance (Table 18), and by gender, with *crying and tearfulness, and*

expressions, including anger of what appear to be unrealistic fears approaching significance (Table 19).

Table 18: Depressive symptom items by age group

Depressive symptom items of the DRS	Age group		Total	Chi-square	*p* -value
	Young old (61-79 yrs)	Older old (80-107 yrs)	(*N* =173)		
	n =63 (36.4%)	*n* =110 (63.6%)	*N* (%)	X^2	*p*
Persistent anger with self or others	21 (33.3%)	43 (39.1%)	64 (37%)	0.6	.450
Repetitive health complaints	20 (31.7%)	43 (39.1%)	63 (36.4%)	0.9	.334
Sad, pained or worried facial expressions	20 (31.7%)	32 (29.1%)	52 (30.1%)	0.1	.714
Repetitive anxious complaints/ concerns (non-health related)	13 (20.6%)	38 (34.5%)	51 (29.5%)	3.7	.053
Made negative statements	14 (22.2%)	29 (26.4%)	29 (26.4%)	0.4	.544
Crying, tearfulness	11 (17.5%)	18 (16.4%)	29 (16.8%)	0.4	.853
Expressions, including nonverbal, of what appear to be unrealistic fears	6 (9.5%)	9 (8.2%)	15 (8.7%)	0.09	.763
Frequencies of depressive symptoms by demographic variables were tested using Chi-square tests or Fisher Exact Tests. Significance was set as $p<.05$.					

Table 19: Depressive symptom items by gender

Depressive symptom items of the DRS	Gender		Total	Chi-square	*p* -value
	Males	Females	(*N* =173)		
	n =47 (27.2%)	*n* =126 (72.8%)	*N* (%)	X^2	*p*
Persistent anger with self or others	22 (46.8%)	42 (33.3%)	64 (37%)	2.7	.102
Repetitive health complaints	16 (34%)	47 (37.3%)	63 (36.4%)	0.2	.692
Sad, pained or worried facial expressions	11 (23.4%)	41 (32.5%)	52 (30.1%)	1.4	.244
Repetitive anxious complaints/ concerns (non-health related)	10 (21.3%)	41 (32.5%)	51 (29.5%)	2.1	.148
Made negative statements	11 (23.4%)	32 (25.4%)	43 (24.9%)	0.07	.787
Crying, tearfulness	4 (8.5%)	25 (19.8%)	29 (16.8%)	3.2	.076
Expressions, including nonverbal, of what appear to be unrealistic fears	1(2.1%)	14 (11.1%)	15 (8.7%)	3.5	.062
Frequencies of depressive symptoms by demographic variables were tested using Chi-square tests or Fisher Exact Tests. Significance was set as $p<.05$.					

In comparing depressive symptom items across marital status, there was a significant difference between single and married residents in terms of *crying, tearfulness,* with more married residents (8/26, 30.8%) having *crying, tearfulness* rated, compared to single or non-married residents with no partners (21/147; 14.3%; X^2=4.3; *p*=.038) (Table 20).

Table 20: Depressive symptom items by marital status

Depressive symptom items of the DRS	Marital status		Total (*N* =173) *N* (%)	Chi-square X^2	*p* -value *p*
	Married *n* =26 (15%)	No partner *n* =147 (85%)			
Persistent anger with self or others	9 (34.6%)	55 (37.4%)	64 (37%)	0.7	.785
Repetitive health complaints	6 (23.1%)	57 (38.8%)	63 (36.4%)	2.4	.125
Sad, pained or worried facial expressions	7 (26.9%)	45 (30.6%)	52 (30.1%)	0.1	.705
Repetitive anxious complaints/ concerns (non-health related)	7 (26.9%)	44 (29.9%)	51 (29.5%)	0.1	.756
Made negative statements	9 (34.6%)	34 (23.1%)	43 (24.9%)	1.6	.212
Crying, tearfulness	8 (30.8%)	21 (14.3%)	29 (16.8%)	4.3	.038*
Expressions, including nonverbal, of what appear to be unrealistic fears	2 (7.7%)	13 (8.8%)	15 (8.7%)	0.04	.848
Frequencies of depressive symptoms by demographic variables were tested using Chi-square tests or Fisher Exact Tests. *Significance was set as *p* <.05.					

When comparing depressive symptom items across education level, there was a significant difference between residents with >12 years education in terms of the ratings for *persistent anger with self or others* (27/51; 52.9%) compared to less than a third (37/118; 31.4%) of residents who had ≤12 years education (X_2=9.5; *p*=.009) (Table 21).

Table 21: Depressive symptom items by education

Depressive symptom items of the DRS	Education (n =169) ≤ 12 years 118 (68.2%)	Education (n =169) >12 years 51 (29.5%)	Missing data	Total (N =173) N (%)	Chi-square X^2	p -value p
Persistent anger with self or others	37 (31.4%)	27 (52.9%)	0 (0%)	64 (37%)	9.5	.009*
Repetitive health complaints	43 (36.4%)	20 (39.2%)	0 (0%)	63 (36.4%)	2.5	.292
Sad, pained or worried facial expressions	37 (31.4%)	15 (29.4%)	0 (0%)	52 (30.1%)	1.8	.402
Repetitive anxious complaints/ concerns (non-health related)	30 (25.4%)	20 (39.2%)	1 (25%)	51 (29.5%)	3.3	.192
Made negative statements	29 (24.6%)	14 (27.5%)	0 (0%)	43 (24.9%)	1.5	.470
Crying, tearfulness	22 (18.6%)	7 (13.7%)	0 (0%)	29 (16.8%)	1.4	.486
Expressions, including nonverbal, of what appear to be unrealistic fears	10 (8.5%)	4 (7.8%)	1 (25%)	15 (8.7%)	1.4	.497

Frequencies of depressive symptoms by demographic variables were tested using Chi-square tests or Fisher Exact Tests. *Significance was set as p <.05.

4.5.3 Depressive symptom items by categories of the DRS

A significant trend in depressive symptom items of the DRS was observed as the severity of the depression categories of the DRS increase (p<.001) (Table 22).

Table 22: Depressive symptom items by depressive symptom categories

Depressive symptom items of the DRS	Depressive symptom categories of the DRS: No symptoms of depression DRS 0 n=48 (27,7%)	Some symptoms of depression DRS 1-2 n=62 (35,8%)	Possible depression DRS 3-5 n=40 (23,1%)	Possibe severe depression DRS 6-14 n=23 (13,3%)	Total (N =173) N (%)	Chi-Square X^2	p -value p
Persistent anger with self or others	0 (0%)	17 (26,6%)	25 (39,1%)	22 (34,4%)	64 (37%)	75,7	<,001*
Repetitive health complaints	0 (0%)	26 (41,3%)	20 (31,7%)	17 (27%)	63 (36,4%)	45,5	<,001*
Sad, pained or worried facial expressions	0 (0%)	11 (21,2%)	23 (44,2%)	18 (34,6%)	52 (30,1%)	64,9	<,001*
Repetitive anxious complaints/ concerns (non-health related)	0 (0%)	11 (21,6%)	20 (39,2%)	20 (39,2%)	51 (29,5%)	68,8	<,001*
Made negative statements	0 (0%)	11 (25,6%)	16 (37,2%)	16 (37,2%)	43 (24,9%)	*47,1*	<,001*
Crying, tearfulness	0 (0%)	5 (17,2%)	12 (41,4%)	12 (41,4%)	29 (16,8%)	38,7	<,001*
Expressions, including nonverbal, of what appear to be unrealistic fears	0 (0%)	2 (13,3%)	4 (26,7%)	9 (60%)	15 (8,7%)	33,9	<,001*

Frequencies of depressive symptoms by depression categories of the DRS were tested using Chi-square tests or Fisher Exact Tests, *Significance was set as p<,05,

In comparing depression diagnosis by frequencies of depressive symptoms, no significant differences were found (Table 23).

Table 23: Depression diagnosis by frequencies of depressive symptoms

Frequencies of depressive symptoms of the DRS	Depression diagnosis		Total (*N* =173)	Chi-Square	*p* -value
	Present	Not present			
	94 (54.3%)	79 (45.7%)	*N* (%)	X^2	*p*
Persistent anger with self or others	38 (40.4%)	26 (32.9%)	64 (37%)	1.0	.308
Repetitive health complaints	32 (34%)	31 (39.2%)	63 (36.4%)	0.5	.479
Sad, pained or worried facial expressions	33 (35.1%)	19 (24.1%)	52 (30.1%)	2.5	.114
Repetitive anxious complaints/concerns (non-health related)	30 (31.9%)	21 (26.6%)	51 (29.5%)	0.6	.444
Made negative statements	30 (31.9%)	13 (16.5%)	43 (24.9%)	5.5	.019
Crying, tearfulness	21 (22.3%)	8 (10.1%)	29 (16.8%)	4.6	.032
Expressions, including nonverbal, of what appear to be unrealistic fears	10 (10.6%)	5 (6.3%)	15 (8.7%)	1.0	.316
Frequencies of depressive symptoms by depression diagnosis were tested using Chi-square tests or Fisher Exact Tests. Significance was set as $p < .05$.					

4.5.4 Depression and anxiety diagnosis and medication use

A documented *diagnosis of depression* was recorded in more than half of all the residents (94; 54.3%), and most of these 94 residents (82; 47.4%) with a diagnosis of depression, received medication for depression, which amounted to just under a half of the total population of residents. Twenty-five (25) residents (30.5%) who received medication for depression has no recorded symptoms of depression. A documented *diagnosis of anxiety* was present in a fifth of all the residents (35; 20.2%), and nearly all of these 35 residents with a diagnosis of anxiety, received medication for anxiety (32; 18.5%), which amounted to less than a fifth of the population of the residents (Table 24).

Table 24: Depressive symptom categories by diagnosis and medication

Diagnosis and medication for depression and anxiety	Depressive symptom categories of the DRS				Total (N =173) N (%)	Chi-Square X^2	p -value p
	No symptoms of depression DRS 0 n =48 (27.7%)	Some symptoms of depression DRS 1-2 n =62 (35.8%)	Possible depression DRS 3-5 n =40 (23.1%)	Possibe severe depression DRS 6-14 n =23 (13.3%)			
Depression diagnosis present	27 (28.7%)	28 (29.8%)	22 (23.4%)	17 (18.1%)	94 (54.3%)	5.7	.125
Depression medication used	25 (30.5%)	25 (30.5%)	18 (22%)	14 (17.1%)	82 (47.4%)	3.4	.329
Anxiety diagnosis present	7 (20%)	16 (45.7%)	5 (14.3%)	7 (20%)	35 (20.2%)	5.1	.164
Anxiety medication used	6 (18.8%)	15 (46.9%)	5 (15.6%)	6 (18.8%)	32 (18.5%)	4.3	.230
Differences in depression categories of the DRS by clinical variables were tested using Chi-Square Tests or Fisher Exact Tests. Significance was set as p <.05.							

To assess the validity of the DRS to detect depression and possible depression, as diagnosed by a medical professional, the DRS score and recommended cut-off categories, were compared with a doctor's diagnosis of depression. The *documentation* of depression by a diagnosis was over half of the population, at 54.3% (94/173) compared to 36.4% (63/173) by the DRS. Using depression diagnosis as the gold standard, the DRS had a *sensitivity* (Se) of 41.5% (39/94), which indicated that the DRS identified less than half of residents with a diagnosis of depression. The DRS had a specificity (Sp) of 69.6% (55/79), with the DRS correctly excluding nearly 70% of all residents with no depression (Table 25).

Table 25: DRS possible depression by depression diagnosis

		Depression diagnosis		
		Depression diagnosis	No depression diagnosis	Total
DRS possible depression	Yes	39	24	63
	No	55	55	110
	Total	94	79	173

Out of a total of 63 residents who had a positive screening test for DRS possible depression (Table 25), 39 had a diagnosis of depression recorded, resulting in a *positive predictive value* (PPV) of 61.9% (39/63). This shows that among 63 residents who had a positive screening test for DRS possible depression, the probability of having a diagnosis of depression was 61.9%. Out of 110 residents who had a negative screening test for DRS possible depression, 55 (50%) did not have a diagnosis of depression. The *negative predictive value* (NPV) was 50% (55/110), which shows that among 55 residents who had a negative screening test for DRS possible depression, the probability of not having a diagnosis of depression was 50%.

4.5.5 Associations between depressive symptoms and demographic and clinical variables

The null hypothesis was used to prove that there is no association between depressive symptoms of the interRAI-LTCF for various demographics (age, gender, marital status, and education), or clinical variables (recorded diagnosis of depression and anxiety, and medications for depression and anxiety, and depressive symptoms of the DRS) in residents in a LTCF. A rejection of the null hypothesis indicated a positive association between depressive symptoms of the DRS for various demographics or clinical variables.

H_0: There is no association between depressive symptoms of the interRAI-LTCF for various demographics in residents in a LTCF.

Testing whether there was an association between depressive symptoms and the demographic variables, the following H_0 was rejected. P*ersistent anger with self or others* and the different education groups had significant associations found between ≤12 years education and >12 years education (0.3 [0.5] vs 0.5 [0.5]; x^2=9.4; *p*=.002; *K*=.009). Similarly, between *crying, tearfulness* and marital status, significant associations were found between married and unmarried (no partner) residents (0.3 [0.5] vs 0.1 [0.4], x^2=4.3; *p*=.038; *K*=.039) (Table 26).

