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THE IMPORTANCE OF DIRECT-CARE HOME ASSISTANCE FOR PEOPLE WITH AMYOTROPHIC LATERAL SCLEROSIS AND THEIR CAREGIVERS.

A longitudinal study

by

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Index

Chapter 1 - Introduction

What is Amyotrophic Lateral Sclerosis?

Amyotrophic lateral sclerosis (ALS) is a devastating illness for patients, relatives and carers, and is one of the major neurodegenerative diseases alongside Alzheimer's disease and Parkinson's disease. ALS is also known as Charcot's disease (Rowland, 2001), as it is often believed that Jean-Martin Charcot (1825-1893), the 19th century French pioneer of neurology, first described this illness (Charcot, 1874). However, Augustus Jacob Lockhart Clarke (1817-80) had already recognized what appear to be classical cases of ALS in two rigorous post-mortem neuropathological studies from the 1860s (Lockhart & Hughlings, 1867; Turner, Swash, & Ebers, 2010).

Other names of the illness are Motor Neuron Disease, because of his involvement of motor neurons, and Lou Gehrig's disease, from the name of the american baseball player Lou Gehrig who died from complications of ALS in 1941.

ALS is a progressive and fatal neurodegenerative disease affecting motor neurons in the anterior horn of the spinal cord, the brainstem and the motor cortex with a pattern of progression not shared by other fatal diseases (Mitchell & Borasio, 2007).

The disease is clinically characterized by progressive increasing weakness leading to death by respiratory insufficiency usually within three years (Haverkamp, Appel, & Appel, 1995). ALS typically manifests itself as a muscle wasting or weakness in a limb or bulbar regions (Talbot, 2002). It then progresses to pervasive muscle weakness with a combination of upper and lower motor neuron dysfunction. Patients become relentlessly immobile, develop an impaired speech, often leading to social isolation. In the late stages of the disease, progressing paralysis can result in a "locked-

in" state in which only residual muscular movement is possible (Borasio, Voltz, & Miller, 2001), but the intellect and the personality usually remain unimpaired.

The mean age of onset for ALS is between 55–65 years, tending to increase up to ages 65 to 74 and to decrease thereafter (Beghi, Millul, Micheli, Vitelli, & Logroscino, 2007). There is a 5% of cases that had an onset before the age of 30 years (Haverkamp, et al., 1995). Although most cases of ALS are sporadic, about 5% of cases have a family history of ALS (Mulder, Kurland, Offord, & Beard, 1986).

Epidemiology

The incidence of ALS is reported to be between 1.5 and 2.7 per 100,000 population/ year (average 1.89 per 100,000/ year) in Europe and North America, with a uniform incidence across these countries (Worms, 2001). In Lombardy, study by Beghi and colleagues (Beghi, et al., 2007) indicated a standardized incidence rate for ALS-suspected population of 2.09 per 100,000/year (2.43 in men and 1.76 in women), even if the incidence of definite ALS was 0.93 per 100,000.

Epidemiological peaks have been located in some geographic loci of the Western Pacific, where the prevalence is 50–100 times higher than elsewhere world have been reported (Steele & McGeer, 2008). These populations include the Chamorro people of Guam and Marianas island, the Kii peninsula of Honshu Island, and the Auyu and Jakai people of south west New Guinea, in whom ALS is associated with the Parkinsonism and dementia (Plato, et al., 2003). More recent studies however have shown a decrease in incidence of ALS in these areas over the past 40 years (Waring, et al., 2004).

Medical and biological characteristics

Diagnosis of ALS is mainly based on clinical criteria. These criteria were defined in 1994 and revised in 1998 during two workshops held in El Escorial in Spain and in Airlie House in the US. These workshops led to the establishment of the El Escorial criteria and the El Escorial revisited criteria, respectively (table I). Four stages are defined, from definite to probable, probable with laboratory support, and possible based on the presence of upper and lower motor neuron signs in three to one of the anatomic regions bulbar, cervical, thoracic, lumbo sacral, respectively (Brooks, Miller, Swash, & Munsat, 2000).