Table 26: Testing hypotheses between depressive symptoms and demographic variables

Depressive symptoms	Age group	Gender	Marital status	Education
	U =Mann-Whitney tests, *K* = Kruskal-Wallis tests, *N* =173			
Made negative statements				
Statistics	*U* =.545	*U* =.788	*U* =.213	*K* =.472*
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o	Retain Null H_o	Retain Null H_o
Persistent anger with self or others				
Statistics	*U* =.452	*U* =.103	*U* =.786	*K* =.009*
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o	Retain Null H_o	Reject Null H_o
Expressions, including nonverbal, of what appear to be unrealistic fears				
Statistics	*U* =.763	*U* =.063	*U* =.848	*K* =.499
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o	Retain Null H_o	Retain Null H_o
Repetitive health complaints				
Statistics	*U* =.335	*U* =.693	*U* =.126	*K* =.294
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o	Retain Null H_o	Retain Null H_o
Repetitive anxious complaints/concerns (non-health related)				
Statistics	*U* =.054	*U* =.150	*U* =.757	*K* =.194
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o	Retain Null H_o	Retain Null H_o
Sad, pained or worried facial expressions				
Statistics	*U* =.715	*U* =.245	*U* =.706	*K* =.404
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o	Retain Null H_o	Retain Null H_o
Crying, tearfulness				
Statistics	*U* =.853	*U* =.077	*U* =.039*	*K* =.488
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o	Reject Null H_o	Retain Null H_o

Distribution of depressive symptoms by demographic variables were tested using Non-parametric tests (Mann-Whitney tests or Kruskal-Wallis tests). *Significance was set as *U* <.05, or *K*< .05.

H_0: There is no association between depressive symptoms of the interRAI-LTCF for various clinical variables in residents in a LTCF.

Testing whether there was an association between depressive symptoms and the clinical variables, the following *H_0* was rejected. M*ade negative statements* and depression diagnosis had significant associations (0.3 [0.5] vs 0.2 [0.4]; x^2=5.5;

p=.019; *U*=.019) and significant associations found between anxiety diagnosis and no anxiety diagnosis (0.1 [0.3] vs 0.3 [0.5], x^2=4.2; *p*=.040; *U*=.040) (Table 27). Similarly *expressions, including nonverbal, of what appear to be unrealistic fears* and anxiety diagnosis had significant associations found between anxiety diagnosis and no anxiety diagnosis (0.2 [0.4] vs 0.07 [0.3]; x^2=3.93; *p*=.046; *U*=.047 and *sad, pained or worried facial expressions* and depression medication had significant associations found between depression medication and no depression medication (0.4 [0.5] vs 0.2[0.4]; x^2=4.5; *p*=.035; *U*=.035). Lastly, there was an association between *crying, tearfulness* and depression medication (0.2 [0.4] vs 0.1[0.3]; x^2=6.5; *p*=.011; *U*=.011) (Table 27).

Table 27: Testing hypotheses between depressive symptoms and clinical variables

Depressive symptoms	Depression diagnosis	Depression medication	Anxiety diagnosis	Anxiety medication
	U =Mann-Whitney tests, *N* =173			
Made negative statements				
Statistics	*U* =.019*	*U* =.105	*U* =.040*	*U* =.074
Testing Null hypothesis (H_o)	Reject Null H_o	Retain Null H_o	Reject Null H_o	Retain Null H_o
Persistent anger with self or others				
Statistics	*U* =.309	*U* =.601	*U* =.423	*U* =.382
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o	Retain Null H_o	Retain Null H_o
Expressions, including nonverbal, of what appear to be unrealistic fears				
Statistics	*U* =.317	*U* =.631	*U* =.047*	*U* =.123
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o	Reject Null H_o	Retain Null H_o
Repetitive health complaints				
Statistics	*U* =.480	*U* =.557	*U* =.202	*U* =.174
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o	Retain Null H_o	Retain Null H_o
Repetitive anxious complaints/concerns (non-health related)				
Statistics	*U* =.445	*U* =.783	*U* =.486	*U* =.502
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o	Retain Null H_o	Retain Null H_o
Sad, pained or worried facial expressions				
Statistics	*U* =.115	*U* =.035*	*U* =.843	*U* =.871
Testing Null hypothesis (H_o)	Retain Null H_o	Reject Null H_o	Retain Null H_o	Retain Null H_o
Crying, tearfulness				
Statistics	*U* =.033	*U* =.011*	*U* =.661	*U* =.476
Testing Null hypothesis (H_o)	Retain Null H_o	Reject Null H_o	Retain Null H_o	Retain Null H_o

Distribution of depressive symptoms by demographic variables were tested using Non-parametric tests (Mann-Whitney tests). *Significance was set as *U* <.05.

4.5.6 Factors predicting the likelihood of a diagnosis of depression

Using a direct logistic regression model with the outcome: Depression Yes/No and factors of DRS scores 3-6, gender and age (in years), both age (*p*=.003) and DRS score (*p*=.001) significantly influenced the likelihood of having a diagnosis of

depression. Being older had an increased risk of OR=1.1 [CI 95% 1.0-1.1] and DRS score OR=1.3 [CI 95% 1.1 - 1.4] (Table 28).

Table 28: Logistic regression of age, gender and DRS score in predicting a diagnosis of depression

		Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP (B)	
								Lower	Upper
Step 1[a]	Age (in years)	.061	.021	8.750	1	.003*	1.063	1.021	1.107
	Gender (1)	-.183	.378	.234	1	.629	.833	.397	1.747
	Depression Rating Scale score	.221	.069	10.183	1	.001*	1.247	1.089	1.429
	Constant	-6.018	1.760	11.686	1	.001*	.002		

a. Variable (s) entered on step 1: Age (in years), Gender, Depression Rating Scale score. *Significance was set as $p < .05$.

This is further examined when using direct logistic regression to assess the impact of a number of factors on the likelihood that residents would report that they had a problem with depressive symptoms. The model used Depression Yes/ No and contained nine independent variables (*age; gender; made negative statements; persistent anger with self or others; expressions, including nonverbal, of what appear to be unrealistic fears; repetitive health complaints; repetitive anxious complaints/concerns (non-heath related); sad, pained or worried facial expressions;* and *crying tearfulness).* The full model containing all predictors was statistically significant X^2 (7; N=173) = 18.3; p<.001, indicating that the model was able to distinguish between residents with reported possible depression and those with no possible depression. The model correctly classified 36.4% of cases. The model showed that being female (p=.012) and the DRS item *made negative*

statements (*p*=.061), were most likely to influence the likelihood of having a diagnosis of depression (Table 29).

Table 29: Logistic regression of age, gender and DRS items in predicting a diagnosis of depression

		Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP (B)	
								Lower	Upper
Step 1[a]	Age (in years)	-.006	.019	.091	1	.763	.994	.958	1.032
	Gender (1)	.935	.371	6.349	1	.012*	2.547	1.231	5.272
	Made negative statements	-.414	.221	3.520	1	.061*	.661	.429	1.019
	Persistent anger with self or others	-.103	.199	.268	1	.605	.902	.610	1.333
	Expressions, including nonverbal, of what appear to be unrealistic fears	-.013	.276	.002	1	.962	.987	.574	1.697
	Repetitive health complaints	.106	.145	.536	1	.464	1.112	.837	1.476
	Repetitive anxious complaints/concerns (non-health related)	.170	.179	.900	1	.343	1.185	.834	1.684
	Sad, pained, or worried facial expressions	-.198	.196	1.025	1	.311	.820	.559	1.204
	Crying, tearfulness	-.236	.277	.723	1	.395	.790	.459	1.360
	Constant	.266	1.559	.029	1	.865	1.305		

a. Variable (s) entered on step 1: Age (in years). Gender. Made negative statements. Persistent anger with self or others. Expressions, including nonverbal, of what appear to be unrealistic fears. Repetitive health complaints/concerns (non-health related). Sad, pained, or worried facial expressions. Crying, tearfulness.

*Significance was set as $p < .05$.

4.6 Cognitive Impairment

CI in this population was analysed by comparing the categories of CI of the CPS, the frequencies in which CI occurred (cognitive impairment items of the CPS) and testing for associations between these and resident demographics. The frequencies of CI are determined by the presence of CI, according to the

Cognitive Performance Scale (CPS), as discussed in chapter 3, from the interRAI-LTCF instrument (Appendix 1).

4.6.1 Cognitive impairment categories of the CPS

Less than a quarter (42; 24.3%) of the residents had ratings MCI, with more than a tenth (26; 15%) with ratings of moderate to severe CI recorded. This indicated that more than a third (68; 39.3%) of all residents met the criteria for *cognitive impairment* as per the CPS. The rest of the residents had either no CI (60; 34.7%) or borderline intact cognition (45; 26%) recorded. Thus, nearly two thirds (105; 60.7%) of the residents did not meet the criteria for CI (Table 30).

Table 30: Categories and frequencies of CI of the CPS

Cognitive impairment categories of the CPS	Frequencies of cognitive impairment	Total (*N* =173) *N* (%)
No cognitive impairment		105 (60.7%)
No CI - CPS 0	(60, 34.7%)	
Borderline intact - CPS 1	(45, 26%)	
Cognitive impairment		68 (39.3%)
MCI - CPS 2	(42, 24.3%)	
Moderate/severe CI - CPS 3-6	(26, 15%)	
Categories and frequencies of cognitive impairment of the CPS were tested using Chi-square tests or Fisher Exact Tests. Signficance was set at $p < .05$.		

Comparing the proportion of residents by different demographics (age, gender, marital status, and education) across the four (4) CI categories (Table 31), no significant differences were found between the proportion of residents in the different CI categories of residents for *gender, marital status,* and *education.*

Significant differences were found between the proportion of residents in the different CI categories of residents by *age group,* with less than a fifth (21/26; 19.1%) of the older old residents in the moderate/severe CI categories, compared to the less than a tenth (5/26; 7.9%) of the younger old residents (X^2=13.6; p=.003) (Table 31).

Table 31: CI categories by demographic variables

Demographics	Cognitive impairment (CI) categories of the CPS				Total (N =173) N (%)	Chi-square X^2	p -value p
	No CI CPS 0 n =60 (34.7%)	Borderline CI CPS 1 n =45 (26%)	MCI CPS 2 n =42 (24.3%)	Mod/severe CI CPS 3-6 n =26 (15%)			
Age group						13.6	.003*
Older old (80-107 years)	28 (25.5%)	29 (26.4%)	32 (29.1%)	21 (19.1%)	110 (63.6%)		
Younger old (61 - 79 yrs)	32 (50.8%)	16 (25.4%)	10 (15.9%)	5 (7.9%)	63 (36.4%)		
Gender						0.9	.836
Females	43 (34.1%)	31 (24.6%)	32 (25.4%)	20 (15.9%)	126 (72.8%)		
Males	17 (36.2%)	14 (29.8%)	10 (21.3%)	6 (12.8%)	47 (27.2%)		
Marital status						2.8	.424
No partner	50 (34%)	37 (25.2%)	39 (26.5%)	21 (14.3%)	147 (85%)		
Married	10 (38.5%)	8 (30.8%)	3 (11.5%)	5 (19.2%)	26 (15%)		
Education (n =169)						8.1	.230
≤ 12 years education	41 (34.7%)	37 (31.4%)	24 (20.3%)	16 (13.6%)	118 (68.2%)		
> 12 years education	18 (35.3%)	8 (15.7%)	16 (31.4%)	9 (17.6%)	51 (29.5%)		

Differences in cognitive impairment categories of the CPS by demographic variables were tested using Chi-square tests or Fisher Exact tests. *Significance was set as p <.05.

Comparing the proportion of residents in the different CI categories by the length of stay, no significant differences in the proportion of residents in the longer stay (>12-month group) compare to the shorter stay facility (≤12months) (X^2=2.6; p=.459). Significant differences were found between the proportion of residents by residential section, in the different CI categories of residents in Special Care Unit for Dementia section vs the cognitively intact section, with under a half (18/26; 45%) of the residents in the Special Care Unit for Dementia having moderate/severe CI, compared to less than a tenth (8/26; 6%) of the

residents in the cognitively intact section having moderate/severe CI (X^2=58.9; p=<.001) (Table 32).

Table 32: CI by the length of stay and residential section

Demographics	Cognitive impairment categories of the CPS				Total (N=173) N (%)	Chi-square X^2	p-value p
	No CI CPS 0 n=60 (34.7%)	Borderline CI CPS 1 n=45 (26%)	MCI CPS 2 n=42 (24.3%)	Mod/severe CI CPS 3-6 n=26 (15%)			
Length of stay						2.6	.459
≤12 months	31 (39.7%)	17 (21.8%)	20 (25.6%)	10 (12.8%)	78 (45.1%)		
> 12 months	29 (30.5%)	28 (29.5%)	22 (23.2%)	16 (16.8%)	95 (54.9%)		
Residential section							
Cognitivey intact section	59 (44.4%)	41 (30.8%)	25 (18.8%)	8 (6%)	133 (76.9%)	58.9	<.001*
Special Care Unit for	1 (2.5%)	4 (10%)	17 (42.5%)	18 (45%)	40 (23.1%)		
Dementia							
Differences in location by demographic variables were tested using Chi-square tests or Fisher Exact Tests.							
*Significance was set as p<.05.							

4.6.2 Cognitive impairment items of the CPS

The highest rated CI item recorded was *short-term memory recall* (n=103; 59.5%), followed by *cognitive skills for daily decision making* (n=70; 40.5%), and the lowest rated CI item was *eating – assistance needed* (n= 14; 8.1%). In comparing CI items across age groups, there were no significant differences between the younger old and older old residents for *making self understood,* and *eating -assistance needed*. Significant differences were found between CI items and *short-term memory recall,* with more than half (75/110; 68.2%) of the older old residents with *short-term memory recall*, compared to less than a half (28/63; 44.4%) of the younger old residents (X^2=9.4; p=.002); and nearly half (54/110; 49.1%) of the older old residents with *cognitive skills for daily decision*

making difficulties, as opposed to a quarter (16/63; 25.4%) of the younger old residents (X^2=9.3; p=.002) (Table 33).

Table 33: Cognitive impairment by age group

Cognitive impairment items of the CPS	Age group: Young old (61-79 yrs) *n* =63 (36.4%)	Age group: Older old (80-107 yrs) *n* =110 (63.6%)	Total (*N* =173) *N* (%)	Chi-square X^2	*p* -value *p*
Short-term memory recall	28 (44.4%)	75 (68.2%)	103 (59.5%)	9.4	.002*
Cognitive skills for daily decision making	16 (25.4%)	54 (49.1%)	70 (40.5%)	9.3	.002*
Making self understood	7 (11.1%)	25 (22.7%)	32 (18.5%)	3.6	.058
Eating - assistance needed	4 (6.3%)	10 (9.1%)	14 (8.1%)	0.4	.525

Frequencies of cognitive impairment by demographic variables were tested using Chi-square tests or Fisher Exact Tests. *Significance was set as p <.05.