Table 1. Summary of Revised El Escorial Research Diagnostic Criteria for ALS (adapted from Brooks, et al., 2000)

The diagnosis of ALS requires:
1. Evidence of Lower Motor Neuron (LMN) degeneration by clinical, electrophysiological or neuropathological examination;
2. Evidence of Upper Motor Neuron (UMN) degeneration by clinical examination, and
3. Progressive spread of symptoms or signs within a region or to other regions, as determined by history or examination,

Together with the absence of:
1. Electrophysiological and pathological evidence of other disease that might explain the signs of LMN and/or UMN degeneration, and
2. Neuroimaging evidence of other disease processes that might explain the observed clinical and electrophysiological signs.

Categories of clinical diagnostic certainty on clinical criteria alone
Definite ALS
• UMN signs and LMN signs in 3 regions

Probable ALS
• UMN signs and LMN signs in 2 regions with at least some UMN signs rostral to LMN signs

Probable ALS – Laboratory supported
• UMN signs in 1 or more regions and LMN signs defined by EMG in at least 2 regions

Possible ALS
• UMN signs and LMN signs in 1 region (together), or
• UMN signs in 2 or more regions
• UMN and LMN signs in 2 regions with no UMN signs rostral to LMN signs

UMN signs: clonus, Babinski sign, absent abdominal skin reflexes, hypertonia, loss of dexterity.
LMN signs: atrophy, weakness. If only fasciculation: search with EMG for active denervation.

Approximately two thirds of patients with typical ALS have a spinal form of the disease (Wijesekera & Leigh, 2009). They present with symptoms related to focal muscle weakness where the symptoms may start either distally or proximally in the upper limbs and lower limbs. Some patients may present with a spastic paraparesis or focal muscle wasting before onset of weakness. Fasciculations (noticed as involuntary muscle twitching) or cramps can precede the onset of weakness or wasting for some months, but these are rarely the presenting symptoms. Although it is usually asymmetrical at onset, the other limbs develop weakness and wasting sooner or later, and most patients go on to develop bulbar symptoms and eventually respiratory symptoms (although not necessarily in that sequence). Gradually, spasticity may develop in the weakened atrophic limbs, affecting manual dexterity and gait. During late stages of the disease patients may develop 'flexor spasms', which are involuntary spasms occurring due to excess activation of the flexor arc in a spastic limb.

Patients with bulbar onset ALS usually present with dysarthria of speech, which may initially only be apparent after ingestion of small amount of alcohol.

Limbs symptoms can develop in close succession with bulbar symptoms and in the vast majority of cases will occur within 1–2 years. Almost all patients with bulbar symptoms develop sialorrhoea (excessive drooling) due to difficulty swallowing saliva and mild UMN type bilateral facial weakness that affects the lower part of the face.

About 5% of cases with ALS present with respiratory weakness without significant limb or bulbar symptoms (de Carvalho, et al., 1996).

Respiratory insufficiency occurs commonly in patients with ALS and is a major cause of mortality (Kareus, Kagebein, & Rudnicki, 2008). Symptoms of respiratory muscle weakness include dyspnoea on exertion or talking, orthopneoa, disturbed sleep, ex-

cessive daytime somnolence, morning headaches, fatigue, anorexia, depression, poor concentration, vivid nightmares and nocturia (Wijesekera & Leigh, 2009).

Dysphagia is another diffused symptom of ALS (Verschueren, Monnier, Attarian, Lardillier, & Pouget, 2009) and leads to increased risk of aspiration, malnutrition, weight loss and dehydration (Boliart, 2007). Malnutrition and dehydration can also occur inpatients whom have severe upper limb weakness, especially if they live alone, as this leads to difficulties in meal preparation or prolonged meal times (Desport & Couratier, 2006; Wijesekera & Leigh, 2009).

Aetiology

The cause of ALS is still unknown. However, some genetic risk factors have been identified (Wijesekera & Leigh, 2009), with a possible interaction of environmental risk factors (Armon, 2001). The hypothesis of a complex genetic-environmental interaction as the causal factor for motor neuron degeneration seems to be the most probable (Shaw, 2005).

Between environmental risk factors, smoking is the most likely to be associated with developing ALS, independent of age, level of education and occupation (Sutedja, et al., 2007).

Motor neuron degeneration in ALS is likely to be a complex interplay between multiple pathogenic cellular mechanisms, even if the exact molecular pathway is still unclear (Cozzolino, Ferri, & Carri, 2008).

Present knowledge indicates that part of these mechanism are genetic factors, with 20% of cases with autosomal dominant familiar ALS and 2% of patients with sporadic ALS show mutations in the Copper-Zinc superoxide dismutase (SOD1) gene (Valdmanis & Rouleau, 2008). Other genes causing familial ALS include alsin (ALS2) (Hadano, et al., 2001), senataxin (ALS4) (Chen, et al., 2006), Vesicle associated mem-

brane protein (VAPB, ALS8) (Mitne-Neto, et al., 2007), angiogenin (Greenway, et al., 2006) and a mutation in the p150 subunit of dynactin (DCTN1) (Ludolph, et al., 2006; Munch, et al., 2007). More recently, mutations in TARDBP gene have been linked to familial and sporadic ALS (Vance, et al., 2009).

More so than genetic factors, motor neuron degeneration seems to be related to neuronal injury induced by excessive glutamate, known as excitotoxicity (Pasinelli & Brown, 2006). Glutamate levels in cerebrospinal fluid are elevated in some patients with ALS and this over stimulation of glutamate receptors leads to neuronal death in few steps (Woolsey, 2008).

Scientific literature has identified other factors that influence the molecular pathways to neurodegeneration: oxidative stress (Mitsumoto, et al., 2008), mitochondrial dysfunction (Baron, Kudin, & Kunz, 2007), impaired axonal transport (Pantelidou, et al., 2007), neurofilament aggregation (Lin & Schlaepfer, 2006) and protein aggregation (Hachiya, Kozuka, & Kaneko, 2008).

The final process of cell death in ALS motor neurones is thought to closely resemble a programmed cell death pathway, known as apoptosis (Wijesekera & Leigh, 2009). Biochemical markers of apoptosis are detected in the terminal stages of human and models of ALS (Brooks, 2009). Key elements of the normal apoptotic pathway are found to be involved in cell death in ALS (Guegan & Przedborski, 2003).

Quality of Life

The World Health Organization defines quality of life (QoL) as “a broad ranging concept affected in a complex way by the person’s physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of their environment” (WHOQOL Group, 1998, p. 1570). The WHO definition reflects a bio-psycho-social approach to QoL (Engel, 1977). In a medical

setting, especially when there is a serious illness such as ALS, the factor of physical health became larger than normal, and negative aspects of the illness, fears about dying, and concerns for others (family, friends and also physicians) can be overwhelming. Therefore, the great physical impairment associated with ALS may lead to the assumption that alleviation of the physical burden will also relieve the emotional burden and thus restore QoL. However the available research shows that the relationship is not this simple (McLeod & Clarke, 2007). Quality of life has been reported to be correlated to suffering, social support, sense of burden and hopelessness; the relation with physical functioning is still unclear (Ganzini, Johnston, & Hoffman, 1999). Clarke and colleagues (Clarke, Hickey, O'Boyle, & Hardiman, 2001) reported that determinants of QoL in ALS patients were more likely to be related to psychosocial aspects of life rather than physical aspects, particularly in those patients with greater physical disability. Simmons (Simmons, Bremer, Robbins, Walsh, & Fischer, 2000) also found no correlation between QoL and physical functioning or strength, but that psychological and existential domains of life were important contributors to QoL. Psychosocial aspects of care are important, and there is more to maintaining QoL than simply attending to a person's physical state.