In comparing CI items across gender, there were no significant differences between *short-term memory recall, making self understood,* and *eating - assistance needed*. Significant differences were found between CI items and *cognitive skills for daily decision making*, with nearly half (57/126; 45.2%) of all females with *cognitive skills for daily decision-making difficulties*, compared to less than a third (13/47; 27.7%) of males (X^2=4.4; p=.036) (Table 34).

Table 34: Cognitive impairment by gender

Cognitive impairment items of the CPS	Gender: Males *n* =47 (27.2%)	Gender: Females *n* =126 (72.8%)	Total (*N* =173) *N* (%)	Chi-square X^2	*p* -value *p*
Short-term memory recall	29 (61.7%)	74 (58.7%)	103 (59.5%)	0.1	.723
Cognitive skills for daily decision making	13 (27.7%)	57 (45.2%)	70 (40.5%)	4.4	.036*
Making self understood	10 (21.3%)	22 (17.5%)	32 (18.5%)	0.3	.565
Eating - assistance needed	4 (8.5%)	10 (7.9%)	14 (8.1%)	0.02	.902

Frequencies of cognitive impairment by demographic variables were tested using Chi-square tests or Fisher Exact Tests.* Significance was set as p <.05.

In comparing CI items across marital status, there were no significant differences between any of the CI items (Table 35).

Table 35: Cognitive impairment by marital status

Cognitive impairment items of the CPS	Marital status		Total	Chi-square	*p* -value
	Married	No partner	(*N* =173)		
	n =26 (15%)	*n* =147 (85%)	*N* (%)	X^2	*p*
Short-term memory recall	14 (53.8%)	89 (60.5%)	103 (59.5%)	0.4	.521
Cognitive skills for daily decision making	7 (26.9%)	63 (42.9%)	70 (40.5%)	2.3	.127
Making self understood	5 (19.2%)	27 (18.4%)	32 (18.5%)	0.01	.917
Eating - assistance needed	2 (7.7%)	12 (8.2%)	14 (8.1%)	0.007	.935
Frequencies of cognitive impairment by demographic variables were tested using Chi-square tests or Fisher Exact Tests. Significance was set as $p<.05$.					

In comparing CI items across education, there were no significant differences between *short-term memory recall* and *cognitive skills for daily decision making.* Significant differences were found between CI items and *making self understood,* with nearly a fifth (10/51; 19.6%) of residents with >12 years education with *making self understood difficulties,* compared to (19/118; 16.1%) of residents with ≤12 years education (X^2=9.0; *p*=.011); and *eating -assistance needed*, with less than a tenth (10/118; 8.5%) of residents with ≤12 years education with *eating -assistance needed,* as opposed to (2/51; 3.9%) of residents with >12 years education (X^2=10.7; *p*=.005) (Table 36).

Table 36: Cognitive impairment by education

Cognitive impairment items of the CPS	Education (*n* =169) ≤ 12 years 118 (68.2%)	Education (*n* =169) >12 years 51 (29.5%)	Total (*N* =173) *N* (%)	Chi-square X^2	*p* -value *p*
Short-term memory recall	70 (59.3%)	30 (58.8%)	103 (59.5%)	0.4	.815
Cognitive skills for daily decision making	44 (37.3%)	23 (45.1%)	70 (40.5%)	2.9	.231
Making self understood	19 (16.1%)	10 (19.6%)	32 (18.5%)	9.0	.011*
Eating - assistance needed	10 (8.5%)	2 (3.9%)	14 (8.1%)	10.7	.005*
Frequencies of cognitive impairment by demographic variables were tested using Chi-square tests or Fisher Exact Tests. *Significance was set as *p* <.05.					

4.6.3 Cognitive impairment items by categories of the CPS

A significant trend (all *p*<.001) in *making self understood* and *eating -assistance required,* is observed as the severity of CI categories of the CPS increase. Exceptions were observed for *short-term memory recall* and *cognitive skills for daily decision making,* where an increase was observed in CI categories from borderline CI to MCI with a tapering down to moderate/severe CI category (35.9% to 39.8% to 24.3%; and 10% to 52.9% to 37.1%) (Table 37).

Table 37: CI items by CI categories

Cognitive impairment items of the CPS	Cognitive impairment categories of the CPS: No CI CPS 0 *n* =60 (34.7%)	Borderline CI CPS 1 *n* =45 (26%)	MCI CPS 2 *n* =42 (24.3%)	Mod/severe CI CPS 3-6 *n* =26 (15%)	Total (*N* =173) *N* (%)	Chi-square X^2	*p* -value *p*
Short-term memory recall	0 (0%)	37 (35.9%)	41 (39.8%)	25 (24.3%)	103 (59.5%)	137.7	<.001*
Cognitive skills for daily decision making	0 (0%)	7 (10%)	37 (52.9%)	26 (37.1%)	70 (40.5%)	130.2	<.001*
Making self understood	0 (0%)	1 (3.1%)	14 (43.8%)	17 (53.1%)	32 (18.5%)	65.6	<.001*
Eating - assistance needed	2 (14.3%)	1 (7.1%)	4 (28.6%)	7 (50%)	14 (8.1%)	16.4	.001*
Frequencies of cognitive impairment (CI) by CI categories of the CPS were tested using Chi-square tests or Fisher Exact Tests. *Signficance was set at *p* <.05.							

In comparing CI/dementia diagnosis by frequencies of CI, there were significant differences in most of the CPS items, with short-term memory (X^2=*26.9; p*<.001) and cognitive skills for daily decision making (X^2=*43.3; p*<.001) and making self understood (X^2=*8.6; p*=.003) (Table: 38).

Table 38: **CI/dementia diagnosis by frequencies of CI**

Frequencies of cognitive impairment of the CPS	CI/dementia diagnosis		Total (*N* =173)	Chi-Square	*p* -value
	Present	Not present			
	59 (34.1%)	114 (65.9%)	*N* (%)	X^2	*p*
Short-term memory recall	51 (86.4%)	52 (45.6%)	103 (59.5%)	26.9	<.001*
Cognitive skills for daily decision making	44 (74.6%)	26 (22.8%)	70 (40.5%)	43.3%	<.001*
Making self understood	18 (30.5%)	14 (12.3%)	32 (18.5%)	8.6	.003*
Eating - assistance needed	7 (11.9%)	7 (6.1%)	14 (8.1%)	1.7	.191

Frequencies of cognitive impairment by cognitive impairment diagnosis were tested using Chi-square tests or Fisher Exact Tests. *Significance was set as *p* <.05.

4.6.4 Cognitive impairment/dementia diagnosis and medication use

In comparing CI and dementia diagnoses and medications for CI/dementia across CI categories, significant differences were found between *CI/dementia diagnosis* and *medications for CI/dementia,* with a documented diagnosis of CI/dementia recorded in over a third of all the residents (59; 34.1%; X^2=48.8; *p*=<.001). Very few of these 59 residents (13; 7.5%; X^2=10.1; *p*=.018) with a diagnosis of CI/dementia, received medication for CI/dementia, which amounted to less than a tenth of the total population of residents. There were no residents who received medication for CI/dementia with no recorded CI (Table 39).

Table 39: CI categories by diagnosis and medication

Diagnosis and medication for CI/dementia	Cognitive impairment categories of the CPS				Total	Chi-square	*p* -value
	No CI	Borderline CI	MCI	Mod/severe CI			
	CPS 0	CPS 1	CPS 2	CPS 3-6	(*N* =173)		
	n =60 (34.7%)	*n* =45 (26%)	*n* =42 (24.3%)	*n* =26 (15%)	*N* (%)	X^2	*p*
CI/dementia diagnosis present	5 (8.5%)	11 (18.6%)	23 (39%)	20 (33.9%)	59 (34.1%)	48.8	<.001*
CI/dementia medication used	0.0%	3 (23.1%)	6 (46.2%)	4 (30.8%)	13 (7.5%)	10.01	.018*
Differences in CI categories of the CPS by clinical variables were tested using Chi-Square Tests or Fisher Exact Tests. *Significance was set as *p* <.05.							

To assess the validity of the CPS to detect CI/dementia as diagnosed by a medical professional, the CPS score and recommended cut-off categories was compared with a doctor's diagnosis of CI/dementia. The *documentation* of CI/dementia by a diagnosis was more than a third of the population, at (59/173; 34.1%), compared to (68/173; 39.3%) by the CPS. Using CI/dementia diagnosis as the gold standard, the CPS had a *sensitivity* (Se) of (43/59; 72.9%), which indicated that the CPS identified just under three-quarters of the residents with a diagnosis of CI/dementia. The CPS had a specificity (Sp) of (16/114; 14%), with the CPS only excluding 14% of all residents with no CI/dementia (Table 40).

Table 40: **CPS CI by CI/dementia diagnosis**

		CI/dementia diagnosis		
		CI/dementia diagnosis	No CI/dementia diagnosis	Total
CPS CI	Yes	43	25	68
	No	16	89	105
	Total	59	114	173

Out of a total of 68 residents who had a positive screening test for CPS CI, 43 had a diagnosis of CI/dementia recorded, resulting in a *positive predictive value* (PPV) of (43/68; 63.2%). This shows that among 68 residents who had a positive screening test for CPS CI, the probability of having a diagnosis of CI/dementia was 63.2%. Out of 105 residents who had a negative screening test for CPS CI, (16; 15.2%) did not have a diagnosis of CI/dementia. The *negative predictive value* (NPV) was (16/105; 15.2%), which shows that among 16 residents who had a negative screening test for CPS CI, the probability of not having a diagnosis of CI/dementia was 15.2%.

4.6.5 Associations between cognitive impairment and demographic and clinical variables

The null hypothesis was used to prove that there is no association between CI of the interRAI-LTCF for various demographics (age, gender, marital status, and education), or clinical variables (recorded diagnosis of CI and dementia and medications for CI and dementia, and CI of the CPS) in residents in a LTCF. A rejection or disproof of the null hypothesis indicated a positive association between CI of the CPS for various demographics or clinical variables.

H_0: There is no association between cognitive impairment of the interRAI-LTCF for various demographics in residents in a LTCF.

Testing the Null hypothesis that there is no association between CI items and demographics, significant associations were found between *cognitive skills for daily decision making* and the young old and older old (0.3 [0.4] vs 0.5 [0.5]; x^2=9.3; *p*=.002, *U*=.024) and *short-term memory recall* and young old and older old (0.4 [0.5] vs 0.7 [0.5]; x^2=9.4; *p*=.002, *U*=.002); *eating – how a person eats/drinks* and ≤12 years education and >12 years education (1.1 [0.3] vs 1.0 [0.2]; x^2=10.7; *p*=.005; *K*=.005) (Table: 41).

Table 41: Testing hypotheses between CI and demographic variables

Cognitive impairment	Age group	Gender	Marital status	Education
	U =Mann-Whitney tests, *K* = Kruskal-Wallis tests, *N* =173			
Cognitive skills for daily decision making				
Statistics	*U* =.024*	*U* =.206	*U* =.247	*K* =.676
Testing Null hypothesis (H_o)	Reject Null H_o	Retain Null H_o	Retain Null H_o	Retain Null H_o
Short-term memory recall				
Statistics	*U* =.002*	*U* =.724	*U* =.522	*K* =.816
Testing Null hypothesis (H_o)	Reject Null H_o	Retain Null H_o	Retain Null H_o	Retain Null H_o
Making self understood				
Statistics	*U* =.661	*U* =.111	*U* =.970	*K* =.847
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o	Retain Null H_o	Retain Null H_o
Eating - how a person eats/drinks				
Statistics	*U* =.526	*U* =.902	*U* =.935	*K* =.005*
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o	Retain Null H_o	Reject Null H_o

Distribution of cognitive impairment by demographic variables were tested using Non-parametric tests (Mann-Whitney tests or Kruskal-Wallis tests). *Significance was set as *U* <.05, or *K*< .05

H_0: There is no association between cognitive impairment of the interRAI-LTCF for various clinical variables in residents in a LTCF.

Testing the Null hypothesis between CI items and clinical variables, significant associations were found between *cognitive skills for daily decision making* and CI/dementia diagnosis and no CI/dementia diagnosis (0.8 [0.4] vs 0.2 [0.4]; x^2=43.3; *p*= <.001; *U*=<.001); *cognitive skills for daily decision making* and CI/dementia medication and no CI/dementia medication (0.8 [0.4] vs 0.4[0.5]; x^2=7.8; *p*=.005; *U*=.004); *short-term memory recall* and CI/dementia diagnosis, and no CI/dementia diagnosis (0.9 [0.3] vs 0.5[0.5]; x^2=26.9; *p*= <.001; *U*= <.001); *short-term memory recall* and CI/dementia medication and no CI/dementia medication (0.9 [0.3] vs 0.6[0.5]; x^2=6.3; *p*=.012; *U*=.013); and lastly m*aking self understood* and CI/dementia diagnosis and no CI/dementia diagnosis (0.3 [0.5] vs 0.1[0.3]; x^2=8.6; *p*=.003; *U*= <.001) (Table 42).

Table 42: Testing hypotheses between CI and clinical variables

Cognitive impairment	CI/dementia diagnosis	CI/dementia medication
	U =Mann-Whitney tests, *N* =173	
Cognitive skills for daily decision making		
Statistics	*U* =.<.001*	*U* =.004*
Testing Null hypothesis (H_o)	Reject Null H_o	Reject Null H_o
Short-term memory recall		
Statistics	*U* =.<.001*	*U* =.013*
Testing Null hypothesis (H_o)	Reject Null H_o	Reject Null H_o
Making self understood		
Statistics	*U* =.<.001*	*U* =.264
Testing Null hypothesis (H_o)	Reject Null H_o	Retain Null H_o
Eating		
Statistics	*U* =.192	*U* =.956
Testing Null hypothesis (H_o)	Retain Null H_o	Retain Null H_o

Distribution of cognitive impairment by demographic variables were tested using Non-parametric tests (Mann-Whitney tests). *Significance was set as *U* <.05.