A frequent symptom that influences QoL in ALS is pain, especially in the later stages of disease (Roelke, et al., 2000), increasing suffering and hopelessness (Ganzini, et al., 1999). Previous works report the prevalence of pain complains in ALS patients from about 50% (de Tommaso, et al., 2008; Ganzini, et al., 1999) to more than 70% (Oliver, 1996). It is believed an indirect symptom of pathology, as a result of primary symptoms. Musculoskeletal pain is often related to atrophy and altered tone around joints, but also muscle contractures and joint stiff ness can be painful (Mitchell & Borasio, 2007). With the decreasing of mobility, pain becomes more common, often as a result of frozen joints or inability to change position (Simmons, 2005). Pain is often

underestimated or untreated in patients with ALS (Ganzini, et al., 1999). A 2008 Cochrane review about pain treatment in ALS indicates that there are no randomized or quasi-randomized controlled trials about this topic (Brettschneider, Kurent, Ludolph, & Mitchell, 2008).

Hope and hopelessness are other important psychological variables that may predict changes in QoL. Hopelessness can be defined as “a system of cognitive schemas whose common denomination is negative expectations about the future” (Beck, Weissman, Lester, & Trexler, 1974, p. 864) and its development depends on the interaction of stressful or crisis events with the psychological vulnerability factors of loneliness, irrational beliefs and a paucity of reasons for living leads to the development of hopelessness (Bonner & Rich, 1991). A diagnosis of ALS threatens hope, forcing patients and their carers to rewrite their life plans, dreams and expectations (McLeod & Clarke, 2007; Mitsumoto & Rabkin, 2007). Individuals have no remedy and are left helpless, knowing that there is nothing that can be done to change their fate. Goggin and colleagues (Goggin, et al., 2000) emphasize the relevance of hopelessness to ALS, reporting that hopelessness scores of ALS patients exceeded those of HIV/AIDS patients. According to Plahuta and colleagues (Plahuta, et al., 2002), once an individual receives an ALS diagnosis, external locus of control and lack of meaning of life are predictive of hopelessness, rather than the severity and length of illness. Therefore, an externally oriented locus of control and a poor sense of meaning are significant predictors of high levels of hopelessness in the ALS patient.

The meaning of life and death may be questioned when faced with a terminal illness and spirituality may be sought for comfort. Spiritual well-being has been described as having two dimensions: a religious dimension, referred to a person's relationship with a higher being, and an existential domain, that involves a sense of purpose and meaning in life and a connection to the world (Dal Bello-Haas, et al., 2000).

Spiritual and existential issues, such as beliefs and feelings of meaningfulness, purpose and satisfaction with life progress, are a crucial for many people. Reference to spirituality frequently occurs in the incurable illness literature in relation to the maintenance of health and wellbeing (E. J. Taylor, 2006), with a positive impact on patient QoL (Walsh, Bremer, Felgoise, & Simmons, 2003). Patients who attended worship and prayed regularly used these experiences to cope with their illness (Rabkin, Wagner, & Del Bene, 2000), maybe because religious ideas were used to interpret aspects of the illness experience and its meaning, and as a source of comfort for dying patients (McLeod & Clarke, 2007). ALS patients with higher levels of spirituality showed more hope, fewer concerns about death (Murphy, Albert, Weber, Del Bene, & Rowland, 2000) and were less likely to consider assisted suicide (Ganzini, Johnston, McFarland, Tolle, & Lee, 1998). Existential issues also affects patient's decisions to choose certain types of medical technology (Murphy, et al., 2000).

Depression and anxiety

Considering the devastating nature of the disease, a wide prevalence of depression and anxiety would be expected. However, there is still uncertainty about their real prevalence of these features of the disease (Norris, Que, & Bayat, 2010; L. Taylor, Wicks, Leigh, & Goldstein, 2010).

In fact, the reported distribution and severity of depression amongst ALS patients has been controversial in the literature (Rossi & Pagnini, 2010). The prevalence of reported depression in this population varied from 0% (Clarke, et al., 2001) to 44% (Tedman, Young, & Williams, 1997). Depression appears to have no biological association with ALS aetiology or symptoms. While high rates of depressive symptoms have been reported when investigators used symptom checklists (Rabkin, et al., 2000), largest studies, with sample sizes over 100, indicate a prevalence of severe