4.6.6 Factors predicting the likelihood of a diagnosis of cognitive impairment/dementia

Using a direct logistic regression model with the outcome: CI/Dementia Yes/No and factors of CPS scores of 3-6, only the CPS scale score (p<.001) significantly influenced the likelihood of having a diagnosis of a diagnosis of CI/Dementia (Table 43).

Table 43: Logistic regression of age, gender and CPS score predicting a diagnosis of CI/dementia

		Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP (B)	
								Lower	Upper
Step 1[a]	Age (in years)	-.011	.020	.309	1	.578	.989	.952	1.028
	Gender (1)	-.189	.377	.252	1	.616	.828	.395	1.733
	Cognitive Performance	.457	.125	13.461	1	<.001*	1.580	1.237	2.017
	Constant	-.258	1.605	.026	1	.872	.773		

a. Variable (s) entered on step 1: Age (in years), Gender, Cognitive Performance Scale score.

*Significance was set as $p < .05$.

This is further examined when using direct logistic regression to assess the impact of several factors on the likelihood that residents being diagnosed as having CI/Dementia. The model used CI/Dementia Yes/No and contained five independent variables (*age; cognitive skills for decision making, short-term memory recall, making self understood and eating)*. The model showed that the CPS items of *cognitive skills for decisions-making* (p<.001) and *short-term memory recall* (p=.003) were most likely to influence the likelihood of having a diagnosis of CI/Dementia (Table 44).

Table 44: Logistic regression of age, gender and CPS items in predicting a diagnosis of CI/dementia

		Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP (B)	
								Lower	Upper
Step 1[a]	Age (in years)	.035	.023	2.203	1	.138	1.035	.989	1.084
	Cognitive skills for daily decision making	-1.056	.209	25.423	1	<.001*	.348	.231	.524
	Short-term memory recall	-1.450	.492	8.683	1	.003*	.235	.089	.615
	Making self understood (expression)	.061	.351	.030	1	.862	1.063	.534	2.114
	Eating – how a person eats/drinks	.343	.204	2.825	1	.093	1.409	.945	2.101
	Constant	-.303	1.875	.026	1	.872	.739		

a. Variable (s) entered on step 1: Age (in years), Cognitive skills for daily decision making, Short-term memory recall, Making self understood (expression), Eating – how a person eats/drinks. *Significance was set as p<.05.

4.7 Associations between 'depression' and 'cognitive impairment' in this population

Multiple direction associations between depressive symptoms, depressive categories, possible depression and CI symptoms, CI categories and possible CI, were tested using the conceptual framework of the interRAI, which was formulated, against the formative documented literature of the DRS and CPS (Burrows et al., 2000; Morris et al., 1994; Morris et al., 2011).

4.7.1 The risk of developing depression when cognitive impairment is present

To determine the risk of developing depression when CI is present, *the RR and AR* were calculated (Table 45). There is a 55.9% risk of possible depression with CI present as compared to a 23.8% risk of possible depression when CI is not present, resulting in an *AR* of 32.1% and *RR* of 2.3471 [95%ci 1.57 - 3.5] *p*<.0001.

That means that people meeting criteria for CI on the CPS are 2.3 times more likely to meet the criteria for possible depression on the DRS.

Table 45: Risk of having possible depression with CI

CPS cognitive impairment (CI)	DRS possible depression		Total	Chi-square	*p* -value
	Possible depression present	No possible depression present	(*N* =173)		
	63 (36.4%)	110 (63.6%)	*N* (%)	X^2	*p*
CPS CI				18.3	<.001*
CI present	38 (55.9%)	30 (44.1%)	68 (39.3%)		
No CI present	25 (23.8%)	80 (76.2%)	105 (60.7%)		

DRS possible depression and CPS CI were tested using Chi-square tests or Fisher Exact tests. *Significance was set as $p < .05$.

4.7.2 Risk of developing CI when depression is present

To determine the risk of developing CI when depression is present, *RR and AR* were calculated (Table 46). There is a 60.3% risk of CI with possible depression present as compared to a 27.3% risk of CI when possible depression is not present, resulting in an *AR* of 33% and *RR* of 2.2 [95%ci 1.54 - 3.2] $p<.0001$. That means that people meeting criteria for possible depression on the DRS are 2.2 times more likely to meet the criteria for CI on the CPS.

Table 46: Risk of having CI with possible depression

DRS possible depression	CPS cognitive impairment (CI)		Total	Chi-square	*p* -value
	CI present	No CI present	(*N* =173)		
	68 (39.3%)	105 (60.7%)	*N* (%)	X^2	*p*
DRS possible depression				18.3	<.001*
Possible depression present	38 (60.3%)	25 (39.7%)	63 (36.4%)		
No possible depression present	30 (27.3%)	80 (72.7%)	110 (63.6%)		

CPS CI and DRS possible depression were tested using Chi-square tests or Fisher Exact tests. *Significance was set as $p < .05$.

4.7.3 Associations between DRS and CPS categories

H_0: There is no association between depressive and CI categories of the interRAI-LTCF in residents in a LTCF.

Testing the Null hypothesis that there is no association between depressive symptoms and CI, significant associations were found between the DRS categories and the CPS categories (X^2=22.3; p=.008) (Table 47). A decline in numbers was noted in residents with no symptoms of depression (DRS 0), as the severity levels of CI increased, across all levels of CI, with more than a third with no CI (CPS 0), compared to less than a quarter with moderate to severe CI (CPS 3-6) (23/60; 38.3% vs 4/26; 15.4%). This decline was also noted in residents with some symptoms of depression (DRS 1-2), with less than half in those with no CI, compared to less than a quarter in MCI (CPS 2) (26/60; 43.3% vs 9/42; 21.4%), with an increase (more than a third) (9/26; 15%) in depressive symptoms (DRS 1-2) was noted in moderate to severe CI. As the possibility of depression (DRS 3-5) increased in severity, an increase in numbers was noted in residents as the severity levels of CI increased, with a tenth in those with no CI, compared to more than a third in MCI (6/60; 10% vs 16/42; 38.1%). However, a decrease in depressive symptoms was noted in moderate to severe CI (9/26; 34.6%). A similar pattern of decline was also noted in possible severe depression (DRS 6-14), although the numbers were less, with less than a tenth in no CI, compared to less than a quarter in MCI (5/60; 8.3% vs 9/42; 21.4%), with a decrease in moderate to severe CI (4/26; 15.4%).

Table 47: CPS categories and DRS categories

DRS categories	CPS categories: No CI CPS 0 *n* =60 (34.7%)	Borderline CI CPS 1 *n* =45 (26%)	MCI CPS 2 *n* =42 (24.3%)	Mod/severe CI CPS 3-6 *n* =26 (15%)	Total (*N* =173) *N* (%)	Chi-square X^2	*p* -value *p*
No symptoms of depression (DRS 0)	23 (38.3%)	13 (28.9%)	8 (19%)	4 (15.4%)	48 (27.7%)	22.3	.008
Some symptoms of depression (DRS 1-2)	26 (43.3%)	18 (40%)	9 (21.4%)	9 (34.6%)	62 (35.8%)		
Possible depression (DRS 3-5)	6 (10%)	9 (20%)	16 (38.1%)	9 (34.6%)	40 (23.1%)		
Possible severe depression (DRS 6-14)	5 (8.3%)	5 (11.1%)	9 (21.4%)	4 (15.4%)	23 (13.3%)		

CPS categories by DRS categories were tested using Chi-square tests or Fisher Exact tests. Significance was set as p<.05

4.8 Summary of chapter

This chapter presented the findings of this study, which aimed to describe a profile of depressive symptoms and CI in residents using the interRAI-LTCF. The results showed a rejection of the null hypotheses in many of the items of the DRS and CPS, which indicated positive associations between depressive symptoms and CI for the various demographics (age, gender, marital status, and education), or clinical variables (recorded diagnosis of depression and anxiety, and medications for depression and anxiety, and depressive symptoms of the DRS) The direct logistic regression model was used to confirm that the CPS scale score significantly influenced the likelihood of having a diagnosis of a diagnosis of CI/Dementia, especially the CPS items of "*Cognitive skills for decisions making* and *short-term memory recall".* Similarly, the DRS scale score significantly influenced the likelihood of having a diagnosis of depression, especially being female, and the DRS item of "m*ade negative statements".* This leads to the discussion of the findings in the following chapter.

CHAPTER 5: DISCUSSION

5.1 Introduction

The analysis of depressive symptoms and CI in residents in this specific setting is complex, and in the context of analysing depression and CI, using the interRAI in a LTCF in the South African setting, this is the first of its kind on the African continent. This chapter will discuss the main findings in accordance with the research aim and objectives of this study, and where applicable, links the literature to the research outcomes.

5.2 The setting and population

This setting was a specific LTCF in which all 173 resident's medical and interRAI-LTCF records were included for analysis. The population comprised white Jewish, English speaking older adults (61+ years of age) with more than half of whom (95; 54.9%) stayed in the LTCF for longer than 12 months. The majority of the residents (133; 76.9%) resided in the cognitively intact section of the LTCF, with less than a third (40; 23.1%) living in the Special Care Unit for dementia. The *age* of the residents varied from 61 to 107 years (mean age of 82.7 years), with more than half (63.3%) being older than 80 years. Nearly three-quarters of the residents were *female* (126; 72.8%), with living without partners (never married, separated, divorced, or widowed) (147; 85%).

When considering the overall demographics and clinical variables of this population, it was similar to other LTCF's internationally and locally (De Jager et al., 2017; Neufeld et al., 2014; Ramlall et al., 2013; Van Cauwenberghe et al., 2016). International and local studies in LTCF's compared reasonably favourably, with the average age of residents varying between 75-85 years, with the majority being female (66-69%), with almost 80% being over the age of 76 years, and 70-73% living without partners (interRAI New Zealand, 2017; Neufeld et al., 2014; Ramlall et al., 2013; Wellens et al., 2013).

These results were in keeping with the South African statistics in which nearly three-quarters of the population (492,000; 71.3%) were females, over the age of 80 years (STATS SA, 2017). Women generally live longer than men, whereby the majority of male deaths peaked at 60-64 years (8.6%), compared with females, who peaked at 75-79 years (8.3%), and 7.5% at 80-84 years (STATS SA, 2016). Therefore, older adult females who live longer than males, are more likely to be living without partners (United Nations, 2017).

5.3 Depression and anxiety

Many studies recognise the coexistence between depression and anxiety, although they differ with respect to the extent to which they occur together (Baxter et al., 2014). As the DRS of the interRAI incorporates indicators of possible depressed, anxious, or sad mood, the following discussion will focus on depressive symptoms, which includes anxiety.

5.3.1 Depressive symptoms using the DRS

More than a third of the residents (36.4%) had the possibility for depression, according to DRS scores 3-14. These results averaged favourably with other international interRAI studies in LTCF's, *at 20.3% - 42.5%* (Estabrooks et al., 2013; Hirdes et al., 2011; Huang & Carpenter, 2011). The literature reported that comorbidities, poor health, unhealthy lifestyle, and psychosocial and emotional factors can contribute to depression (Aziz & Steffens, 2013; Carrière et al., 2017; Donovan et al., 2017; Holmquist et al., 2017; Narainsamy et al., 2015; Padayachey et al., 2017; Schaakxs et al., 2017). There is an increased likelihood for repeated episodes of depression in older adults, especially in those with comorbid conditions (Haigh et al., 2017). Chronic stress affects the production of hormones in the brain, resulting in depression and CI, with alterations in memory, attention, executive functioning and perception (Chepenik et al., 2007; Saleh et al., 2017). This was however not examined in this study.

More than a half of the residents (57.5%) in the Special Care Unit for dementia had the possibility for depression (DRS 3-14), compared to less than a one third (30%) of the residents in the cognitively intact section having possible depression. This of particular significance, as there are fewer residents (23.1%) who reside in the Special Care Unit for dementia, compared to 76.9% in the cognitively intact section. These findings suggested that residents with dementia are about 50% more likely to have the possibility for depression (DRS 3-14) than those without dementia. The literature supports that depression in late life

increases with reduced memory functioning (Brailean et al., 2017) and that the rate at which dementia progresses is greatly influenced by the presence of depression (odds ratio: 2.63) (Moon et al., 2017). CI may be associated with moderate to severe depression (Almeida et al., 2016), particularly when depression develops in older adults (Neufeld et al., 2014). The literature reported that residents with dementia had CPS scores of 3.7, which indicated a moderate to severe CI (Jones et al., 2003). Another study reported that 64.6% of LTCF residents had high CPS scores, indicating severe CI (van der Steen et al., 2006).

Although not part of this study, the increase in CPS scores associated with severe CI, was reported in many studies to be directly proportional to higher impairment in physical functioning, with increased dependence in managing the basic tasks of everyday living (Bartfay et al., 2016; Jones et al., 2010; Morris et al., 2016). The literature confirms that older adults with dementia required more complex care (Hirdes et al., 2011). Therefore, residents in the Special Care Unit require substantially higher physical care, with more carers to cater for their physical and psychological needs, than in the cognitively intact section of the facility.

More than a third of all residents (35.8%) in this study had some symptoms of depression (DRS scores 1-2), which did not meet the requirements for possible depression. These findings may denote a possible sub-clinical stage of depression (before meeting the clinical diagnostic criteria) (Burrows et al., 2000; JI, 2012). The literature reported that people with sub-clinical depression (insufficient signs

and symptoms), were more highly at risk for developing CI (Gonzales et al., 2017). These risk factors include comorbidities, unhealthy lifestyle, and poor physical, psychosocial and emotional health (Donovan et al., 2017; Narainsamy et al., 2015; Padayachey et al., 2017).

Interventions which can be immediately introduced into the LTCF to enhance healthy lifestyle habits of the residents include regular exercising, stop smoking, eating a well-balanced diet, good sleep hygiene, and activities to promote social interaction and wellbeing. This affords the opportunity to identify residents at risk for developing depression, and to receive timeous prophylactic treatment and interventions (JI, 2012., Burrows et al., 2000). These results are higher than other reported studies of sub-clinical depression, at 24% (Jongenelis et al., 2004).