depressive symptoms between 11% and 15% (McLeod & Clarke, 2007), double that of the general population of comparable age (Ganzini, et al., 1998). Depressive features, with pre-morbid depression, are also diffused among ALS caregivers, with a worsening of symptoms during time (Gauthier, et al., 2007). Definite Depressive Disorders appear to be rare (Tedman, et al., 1997), but the estimation of its prevalence based on the literature is difficult, because results usually refer to questionnaires scores, insufficient for a psychiatric diagnosis. Furthermore, the diagnosis of depressive disorder in ALS patients is difficult due to the fact that classification of depressive symptoms includes psychological and somatic aspects (Kurt, Nijboer, Matuz, & Kubler, 2007), such as loss of appetite, insomnia or hypersomnia, psychomotor retardation, fatigue or loss of energy (American Psychiatric Association, 1994). All of these symptoms can be a direct consequence of motor neuron disease.

Depressive symptoms have been correlated to low quality of life (Kubler, Winter, Ludolph, Hautzinger, & Birbaumer, 2005; Lou, Reeves, Benice, & Sexton, 2003), anxiety (Wicks, et al., 2007), suffering, hopelessness and low social support (Ganzini, et al., 1999), hastened death (Ganzini, Silveira, & Johnston, 2002), alexithymia (Roy-Bellina, Almohsen, Gely-Nargeot, Carton, & Camu, 2008). There is still uncertainty about the relation between depression and physical impairment (Hillemacher, et al., 2004; Lule, Hacker, Ludolph, Birbaumer, & Kubler, 2008).

The presence of anxiety in ALS patients and their caregivers is less studied. As for depression, symptoms of anxiety include somatic aspects, which can also be caused by ALS. For example, muscles spasms may be reported by patients as muscular tension; there is often fatigue caused by hypoventilation and not because of anxiety.

Vignola and colleagues found that, during the diagnosis period, presence of anxiety could be a relevant psychological aspect that affects ALS patients and caregivers

(Vignola, et al., 2008). However, trait anxiety scores were generally low both in ALS patients and in their caregivers (Pagnini, Rossi, et al., 2009).

Caregivers

Caregivers can be defined as people who live with the person with ALS and provide the patient "with the most care and assistance" (Cockerill & Warren, 1990, p. 42). Caregivers usually are patient's relatives, as spouses or mates, sons, sometimes brothers, sisters and parents. As the onset of the disease arrives in the adulthood, when the patient has already built a family, so the primary caregiver is often his or her spouse.

The fatal and degenerative nature of the illness deals with the whole family, with a significant emotional impact.

The burden experienced by ALS caregivers is severe, similar to those experienced in caring for any other neurological disorder or terminal disease (Goy, Carter, & Ganzini, 2008). Hecht and colleagues (Hecht, et al., 2003) analyzed the burden of ALS carers, comparing it with the one experienced by carers of other diseases. They found a lower level of care burden for ALS, compared with dementia or mixed neuropsychiatric and internal diseases, but it was correlated with functional impairment, as confirmed by Chio and colleagues (Chio, Gauthier, Calvo, Ghiglione, & Mutani, 2005). Personal and social restrictions and physical and emotional problems were the main burden components. Given that the burden of care increases with the functional impairment, these researchers suggest that support for caregivers has to start sooner.

Caregivers spend a lot of time for day caring, sometimes more than 11 hours a day and they often need to reduce their work activities or renounce at all (Krivickas, Shockley, & Mitsumoto, 1997). Those who believe they cannot leave the patient are

the most distressed (Rabkin, et al., 2005). The most time-consuming duties were housekeeping, feeding, and toileting (Chio, et al., 2006).

ALS caregivers note many changes in patients, including increased tension, less frequent vacations, decreased time for themselves, increased anxiety and decreased time for recreational activities (Mitsumoto, 2002). Together with emotional strain, care in ALS requires a certain amount of physical effort, in particular during the advanced phases of the disease. Patients need assistance to make movements and to get up and providing this could be a problem for people with physical impairments. This is particularly true for older adults acting as primary caregivers for patients with ALS.

The progressive nature of the disease promote dependence of the patient upon a primary caregiver and it is important to identify factors relevant to quality of life for both patient and caregiver (Lo Coco, et al., 2005) and to improve these as much as possible (Armon, 2006). There is some evidence supporting the idea that caregivers influence the mental (Chio, et al., 2004) and physical (Banfi, et al., 2010) status of patients with ALS. The therapeutic team should be aware of the strengths and deficiencies of the caregivers and should help them in improving their coping skills. Since concordance of depression and distress levels between patients and caregivers is high, attention to the mental health of the caregiver could alleviate the patient's distress as well (Rabkin, et al., 2000).

Perceived social support is an important predictor of carer distress (Goldstein, Atkins, Landau, Brown, & Leigh, 2006a), marital relationship satisfaction (O'Connor E, McCabe, & Firth, 2008) and patient's quality of life (Chio, et al., 2004). However, the maintain of a network of social support may be difficult to accomplish, as friends often stop visiting or became awkward around the patient as symptoms increase in severity (Cobb & Hamera, 1986), increasing carer's loneliness (Levine, 1999). Even if the enhancement of relationships may be considered as a task for other specialists,

clinicians could work with caregivers and patients in order to improve their social networks, when this could have a positive influence on their well-being.

The role of psychological assistance along disease's course

So far it is not possible to stop the progression of the disease therefore the primary goal in caring for patients with ALS is often considered to be the enhancement of their quality of life (Simmons, 2005). Quality of life can be considered in terms of a match between an individual's hopes and expectations and current reality (Calman, 1984). For illnesses such as ALS, where there is no curative treatment, the focus of care must be on the maintenance and improvement of QoL.

All ALS patients show a similar clinical evolution, while loss of functions can have a different onset and has different times of worsening. Given the devastating nature of the disease, the access to a psychological support can be highly important. As well as for other very serious illness (i.e. cancer), psychological support should provide a scaffolding action, with a safe emotional space where people can express their feelings and emotions and be accompanied in the analysis of pain and fears. Psychologists can play an extremely active role in the rehabilitation process of ALS patients due to their capacity in providing a specific support for every phase in the disease progression (Pagnini, Rossi, Lunetta, Banfi, & Corbo, 2010).

Furthermore, psychologists should help not only patients and families in understanding what is happening, but they can also play a key role in supporting the other members of the multi-professional team in their endeavor managing such an over complex framework.

The communication of diagnosis

The way in which ALS diagnosis is communicated to the patients appears to be of the most importance in determining their initial reaction (Simmons, 2005). Communication of ALS diagnosis may cause major repeated psychological trauma that the patient will have to cope with, using defenses and adaptation mechanisms. Clinical management of ALS should include knowledge, understanding and acceptance of these mechanisms. This can be challenging for physicians, who may be unprepared to break bad news (Buckman, 1996), mostly because of a lack of emotional management training (Pagnini, Manzoni, & Castelnuovo, 2009). Guidelines for breaking the news to a patient with ALS (Borasio & Voltz, 1998) also suggest the proposal of a psychological support.

The ALS diagnosis is a devastating experience for the patient and their family. Right after the communication of the diagnosis, patients often need a “room” in which they can express their emotions, usually despair, regarding what they will have to inevitably face in the future.

As mentioned above, the diagnostic communication of the illness is a crucial and emotionally relevant moment for the patient. The presence of a psychologist affords the patient an opportunity to express their feelings and fears.. A patient-centered service should be very careful in diagnostic communication and the clinical team should work together to enhance the quality of the patient-clinician relationship, with a particular focus on the diagnostic and prognostic communication processes.

Relatives and close caregivers of ALS patients should be able to receive psychological support from the very first period of disease. The label “ALS” is a huge burden carry, both by patients and their relatives who need to come to terms with the incurable, fatal and often fast progressive nature of the disease.

Psychological support for families should be both expressive (promoting mourning management) and practical, helping relatives with discussion and practical suggestions. For example, people can be worried and confused about “if” and “how” to communicate information regarding the disease to their small children and this could be object of practical analysis in psychological counseling.

Disease progression

During illness progression, the awareness of an emotionally safe “room”, offered by the psychologist, is a useful resource for patients and caregivers, improving their quality of life. During counseling they can explore their needs, feel free to voice their emotions, guaranteeing a cathartic effect. People can be seen alone, with their partner or as a family. At the same time it is also possible to manage other practical troubles that cause personal, familiar or social diseases, problems that could be unrelated to the apparition of ALS symptoms. Sometimes clinicians need to face pre-existent issues, for example couple problems, which interact with the new medical condition.