The highest indicator of possible depressed, anxious, or sad mood was *persistent anger with self or others,* with more than a third (37%) of all the residents. It was present in 40.4% of residents with a clinical diagnosis of depression. This indicator was highest in the older old residents (39.1%), in males (46.8%), and in those with no partners (37.4%). In addition, it was also significantly higher in residents with >12 years of education (52.9%). This was followed by *repetitive health complaints,* with more than a third (36.4%) of all residents with depressive symptoms. It was present in 34% of residents with a clinical diagnosis of depression. This indicator had similar comparisons, except for gender, where females had higher symptoms than males (37.3% vs 34%). The least depressive indicator in this study was *expressions, including nonverbal, of what appear to be*

unrealistic fears (7.5%), which was higher females than males (11.1% vs 2.1%). It was present in 10.6% of residents with a clinical diagnosis of depression. While another interRAI study also reported the highest indicators to be persistent anger with self or others, at 33.2%, it differed in the least recorded indicator, as being repetitive health complaints, at 14.6% (Huang & Carpenter, 2011). The DRS indicators of sad mood were found in the literature to be the most represented in the diagnosis of depression (Langlois & Martin, 2008).

The favourable comparisons between depressive symptoms of the DRS in this study and other interRAI studies (Martin et al., 2007), gave credence to the validity of using the DRS to analyse depressive symptoms, rather than using the gold standard diagnosis of depression. Despite the validity of the DRS as an effective screening tool to identify depressive symptoms (Burrows et al., 2000), there were contrary studies which found that there were discrepancies between the clinical diagnosis of depression, from medical records, and the DRS criteria for the possibility for depression (Baller et al., 2009; Penny et al., 2016; Volicer et al., 2011). These discrepancies may be influenced by concomitant CI, in which case the aforementioned studies may have been better represented by residents without CI.

5.3.2 Depression diagnosis and medication for depression

The reported diagnosis of clinical depression was 54.3%, of whom most received medication for depression. These findings were considerably higher than other studies in LTCF's, which reported a clinical diagnosis of depression in residents at 8% to 24%, which may be contributed by comorbidities and CI (Abrams et al., 2017). The higher results of depression diagnosis in this study may perhaps confer an over-representation of depression, as the diagnostic methods used were in the main were not the same as the rigorous criteria of the (American Psychiatric Association, 2013). The reported diagnosis of anxiety was 20.2%, of whom most received medication for anxiety.

The documentation of depression by a diagnosis was over half of the population, at 54.3%, compared to 36.4% by the DRS. Using depression diagnosis as the gold standard, the DRS had a *Se* of 41.5%, which indicated that the DRS identified less than half of the residents with a diagnosis of depression. The DRS had a *Sp* of 69.6%, with the DRS correctly excluding nearly 70% of all residents with no depression.

The direct logistic regression model indicated that the model was able to distinguish between residents with reported possible depression and those with no possible depression. The model correctly classified 36.4% of cases. The model showed that being female (p=.012) and the DRS item *made negative statements* (p=.061), were most likely to influence the likelihood of having a diagnosis of depression. Both age (p=.003) and DRS score (p=.001) significantly influenced the

likelihood of having a diagnosis of depression (Table 28). Being older had an increased risk of OR=1.1 [CI95% 1.0-1.1] and DRS score OR=1.3.

The use of medication for depression in this study, at 54.3%, was comparable to other interRAI studies, in which 80% of residents who were depressed, received antidepressants (Neufeld et al., 2014). Anstey et al. (2007), noticed that depression was reduced in older adults who received antidepressant therapy (Anstey et al., 2007). However, there may be a reduced efficacy in antidepressant response to treatment in older adults, compared to younger people (Haigh et al., 2017).

5.3.3 Demographic variables and depression

Gender: There were more females (76.2%) with the possibility for depression (DRS 3-14) than males (23.8%). Other interRAI studies in LTCF's compared favourably, with the possibility for depression in females ranging from 66.3% to 76.4%, especially in those older than 85 years of age (Neufeld et al., 2014; Sung, 2014; Burrows et al., 2000; Volicer et al., 2011). The viewpoint taken by Neufeld et al. (2014), was that females may be more likely to present with higher depressive symptoms than males, because of the ease at which they display their emotions (Neufeld et al., 2014). As the DRS involves the observation of mood items (Burrows et al., 2000), this may well be true.

Age: There were nearly double the amount of older old residents (65.1%) with the possibility for depression than the younger old (34.9%), with a tapering off in

residents with possible severe depression. These findings were in keeping with the literature that depressive symptoms increase for each year above 75 years of age (Anstey et al., 2007). Research also concurred that depressive symptoms increase in people above 60 years of age, but decrease with advancing age (Zivin2013). However, increasing age may also be associated with reduced physical and psychosocial functioning (Rock et al., 2014). This may negatively impact on the health, well-being and mood as residents age (Giri et al., 2016).

Marital status: More than three-quarters of the residents with no partners (85.7%) had the possibility for depression, with only 14.3% of whom were married. The literature confirmed higher depression in residents without partners, as it may attribute to loneliness and poor social support, especially in those without family (Aziz & Steffens, 2013; Donovan et al., 2017; Narainsamy et al., 2015). Loneliness in LTCF's has also been found to be related to depression, poor perception of self-related health, increased dependence in the basic tasks of daily living, and reduced psychosocial well-being (Jansson et al., 2017). The literature also stated that depression may also increase after the death of a spouse (40%), and in those who were widowed (56.3%), divorced (50%), and living alone (48.9%) (Padayachey et al., 2017).

Education: There were double the number of residents (66.6%) with the possibility for depression with ≤12 years of education compared to 33.3% in those > 12 years of education. These results compared favourably with other studies reporting greater depression with lower levels of education (Bauldry,

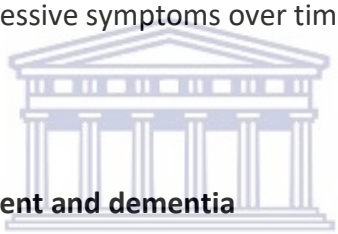
2015; Bracke et al., 2013; Peytrot et al., 2015; Shi et al., 2014). The reasons posited by the aforementioned authors are thought to relate to people with higher education having increased resources from better jobs, to make more informed decisions regarding healthy living, mental health promotion, and the ability to cope with stress. Anstey et al. (2007), found that there was a slight decrease in depressive symptoms in more educated older adults for each year over 9 years of education (Anstey et al., 2007). However, increased dependency needs contributed significantly to depressive symptoms (Anstey et al., 2007).

Length of stay: One of the key factors which were found in this study was that there were more residents with depressive symptoms who resided for more than a year in the LTCF than those who stayed for a lesser period of time. When considering the average length of stay of residents in this study is 2.6 years, these results are comparable to other interRAI studies, in which depressive symptoms increased from 6.5% after a recent transition to a LTCF, to 30% in a follow up assessment (Anstey et al., 2007; Iden et al., 2014; Neufeld et al., 2014).

The vast differences in the degree to which depressive symptoms worsen or improve after admission to a LTCF, depends on the degree of severity of symptoms, and the length of stay of the residents (Neufeld et al., 2014)**.** The increase of depressive symptoms during the initial few months of stay in a LTCF is regarded as the most difficult in terms of adjusting to the new environment, as it is the most emotionally stressful (Yu et al., 2016). Research has shown that an

admission to a LTCF has been recognised to be a risk factor for depression (Iden et al., 2014; Yu et al., 2016).

During the initial stages, there may be a sense of abandonment and a drastic change in the essential aspects of their lives, which may result in shock and tears (Riedl et al., 2013). Residents who stayed for more than twelve months tended to adjust better than those who were more recently admitted (Yu et al., 2016), as psychosocial interventions, and increased social engagement and forming of social relationships enhance self-esteem and quality of life (Davison et al., 2017; Smit et al., 2016). This was evident in the aforementioned studies with a reduction of 30% in depressive symptoms over time (Neufeld et al., 2014).



5.4 Cognitive impairment and dementia

5.4.1 Cognitive impairment of the Cognitive Performance Scale

More than a third (39.3%) of the residents had CI, according to CPS scores 2-6. These findings were lower than other interRAI studies, which varied from 56.6% to 73.5% (Gruber-Baldini et al., 2000; Hartmaier et al., 1994; Hartmaier et al., 1995; Morris et al., 1994; van der Steen et al., 2006). The variation in the findings of this study and other studies may be attributed to concomitant depression; and psychosocial and functional impairment (Andreasen et al., 2014; Neufeld et al., 2014; Morris et al., 2011; Polyakova et al., 2014; Thakur & Blazer, 2008; Volicer et al., 2011). In addition, poor physical health, unhealthy lifestyle (smoking, lack

of exercise, poor sleep hygiene, and poor diet) and cerebral pathology from AD, may also complicate the differences in CI (Baumgart et al., 2015; Ciudin et al., 2017; Gottesman et al., 2017; Ramlall et al., 2013; van Veluw et al., 2017).

Less than a third (26%) of all residents in this study had borderline CI (CPS scores 1), which did not meet the requirements for CI, but nonetheless are important factors. Borderline CI may be considered to be a stage prior to MCI, called preMCI, whereby subjective memory complaints, including preclinical cerebral changes, may be present before meeting the requirements for MCI (Crocco et al., 2018). PreMCI and MCI are important indicators of cognitive decline, which increases the possibility to advance to dementia (Crocco et al., 2018; Csukly et al., 2016; Knopman & Petersen, 2014).

Nearly a quarter (24.3%) of all residents in this study had MCI (CPS scores 2). These results concur with other studies in which the estimated occurrence of MCI in older adults is 15-20%, of whom 8-15% may progress to AD (Petersen, 2016). MCI is concerned with changes in memory and attention, learning, calculation, decision-making, language, as well as physical and social functioning (American Psychiatric Association, 2013). However, amnestic MCI, which has multiple cognitive components (not only memory) is the only subtype to confirm that MCI may advance to AD, as well as the speed in which information in the brain is assimilated (Aerts et al., 2017; Göthlin et al., 2017). MCI affords an opportunity to implement timeous interventions (Knopman & Petersen, 2014).

The highest rated CI item recorded in was *short-term memory recall*, with more than a half (59.5%) of all the residents. It was present in 86.4% of residents with a clinical diagnosis of CI/dementia. This indicator was highest in the older old residents (68.2%), in males (61.7%), and in those with no partners (60.5%). In addition, it was marginally higher in residents with ≤12 years of education (59.3%). This was followed by *cognitive skills for daily decision making,* with under half (40.5%) of all the residents. It was present in 74.6% of residents with a clinical diagnosis of CI/dementia. This indicator was higher in the older old residents (49.1%), in females (45.2%), and in those with no partners (42.9%), and in residents with >12 years education (29.5%).

In *short-term memory recall* and *cognitive skills for daily decision making,* an increase was observed in CI categories from borderline CI to MCI. There was a tapering down in moderate/severe CI; from 35.9% to 39.8% to 24.3% in short-term memory recall, and 10% to 52.9% to 37.1% in cognitive skills for daily decision making. This tapering down of CI scores in this study confers with other literature studies, in which dementia is believed to occur within a precise age group (age-related), rather than by the process of ageing itself (ageing-related), as seen in the following age-related statistics: 7% for 65-75 years; 53% for 75-84 years; and a levelling off to 40% in the older old (85 years and older) (American Psychiatric Association, 2013). The short-term memory recall problems in this study, at 59.5%, compared favourably with other interRAI studies over multi-states in the USA (8651 residents in LTCF's), which averaged 58.6% of the residents with short-term memory recall difficulties (Morris et al., 1994).

However, cognitive skills for daily decision making in this study was higher, at 40.5%, compared to an average of 26% in the aforementioned study (Morris et al., 1994).

The least CI indicator was *eating – assistance needed,* with less than a tenth (8.1%) of all the residents. It must be noted, however, that a person may be cognitively intact, but who may require assistance with eating when physically impaired (Morris et al., 1994). It was present in 11.9% of residents with a clinical diagnosis of CI/dementia.

5.4.2 Demographic variables and CI

The overall results in this study are in accordance with other studies, which suggests that females with less than 12 years education, and advancing age, have been found to be linked with the increased prevalence of MCI and dementia (American Psychiatric Association, 2013; Giri et al., 2016; Ramlall et al., 2013).

Gender and marital status: There were more *females* (76.5%) with CI (CPS 2-6) than males (23.5%), of whom 88.2% of the residents lived without partners, compared to 11.8% who were married. These results are consistent with literature findings that females are more likely to present with CI/dementia than males, possibly because females live longer than males, as well as the associated comorbidities with increasing age (American Psychiatric Association, 2013; STATS SA, 2016). Therefore, older adult females who live longer than males, are more likely to be living without partners (United Nations, 2017). Other studies in LTCF's

have also found that the majority of residents were female (66-69%), and living without partners (70-73%) (interRAI New Zealand, 2017; Neufeld et al., 2014; Ramlall et al, 2013; Wellens et al., 2013). Living alone, without partners, and loneliness is also linked with MCI and dementia (Gibson & Richardson, 2017; interRAI New Zealand, 2017; Neufeld et al., 2014; Ramlall et al., 2013; Wellens et al., 2013).

Age: There were more than three quarters (77.9%) of the older old residents with CI, compared to (22.1%) in the younger old. The literature supports the understanding that increasing age is associated with accelerated CI and dementia (De Jager et al., 2017; Power et al., 2018; Ramlall et al., 2013). MCI has been reported in the literature to increase from 2-10% over the age of 65, to 5 to 25% by the age of 85 years (American Psychiatric Association, 2013). This is primarily because of the higher risk for the development of neurodegenerative and cerebrovascular disease (American Psychiatric Association, 2013). With advancing age, there are morphological brain changes from negative neuroplasticity, which increases CI (Bennett et al., 2017; Vance et al., 2010).

Education: There were less than a third of the residents (36.8%) with CI in those with >12 years education as compared with over a half of the residents with CI who had ≤12 years education (58.8%). These findings are in accordance with the literature in which higher education of more than 12 years has been found to reduce the prevalence of MCI and dementia (Gow et al., 2017; Langa et al., 2017). This is because higher education increases the density of neural synapses

in the neocortical region of the brain which may improve cognitive functioning and decrease impairment (Gow et al., 2017).