Issues surrounding spirituality and existential well-being may be addressed and explored during these interviews, with respect and the awareness that they are very powerful resources in the coping with illness and the shadow of death (Pagnini, Lunetta, et al., 2010). It is sometimes useful for psychologists to send patients to a spiritual counselor (i.e. a priest, a monk, maybe a philosopher...), in necessary accordance with the patients’ beliefs.

The importance of spiritual care is usually underestimated (Lambert, 2006). Spiritual care should encompass the whole family as a means of preventing complicated bereavement.

Throughout the course of the disease, a balance should be maintained by physicians between anticipating onsets of loss of functions and introducing life support measures, on the one hand, and respecting the patient's psychological state, life plans and environment, on the other.

As the disease progresses, patients will lose physical functions. Medical knowledge is unable to reverse this process, but it can offer auxiliaries to compensate, like walkers, manual wheelchairs, or power chairs. Many people look at these auxiliaries as a "painful goodbye" to their autonomy, a limitation of freedom (Rossi & Pagnini, 2010). In a clinical relationship these feelings can be managed and elaborated.

Furthermore, ALS patients will, sooner or later, face the loss of speech and voice. Usually there is an initial decrease of speech volume, followed by a change in the voice, becoming more confused. This may be followed by complete loss of speech. In order to prevent devastating psychological and social consequences, patients and caregivers should access soon to other forms of communication. In addition to technological solutions, like computerized communicators, there are different ways to communicate, like hand signals, head nodding, sign language, etc (Simmons, 2005). The psychologist should facilitate the awareness that living without speech is not living without communicating. Furthermore, it is essential that caregiver-patient couple find a way to easily interact between them and this could be a task for psychologists.

Ventilatory and nutritional management

At a certain point of the illness, ALS patients' respiratory capacity reduces. The ventilatory ability gets worst, providing a minor amount of oxygen. Respiratory support is usually provided by Non Invasive Ventilation (NIV) or invasive ventilation via tracheotomy. NIV is the provision of ventilatory support through the patient's upper airway using a mask or similar device, while tracheotomy is a surgical procedure on the

neck to open a direct airway through an incision in the trachea. NIV is usually initially used for sporadic nocturnal support to alleviate symptoms of nocturnal hypoventilation. As respiratory function worsens, patients tend to require increasing daytime NIV support and eventually continuous support.

Together with the emotional strain due to the decrease of respiratory functions, many patients report a rejection of the mask, describing an experience similar to claustrophobia, where they feel suffocating, feeling an increasing anxiety and anguish. The psychologist can allow a controlled expression of these feelings, reducing anxious symptomatology. Respiratory anxiety can be treated with relaxation techniques (Manzoni, Pagnini, Castelnuovo, & Molinari, 2008), in particular with those related to breathe listening and control (Pagnini, Manzoni, Castelnuovo, & Molinari, 2010).

Bulbar dysfunctions lead to risk for malnutrition and dehydration. Nutrition troubles in ALS usually begin with liquids and then progresses involving other consistencies. Patient's capacity to swallow food decreases as the tongue weakens, while coughing and choking increase. Initial management of dysphagia consists of changing food consistency, but when this method is not enough, it is proposed a feeding gastrostomy tube to the patient (percutaneous endoscopic gastrostomy, PEG or radiologically Inserted Gastrostomy, RIG).

Important choices

Despite a variety in disease progression, all ALS patients must face crucial decisions. In particular, choices about nutrition management or a tracheostomy to keep breathing.

These choices can be hard to be take, since they will have an important impact on the patients' lives. Patients should be able to make a choice with the consciousness of medical issues, communicated by physicians, but they also need time to express

their fears and doubts. When patient have to decide about an intervention, an informed consent must be signed. Banfi and colleagues (Banfi, et al., 2009) propose a two-steps informed consent, with the communication of clinically relevant information made by physician and a second phase, after some hours or some days, where patients can explore feelings and fears to the psychologist. Only in this second step the consent will be signed.