5.4.3 Cognitive impairment and dementia diagnosis, and medications for CI/dementia

The reported diagnosis of CI/dementia was 34.1%, of whom 7.5% received cognitive enhancers (cholinesterase inhibitors), such as donepezil. The findings of the diagnosis of CI/dementia in this study were lower than other studies in LTCF's, which reported a clinical diagnosis of CI/ dementia in residents at 40.9% to 70.8% (Björk et al., 2016; De Jager et al., 2017; Estabrooks et al., 2013; Hirdes et al., 2011; Hoffmann et al., 2014; Zimmerman et al., 2014). This may be because of an under-representation of CI/dementia in this study, as the diagnostic methods used were in the main not the same as the rigorous criteria of the American Psychiatric Association (2013).

The documentation of CI/dementia by a diagnosis was more than a third of the population, at 34.1%, compared to 39.3% by the CPS. Using CI/dementia diagnosis as the gold standard, the CPS had a *Se* of 72.9%, which indicated that the CPS identified just under three-quarters of the residents with a diagnosis of CI/dementia. The CPS had a *Sp* of 14%, with the CPS only excluding 14% of all residents with no CI/dementia.

The direct logistic regression model showed that only the CPS scale score (p<.001) significantly influenced the likelihood of having a diagnosis of a diagnosis of CI/Dementia. Further, the CPS items of the *cognitive skills for decisions making* (p<.001) and *short-term memory recall* (p=.003) were most likely to influence the likelihood of having a diagnosis of CI/Dementia.

5.5 Depressive symptoms and cognitive impairment

There is a 55.9% risk of possible depression with CI present as compared to a 23.8% of possible depression when CI is not present, resulting in an *AR* of 32.1% and *RR* of 2.3471 [95% CI 1.57 - 3.5] *p*<.0001. That means that people meeting criteria for CI on the CPS are 2.3 times more likely to meet the criteria for possible depression on the DRS. There is a 60.3% risk of possible depression with CI present as compared to a 27.3% of possible depression when CI is not present, resulting in an *AR* of 33% and a *RR* of 2.2 [95% CI 1.54 - 3.2] *p*<.0001. That means that people meeting criteria for possible depression on the DRS are 2.2 times more likely to meet the criteria for CI on the CPS. These findings are in accordance with other studies in the literature, that CI can lead to dementia (Petersen, 2016), and there is a two-fold possibility that depression may occur with dementia (Andreasen et al., 2014). Further, there is twice the risk of dementia with pre-morbid depression (Pellegrino et al., 2013).

These findings are in accordance with other studies, which also confirmed this coexistence, and which cautioned the increased risk by which depression may

progress to dementia, especially of the Alzheimer's type (Brewster et al., 2017; Lebedeva et al., 2017; Li et al., 2017; Millikin et al., 2017; Petersen, 2016; Pink et al., 2015; Riddle et al., 2017). Furthermore, the literature agreed that the rate at which CI and dementia progress is greatly influenced by the presence of depression (odds ratio: 2.63) (Moon et al., 2017). Moreover, older adults with MCI, together with active depression (within a period of two years) were at greatest risk to develop AD than those with previous non-active depression (41.7% vs 31.6%) (Gallagher, Kiss, Lanctot, & Herrmann, 2018).

This study also noted that residents with some symptoms of depression (DRS 1-2), which did not meet the requirements for the possibility for depression, also had CI. These findings are important, as demonstrated in the literature, that older adults with depressive symptoms, which did not yet meet the criteria for a diagnosis of depression, were more highly at risk for CI (Gonzales et al., 2017). This study also found that residents with borderline CI (CPS 1), which did not meet the requirements for CI, had depressive symptoms. These findings are also significant, as reported in the literature, that preMCI - a stage before meeting the requirements for MCI, is an important indicator which increases the possibility to advance to dementia (Crocco et al., 2018). Pre MCI and the sub-clinical stage of depression affords opportunities to investigate any underlying risks and contributing factors and to implement prophylactic interventions and treatment (Knopman & Petersen, 2014; Ulbricht et al., 2017). As depression increases the risk of CI, and depression may also be an early symptom in CI and dementia, it is

a necessity to screen for CI in individuals with depressive symptoms (Aziz & Steffens, 2017).

This study determined that there were more residents with possible depression (DRS 3-5) and CI than in those with possible severe depression and CI (DRS 6-14). In addition, residents with moderate to severe CI (CPS 3-6) had fewer possibilities for depression than those with MCI. These findings concur with other studies in which depression in late life increases with reduced memory functioning (Brailean et al., 2017). The findings of this study support the literature that CI can lead to dementia (Petersen, 2016). Further, there is a two-fold possibility that depression may occur with dementia (Andreasen, Lonnroos, & von Euler-Chelpin, 2014), and that there is twice the risk for dementia with pre-morbid depression (Pellegrino et al., 2013).

5.6 Summary of chapter

This chapter described the results of this study, which confirmed the coexistence between depressive symptoms and CI in residents in a LTCF in accordance with the literature review. Although depressive symptoms compared favourably with other interRAI studies, CI was lower in this study, which may have been attributed to concomitant depression, and associated psychosocial and functional impairment. This leads to the conclusion and recommendations in the following chapter.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter summarises the key findings of this study, makes recommendations based on the findings and the literature and discusses the limitations of the study, followed by concluding remarks. This study was the first of its kind to describe a profile of depressive symptoms and CI in residents using the interRAI-LTCF in a LTCF in the Cape Metropole in South Africa.

6.2 Key findings

This study confirmed the presence of depressive symptoms in this population, which presents an opportunity to investigate factors associated with this in this setting.

More than a third of the residents in this study had the possibility for depression (DRS 3-14), which compared favourably with other international interRAI studies in LTCF's (Huang & Carpenter, 2011; Neufeld et al., 2014; Volicer et al., 2011). However, the identification of depressive symptoms at the earliest stage, where some symptoms were present (DRS 1-2), should be viewed by the LTCF as an opportunity to investigate factors which may have contributed to this condition, and to implement timeous treatment and interventions.

This study confirmed the presence of cognitive impairment in this population, which presents an opportunity to investigate factors associated with this in this setting.

More than a third of the residents in this study had CI (CPS 3-6). These results varied considerably from other international interRAI studies, which were generally higher (Bartfay et al., 2016; Bartfay et al., 2014; Pawłucka et al., 2016). As with depressive symptoms, CI should be identified at the earliest stage, in borderline CI (CPS 1), so that underlying contributing factors (similar to depressive symptoms) can be investigated and treated, and timeous interventions can be implemented.

This study confirmed the coexistence between depressive symptoms and cognitive impairment in this population.

The research findings confirmed that there were significant associations between depressive symptoms and CI, with over a third of residents who had the possibility for depression and CI. The literature supported this coexistence, and which cautioned the increased risk by which depression may progress to dementia (Lebedeva et al., 2017; Petersen, 2016; Polyakova et al., 2014; Riddle et al., 2017). This further reinforces the LTCF the opportunity to apply the principles of early identification, interventions, and treatment of depressive symptoms and CI, as discussed above.

In this study, there were more females than males with the possibility for depression and CI, especially in those who were older than 80 years of age, those without partners, and who had ≤12 years of education. These findings were supported by the literature and other similar interRAI studies (De Jager et al., 2017; Donovan et al., 2017; interRAI New Zealand, 2017; Neufeld et al., 2014). Increasing age may be associated with reduced physical, mental, and psychosocial functioning, which may negatively impact on the health and well-being as residents age (Giri et al., 2016; Rock et al., 2014).

This study demonstrated that residents with some symptoms of depression, at 35.8%, which did not meet the requirements for the possibility for depression (sub-clinical depression), also had CI. These findings are important, as reported in the literature, that older adults with depressive symptoms, which did not yet meet the criteria for a diagnosis of depression, were more highly at risk for CI (Gonzales et al., 2017). Similarly, the findings in this study found that residents with borderline CI (preMCI), at 26%, which did not meet the requirements for CI, were also reported to have had depressive symptoms. These findings are also noteworthy, which the literature confirmed, that preMCI is an important indicator which increases the possibility to advance to dementia (Crocco et al., 2018). Furthermore, the literature also reported that the rate at which CI and dementia progresses is greatly influenced by the presence of depression and increasing age (Moon et al., 2017; De Jager et al., 2017; Donovan et al., 2017).

This study confirmed the ability of the interRAI to predict the possibility for depression and cognitive impairment.

The interRAI was used to capture depressive symptoms and CI in residents in a LTCF in this study. The interRAI is recognised as a valid tool to identify these conditions (Carpenter & Hirdes, 2013). In this study, the DRS and CPS were able to predict the possibility for depression and CI. The residents who met the criteria for possible depression on the DRS were 2.2 times more likely to meet the criteria for CI on the CPS. Similarly, those with possible CI on the CPS were 2.3 times more likely to meet the criteria for possible depression on the DRS.

6.3 Recommendations

Based on the findings of the study and the literature, the following recommendations are made.

Practice:

- The identification of depressive symptoms and CI in this study is an opportunity for the LTCF to investigate factors which may have contributed to these conditions, and to implement treatment, interventions, and care plans to manage and to monitor these conditions.
- The identification of the extent and severity of depressive symptoms and CI in this study can guide medical doctors in the review of medications and other treatment.

- The identification of depressive symptoms and CI can also guide family members about the understanding of these conditions, and how to manage these as a team effort.
- As the residents who met the criteria for possible depression were 2.2 times more likely to meet the criteria for CI, and those with possible CI were 2.3 times more likely to meet the criteria for possible depression, regular screening for these conditions should become standard practice in the LTCF.

Education:

- The identification of depressive symptoms and CI in this study is an opportunity to provide regular in-service education to the carers about the importance of screening of residents with depressive symptoms and CI, and to assess the coexistence of these conditions.

Research:

- The extent and severity of depressive symptoms and CI in this study can be compared to the norms in other international LTCF's.
- Further longitudinal studies in the LTCF should be conducted to determine the incidence of depression when cognitively impaired, and the incidence of CI when depressed.

6.4 Limitations

As this research was a cross-sectional study, which identified depressive symptoms and CI at a single point in time, it did not establish the causal pathway as to which came first, and what the contributing factors were. A second limitation is that the study was a context-specific one, which involved only one LTCF, with an exclusively white, Jewish population. A third limitation is that the diagnostic methods used in this study to determine the gold standard diagnosis of depression, anxiety, CI and dementia, were possibly not the same as the rigorous criteria of the DSM-5 (Diagnostic and Statistical Manual of Mental Disorders).

Despite the validity of the DRS as an effective screening tool to identify depressive symptoms (Burrows et al., 2000), there were contrary studies which found that there were discrepancies between the clinical diagnosis of depression, from medical records, and the DRS criteria for the possibility for depression (Baller et al., 2009; Penny et al., 2016; Volicer et al., 2011). These discrepancies in the aforementioned studies may also be limitations in this study, as those results were influenced by the clinical diagnostic measures and concomitant CI, as with this study, which may have been better represented by residents without CI.

Research challenges are further substantiated by the limitation of interRAI-LTCF studies to focus exclusively on the association between depressive symptoms and CI in LTCF's. In addition, there are fewer current interRAI-LTCF research studies,

which necessitated the use of older journals to support the literature review. Furthermore, most interRAI-LTCF studies used the older version of the DRS, which used different time frames in establishing depressive symptoms. The older version used a seven-day lookback period, instead of the current version, 9.1, which uses a three-day lookback period.

6.5 Conclusion

In the context of describing a profile of depressive symptoms and CI in residents using the interRAI-LTCF in a LTCF in the South African setting, this study presented innovation, being the first of its kind on the African continent. These findings were particularly relevant to the South African setting, due to the lack of legislation in South African LTCF's to standardise assessments to identify depressive symptoms and CI, which the interRAI was able to achieve. The significant associations found between depressive symptoms and CI, with over a third of residents who had the possibility for depression and CI, substantiated their coexistence. The knowledge gleaned from the findings of this study substantiated the need to identify early signs and symptoms of possible depression and CI, so that timeous treatment and interventions can be implemented to manage these conditions. This can be achieved through the provision of person-focused care, appropriate care plans, and informed decision-making processes through high-quality data of the interRAI.

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APPENDICES

Appendix 1: Data Capturing Instrument

ID	LOS	Location	Ass. No.	Age	Gender	Martital status	Education	Dep dx	Anx dx	CI/dem dx	Dep meds	Anx meds	CI/dem meds	DRS score	E1a	E1b	E1c	E1d	E1e	E1f	E1g	CPS score	C1	C2a	D1	G1j

The Depression Rating Scale and the Cognitive Performance Scale

interRAI™

Depression Rating Scale (DRS)

Score	Item
0-3	Made negative statements
0-3	Persistent anger with self or others
0-3	Expressions (including non-verbal) of what appear to be unrealistic fears
0-3	Repetitive health complaints
0-3	Repetitive anxious complaints/concerns (non-health related)
0-3	Sad, pained, worried facial expression
0-3	Crying, tearfulness

Range: 0-14

Scoring:

0 = No mood symptoms

14 = All mood symptoms present in last 3 days

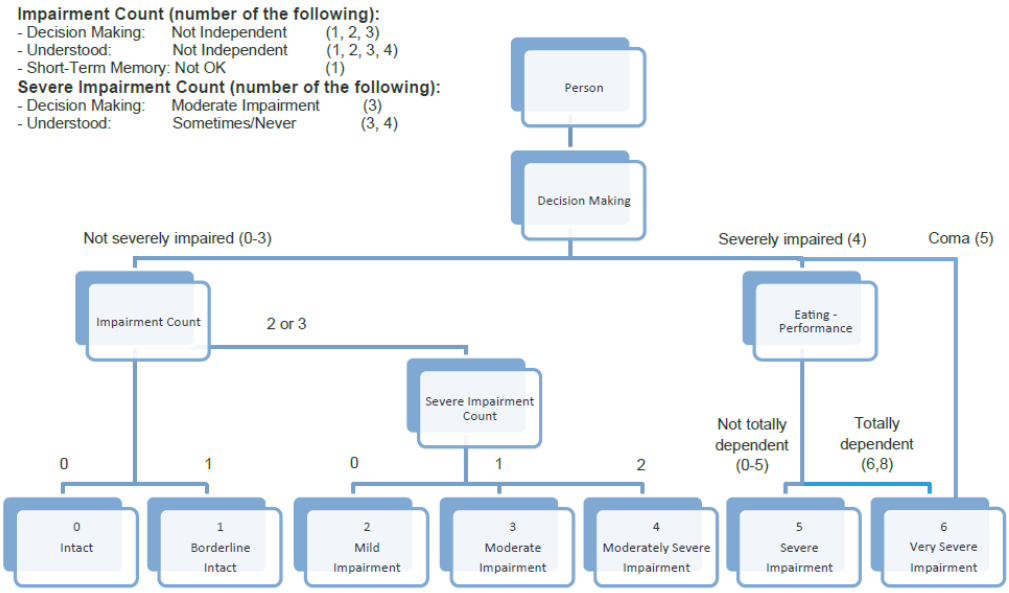
Scores of 3 or greater indicate major or minor depressive disorders.

The Depression Rating Scale (DRS) is calculated by summing all seven input items after recoding each input item to a three-point (0, 1, 2) scale. For each input item, above, the first two levels, 0 and 1, are not recoded; level 2 is recoded to 1; and level 3 is recoded to 2.

Source: Burrows A, Morris JN, Simon S, Hirdes JP, Phillips C. (2000) Development of a Minimum Data Set-based Depression Rating Scale for Use in Nursing Homes. Age and Ageing 29(2): 165-172.

The DRS is published on the open web, which is available for public access:
http://www.interrai.org/assets/files/Scales/depression-rating-scale_rev-03-06-15.pdf

Cognitive Performance Scale



Source: Morris JN, Fries BE, Mehr DR, Hawes C, Philips C, Mor V, Lipsitz L. (1994) MDS Cognitive Performance Scale. Journal of Gerontology: Medical Sciences 49 (4): M174-M182.

The CPS is published on the open web, which is available for public access: http://www.interrai.org/assets/files/Scales/cognitive-performance-scale-2014.pdf

Appendix 2: Permission to collect data from the interRAI and medical records for a research study

THE HIGHLANDS HOUSE
NEW BEGINNINGS

19/02/2018

Dear Ms Mayer

Permission to collect data from the interRAI and medical records for a research study at Highlands House

Reference is made to your application to conduct research at Highlands House, received on 30 October 2017. I write to inform you that permission has been granted for you to collect data from the interRAI and the intranet at Highlands House for a research study titled *"Analysis of depressive symptoms and cognitive impairment in residents using the interRAI in a long-term care facility in the Cape Metropole in South Africa"*.

The proposed study is of relevance to Highlands House; therefore, we expect you to furnish us with the research findings upon completion of the study.

Wishing you all the best in your research.

Yours sincerely

UNIVERSITY of the
WESTERN CAPE

.....

Dr H. Chait
Medical Superintendent Highlands House

.....

Mr H. Burman
Executive Director Highlands House

PO BOX 1650, CAPE TOWN, 8000 | 234 UPPER BUITENKANT STREET, CAPE TOWN, 8001
TEL: +27 21 461 1100 | FAX: 27 21 465 1538 / 086 582 0409 | EMAIL: residents@highlandshouse.co.za | WEB: www.highlandshouse.co.za
Beneficiary of: UJC CHAI SA EURO CHAI

H BURMAN - EXECUTIVE DIRECTOR | D KAPLAN - DEPUTY DIRECTOR
NPO 010 – 520 | VAT NO: 4480124157 | TAX EXEMPT NO: 18/11/13/2830

Appendix 3: UWC HSS Ethics approval

UNIVERSITY of the WESTERN CAPE

OFFICE OF THE DIRECTOR: RESEARCH
RESEARCH AND INNOVATION DIVISION

Private Bag X17, Bellville 7535
South Africa
T: +27 21 959 4111/2948
F: +27 21 959 3170
E: research-ethics@uwc.ac.za
www.uwc.ac.za

03 May 2018

Ms L Mayer
School of Nursing
Faculty of Community and Health Science

Ethics Reference Number: BM18/3/3

Project Title: Analysis of depressive symptoms and cognitive impairment in residents using the interRAI-LTCF in a long-term care facility in the Cape Metropole in South Africa.

Approval Period: 20 April 2018 – 20 April 2019

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report in good time for annual renewal.

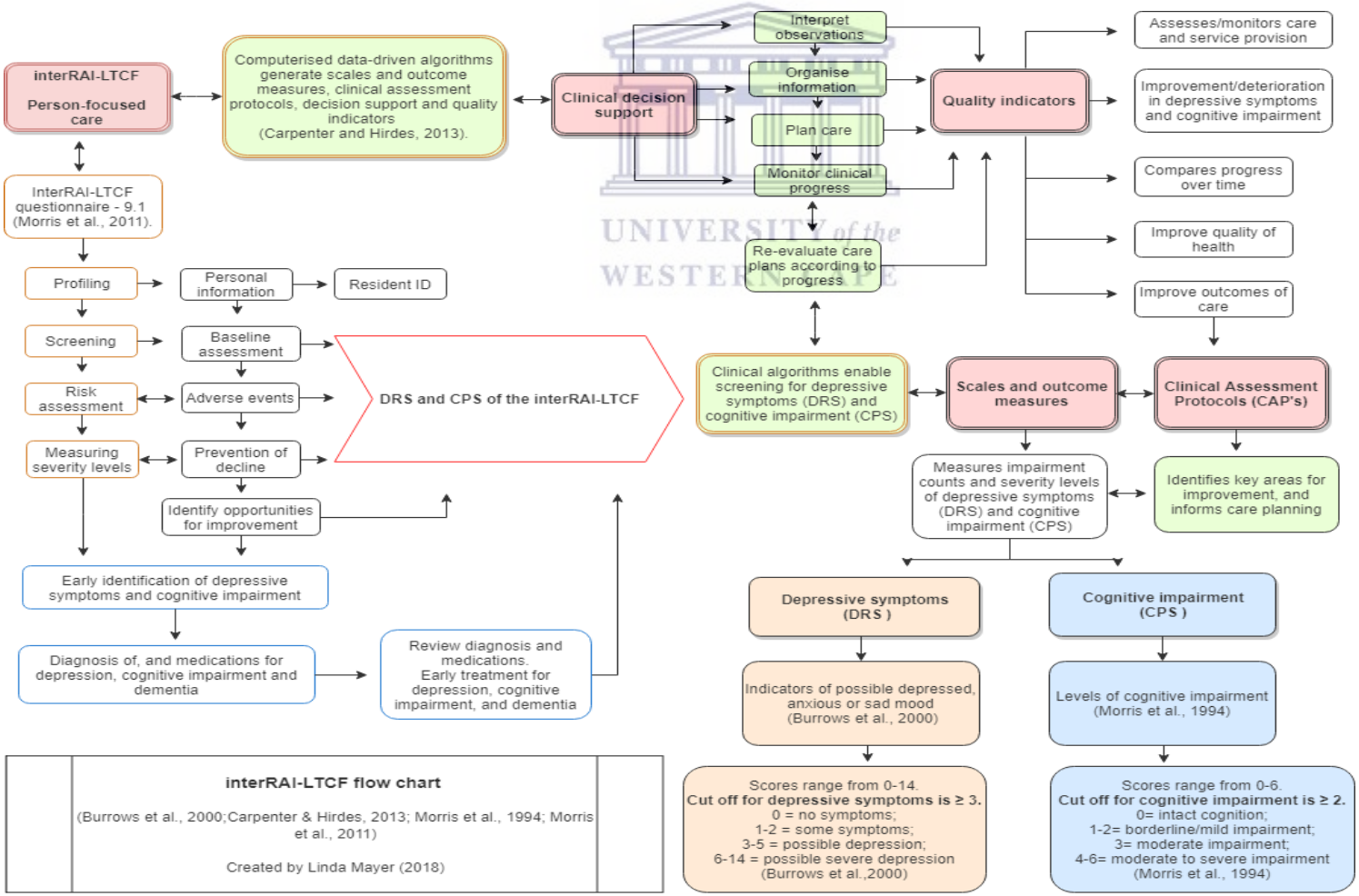
The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

PROVISIONAL REC NUMBER -130416-050

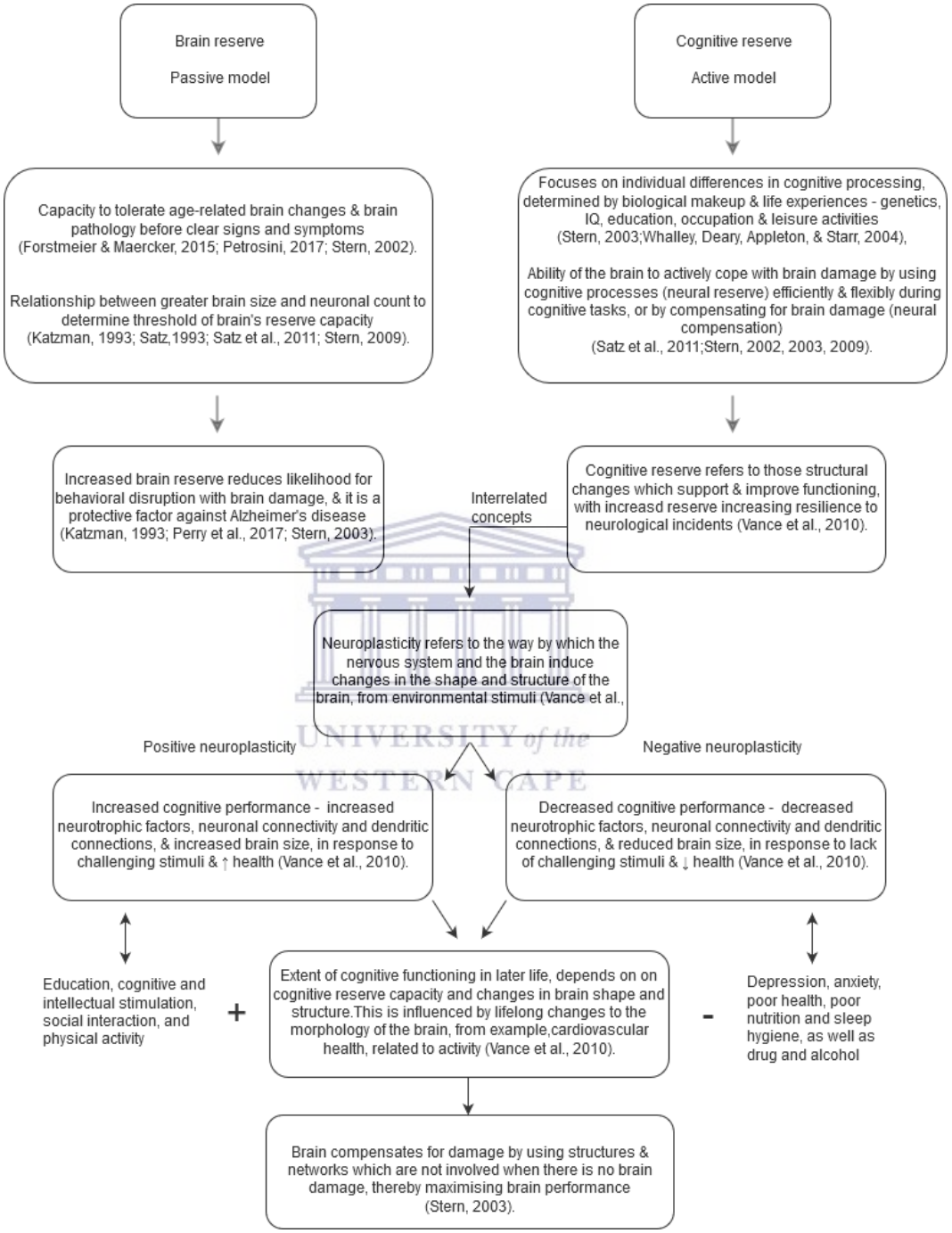
FROM HOPE TO ACTION THROUGH KNOWLEDGE.

Appendix 4: The interRAI-LTCF flow chart



(Burrows et al., 2000; Carpenter & Hirdes, 2013; Morris et al., 2011; Morris et al., 1994)

Appendix 5: Diagrammatic summary of the brain and cognitive reserve models



Appendix 6: Codebook

No.	Name	Type	Label	Values	Measure
	Demographic variables				
1	ID	String	ID		Nominal
2	L.0.S.	Numeric	Length of stay (in months)		Scale
3	L.0.S.CAT	Numeric	Length of stay category Recoded: 1&2=1 (12 months or less); 3=2 (more than 12 months)	1=0-3 months 2=4-12 months 3= 13 months and over	Ordinal
Recoded	**LOS.CAT2**	**Numeric**	**Length of stay category**	**1=12 months or less length of stay** **2=More than12 months length of stay**	**Ordinal**
4	Loc.	Numeric	Location within facility	1=Main home 2=Special Care Unit for dementia	Nominal
5	Ass.no.	Numeric	Assessment number		Scale
6	Age	Numeric	Age in years		Scale
7	Agegrp	Numeric	Age category **Recoded from age in years scale**	1=Young old 61-74 2=Old 75-84 3=Oldest old 85 and older	Ordinal
Recoded	**Agegrp.2**	**Numeric**	**Age category**	**1=Younger old 61-79 years of age** **2=Older old 80-107 years of age**	**Ordinal**
8	Gend.	Numeric	Gender	1=Males 2=Females	Nominal
9	Mar.	Numeric	Marital status **Recoded: 2=1 (married);** **1,3,4&5=2 (never married, separated, divorced, widowed).**	1=never married (single) 2=married 3=separated 4=divorced 5=widowed	Nominal
Recoded	**Mar.2**	**Numeric**	**Marital status**	**1=married** **2=never married, separated, divorced/widowed**	**Nominal**
10	Edu.	Numeric	Education Recoded: 1&2=1 (12 years or less education); **3=2 (more than 12 years education);** **4=3 (missing data)**	1=Less than 12 years 2=12 years 3=More than 12 years 4=Unknown	Ordinal
Recoded	**Edu.2**	**Numeric**	**Education**	**1-12 years or less education** **2=More than12 months education** **3=Missing data**	**Oridinal**
	Diagnostic variables				
11	Dep.dx	Numeric	Depression diagnosis	1=Depression diagnosis present 2=No depression diagnosis present 3=Yes with Bipolar	Nominal
12	Anx.dx	Numeric	Anxiety diagnosis	1=Anxiety diagnosis present 2=No anxiety diagnosis present	Nominal
13	CI.Demdx	Numeric	Cognitive impairment diagnosis	1=CI/dementia diagnosis present 2=No CI/dementia diagnosis present	Nominal
	Medication variables				
14	Dep.meds	Numeric	Depression medication	1=Depression medication used 2=No depression medication used	Nominal
15	Anx.meds	Numeric	Anxiety medication	1=Anxiety medication used 2=No anxiety medication used	Nominal

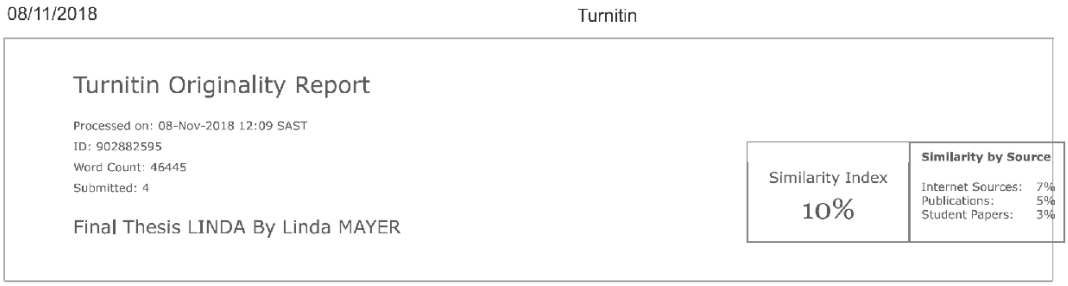
No.	Name	Type	Label	Values	Measure
16	CI.Dem.meds	Numeric	Cognitive impairment/dementia medication	1=CI/dementia medication used 2=No CI/dementia medication used	Nominal
	Cognitive Performance Scale				
17	CPS.score	Numeric	Cognitive Performance Scale score		Scale
18	CPS.CAT	Numeric	Cognitive Performance category	0=No cognitive impairment 0 1=Borderline cognitively intact 1 2=Mild cognitive impairment 2 3=Moderate/severe cognitive impairment 3-6	Ordinal
19 **Recoded from CPS.CAT**	**CPS.CI**	**Numeric**	**Cognitive Performance Scale cognitive impairment** **CPS category 0-1=2 no CI/dementia present** **CPS category 2-3=1 CI/dementia present**	**1=Cognitive impairment present (CPS)** **2=No cognitive impairment present (CPS)**	**Nominal**
	Cognitive impairment variables				
20	CI	Numeric	Cognitive skills for daily decision making	0=Independent 1=Modified independence 2=Minimally impaired 3=Moderately impaired 4=Severely impaired	Ordinal
Recoded	**C1.2**	**Numeric**	**Recoded: 0=0 (not impaired); 1-4=1 (impaired)**	**0=No impairment in cognitive skills for daily decision making** **1=Cognitive skills for daily decision making problems**	**Ordinal**
21	C2a	Numeric	Short-term memory recall	0=Memory OK 1=Memory problem	Ordinal
22	D1	Numeric	Making self understood (expression)	0=Understood 1=Usually understood 2=Often understood 3-sometimes understood 4=Rarely or never understood	
Recoded	**D1.2**	**Numeric**	**Making self understood (expression)** **Recoded: 0=0 (able to make self understood);** **1-4=1 (Making self understood difficulties)**	**0=Able to make self understood** **1=Making self understood difficulties**	**Ordinal**
23	G1j	Numeric	Eating – how a person eats/drinks	0=Independent 1=Independent-set up only 2=Supervision 3=Limited assistance 4=Extensive assistance 5=Maximal assistance 6=Total dependence	Ordinal
Recoded	**G1j.2**	**Numeric**	**Eating – how a person eats/drinks** **Recoded: 0-2=1 (independent/setup/supervision)** **3-6=2 (Needs assisitance)**	**1=Independent/set up help only/supervision, with eating** **2=Eating - assistance needed**	**Ordinal**
	Depressive symptoms variables				
24	E1a	Numeric	Made negative statements	0=Not present 1=Present, but not exhibited in last 3 days 2=Exhibited on 1-2 of last 3 days 3=Exhibited daily in last 3 days	Ordinal
Recoded	**E1a.2**	**Numeric**	**Made negative statements** **Recoded: 0=0 (no negative statements present);** **1-3=1 (negative statements present)**	**0-No negative statements made** **1=Negative statements made**	**Ordinal**

No.	Name	Type	Label	Values	Measure
25	E1b	Numeric	Persistent anger with self or others	0=Not present 1=Present, but not exhibited in last 3 days 2=Exhibited on 1-2 of last 3 days 3=Exhibited daily in last 3 days	Ordinal
Recoded	E1b.2	Numeric	Persistent anger with self or others Recoded: 0=0; 1-3=1	0=Persistent anger with self or others not present 1=Persistent anger with self or others present	Ordinal
26	E1c	Numeric	Expressions, including nonverbal, of what appear to be unrealistic fears	0=Not present 1=Present, but not exhibited in last 3 days 2=Exhibited on 1-2 of last 3 days 3=Exhibited daily in last 3 days	Ordinal
Recoded	E1c.2	Numeric	Expressions, including nonverbal, of what appear to be unrealistic fears Recoded: 0=0; 1-3=1	0=Expressions, including nonverbal, of what appear to be unrealistic fears not present 1=Expressions, including nonverbal, of what appear to be unrealistic fears present	Ordinal
27	E1d	Numeric	Repetitive health complaints	0=Not present 1=Present, but not exhibited in last 3 days 2=Exhibited on 1-2 of last 3 days 3=Exhibited daily in last 3 days	Ordinal
Recoded	E1d.2	Numeric	Repetitive health complaints Recoded: 0=0; 1-3=1	0=Repetitive health complaints not present 1=Repetitive health complaints present	Ordinal
28	E1e	Numeric	Repetitive anxious complaints/concerns (non-health related)	0=Not present 1=Present, but not exhibited in last 3 days 2=Exhibited on 1-2 of last 3 days 3=Exhibited daily in last 3 days	Ordinal
Recoded	E1e.2	Numeric	Repetitive anxious complaints/concerns (non-health related) Recoded: 0=0; 1-3=1	0=Repetitive anxious complaints/concerns (non-health related) not present 1=Repetitive anxious complaints/concerns (non-health related) present	Ordinal
29	E1f	Numeric	Sad, pained, or worried facial expressions	0=Not present 1=Present, but not exhibited in last 3 days 2=Exhibited on 1-2 of last 3 days 3=Exhibited daily in last 3 days	Ordinal
Recoded	E1f.2	Numeric	Sad, pained, or worried facial expressions Recoded: 0=0; 1-3=1	0=Sad, pained, or worried facial expressions not present 1=Sad, pained or worried facial expressions present	Ordinal
30	E1g	Numeric	Crying, tearfulness	0=Not present 1=Present, but not exhibited in last 3 days 2=Exhibited on 1-2 of last 3 days 3=Exhibited daily in last 3 days	Ordinal
Recoded	E1g.2	Numeric	Crying, tearfulness Recoded: 0=0; 1-3=1	0=Crying, tearfulness not present 1=Crying, tearfulness present	Ordinal
	Depression Rating Scale				
31	DRS.score	Numeric	Depression Rating Scale score		Scale
32	DRS.CAT	Numeric	Depression Rating category	0=No symptoms of depression 0 1=Some symptoms of depression 1-2 2=Possible depression 3-5 3=Possible severe depression 6-14	Ordinal
33 Recoded from DRS.CAT	DRS.Dep	Numeric	Depression Rating Scale possible depression DRS category 0-1=2 no possible depression present DRS category 2-3=1 Possible depression present	1= Possible depression present (DRS) 2=No possible depression present (DRS)	Nominal

Appendix 7: Variable view of the SPSS

1	ID	String	4	0	Identification nu...	None	None	12	Left	Nominal	Input
2	LOS	Numeric	4	0	Length of stay (...	None	None	12	Right	Scale	Input
3	LOS.CAT	Numeric	2	0	Length of stay ...	{1, 0-3 mont...	None	12	Right	Ordinal	Input
4	LOS.CAT2	Numeric	8	0	Length of stay ...	{1, 12 mont...	-999	10	Right	Ordinal	Input
5	Loc	Numeric	2	0	Location	{1, Main ho...	None	12	Right	Nominal	Input
6	Ass.no	String	2	0	Assessment nu...	None	None	12	Left	Nominal	Input
7	Age	Numeric	4	0	Age (in years)	None	None	12	Right	Scale	Input
8	Agegrp	Numeric	2	0	Age group	{1, Young ol...	None	12	Right	Ordinal	Input
9	Age.GR	Numeric	8	0	Age group	{1, Younger ...	-999	10	Right	Nominal	Input
10	Gend	Numeric	2	0	Gender	{1, Males}...	None	12	Right	Nominal	Input
11	Mar	Numeric	2	0	Marital status	{1, Never m...	None	13	Right	Nominal	Input
12	Mar.2	Numeric	8	0	Marital status	{1, Married}...	-999	10	Right	Nominal	Input
13	Edu	Numeric	2	0	Education	{1, Less tha...	None	12	Right	Ordinal	Input
14	Edu.2	Numeric	8	0	Education	{1, 12 years...	None	10	Right	Nominal	Input
15	Dep.dx	Numeric	2	0	Depression dia...	{1, Depressi...	None	12	Right	Nominal	Input
16	Anx.dx	Numeric	2	0	Anxiety diagnosis	{1, Anxiety ...	None	12	Right	Nominal	Input
17	CI.Dem.dx	Numeric	2	0	Cognitive impair...	{1, CI/deme...	None	12	Right	Nominal	Input
18	Dep.meds	Numeric	2	0	Depression me...	{1, Depressi...	None	12	Right	Nominal	Input
19	Anx.meds	Numeric	2	0	Anxiety medica...	{1, Anxiety ...	None	12	Right	Nominal	Input
20	CI.Dem.meds	Numeric	2	0	Cognitive impair...	{1, CI/deme...	None	12	Right	Nominal	Input
21	CPS.score	Numeric	2	0	Cognitive Perfor...	None	None	12	Right	Scale	Input
22	CPS.CAT	Numeric	2	0	Cognitive Perfor...	{0, No cogni...	None	12	Right	Ordinal	Input
23	CPS.CI	Numeric	2	0	Cognitive Perfor...	{1, Cognitive...	None	12	Right	Nominal	Input
24	C1	Numeric	2	0	Cognitive skills ...	{0, Independ...	None	12	Right	Ordinal	Input
25	C1.2	Numeric	8	0	Cognitive skills ...	{0, No impai...	-999	10	Right	Nominal	Input
26	C2a	Numeric	2	0	Short-term me...	{0, Memory ...	None	12	Right	Nominal	Input
27	D1	Numeric	2	0	Making self und...	{0, Understo...	None	12	Right	Ordinal	Input
28	D1.2	Numeric	8	0	Making self und...	{1, Able to ...	-999	10	Right	Nominal	Input
29	G1j	Numeric	2	0	Eating - how a ...	{0, Independ...	None	12	Right	Ordinal	Input
30	G1j.2	Numeric	8	0	Eating	{1, Independ...	-999	10	Right	Nominal	Input
31	Gij.3	Numeric	8	0	Eating (how a p...	{1, Independ...	-999	10	Right	Nominal	Input
32	DRS.score	Numeric	3	0	Depression Rat...	None	None	12	Right	Scale	Input
33	DRS.CAT	Numeric	2	0	Depression Rat...	{0, No symp...	None	12	Right	Ordinal	Input
34	DRS.Dep	Numeric	2	0	Depression Rat...	{1, Possible...	None	12	Right	Nominal	Input
35	E1a	Numeric	2	0	Made negative ...	{0, Not pres...	None	12	Right	Ordinal	Input
36	E1a.2	Numeric	8	0	Made negative ...	{0, No negat...	-999	10	Right	Nominal	Input
37	E1b	Numeric	2	0	Persistent ange...	{0, Not pres...	None	12	Right	Ordinal	Input
38	E1b.2	Numeric	8	0	Persistent ange...	{0, Persiste...	-999	10	Right	Nominal	Input
39	E1c	Numeric	2	0	Expressions, in...	{0, Not pres...	None	12	Right	Ordinal	Input
40	E1c.2	Numeric	8	0	Expressions, in...	{0, No expre...	-999	10	Right	Nominal	Input
41	E1d	Numeric	2	0	Repetitive healt...	{0, Not pres...	None	12	Right	Ordinal	Input
42	E1d.2	Numeric	8	0	Repetitive healt...	{0, Repetitiv...	-999	10	Right	Nominal	Input
43	E1e	Numeric	2	0	Repetitive anxio...	{0, Not pres...	None	12	Right	Ordinal	Input
44	E1e.2	Numeric	8	0	Repetitive anxio...	{0, Repetitiv...	-999	10	Right	Nominal	Input
45	E1f	Numeric	2	0	Sad, pained, or...	{0, Not pres...	None	12	Right	Ordinal	Input
46	E1f.2	Numeric	8	0	Sad, pained or ...	{0, Sad, pai...	-999	10	Right	Nominal	Input
47	E1g	Numeric	2	0	Crying, tearfuln...	{0, Not pres...	None	12	Right	Ordinal	Input
48	E1g.2	Numeric	8	0	Crying, tearfuln...	{0, Crying, t...	-999	10	Right	Nominal	Input

Appendix 8: Similarity report from Turnitin



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