End-of-life phase

Psychological support becomes even more important in the end-of-life phase of the disease. Psychologists need to be aware of potential difficulties in the bereavement outcome for surviving relatives and/or carers. Difficult questions are often asked to clinicians from both patients and caregivers, questions typically related to the suffering management at the end of life. In this period the emotional strain is very high and can promote the breakdown of a psychological equilibrium in pre-morbid subjects. There could be requests for assistance to die as a means of stopping the suffering. Answers to these questions should be given sensitively and honestly, considering the ability of the individuals to understand and manage the information that they are asking for.

After the patient's death continuous counseling is often needed in order to cope with the grief of mourning.

The death of a person has a lasting effect on his family and not all people are able to cope well with the situation (Martin & Turnbull, 2001). Grief and bereavement support is integral to ALS care, but a study conducted in the US indicates that the support provided by ALS centers is often inadequate (Hebert, Lacomis, Easter, Frick, & Shear, 2005). Measures such as the possibility to talk to the psychologist or a letter of condolence can improve this support. A letter of condolence can help a bereaved

family and tie-up the relationship between the physician and the late patient's family (Bedell, Cadenhead, & Graboys, 2001).

The impact of direct-care home assistance among patients and caregivers quality of life

Direct-care workers are people who help patients bathe, dress, eat, and negotiate a host of other daily tasks (Egan & Kadushin, 1999). They are a lifeline for those they serve, as well as for families struggling to provide quality care. They have many titles, including personal care attendant, home care worker, personal assistant, and direct support professional (Harrington & Honda, 1986). In addition to helping with activities of daily living such as bathing, dressing, toileting, eating, housekeeping chores, meal preparation and managing medications, these workers provide the personal interaction that is very important for the quality of life and quality of care of chronically disabled individuals (Stone, 2004). They also assist individuals go to work and remain engaged in their communities (Jump, Floen, & Baruth, 2001).

The care that direct-care workers provide is therefore intimate and personal. It is also increasingly complex and frequently both physically and emotionally challenging (Eustis, Kane, & Fischer, 1993; Gilbert, 1991).

Although there is very little empirical research documenting the connection between the presence of an home care worker and the quality of care/life for patients with chronic illness (Devlin & McIlfatrick, 2009), anecdotal and clinical evidences suggest that the presence of direct care assistance has a significant effect on clinical, functional, and lifestyle outcomes of patients and their caregivers (Devlin & McIlfatrick, 2010).

The importance of this kind of assistance in ALS seems to be very important from the clinician's point of view. However, nowadays, no study has investigated with a scien-

tific approach the real impact among patients' and caregivers' psychological well-being.

The present research

ALS is a rare pathology, as above suggested. Scientific literature about this topic is not broad as it is for other neurodegenerative diseases, such as Alzheimer's or Parkinson's disease. In particular, there are few studies that investigated longitudinal patterns of psychological well-being, for both patients and caregivers. Furthermore, no previous published work evaluates the impact of home care assistance on patients' and caregivers' QoL.

The objective of this work is to investigate the progression of psychological well-being of ALS patients and caregivers during time, enhancing psychological trends and relations between variables and to evaluate if direct home care really improves QoL of subjects, by making a comparison between subjects with and without home assistance.

Given the progressive nature of ALS, a worsening of psychological disease and a decreasing in reported QoL would be expected to be found in this study, even if there are still controversies within scientific literature.

The other hypothesis deals with the presence of a direct-care home assistant, believed to be a supportive factor that can improve psychological well being of both patients and caregivers.

Chapter 2 - Methods

Participants and setting

This study included 40 ALS patients (16 females, 24 males), together with their caregivers (31 females and 9 males). A caregiver was defined as a person who lives with the person with ALS and provides him “with the most care and assistance” (Cockerill & Warren, 1990, p. 42) and were mainly spouses or sons.

Patients included were at first stage of the disease, with a baseline evaluation within 6 months from diagnosis, an ALS Functional Rating Scale higher than 29/48 and a Forced Vital Capacity, measured with Spirometry, more than 70%.

All patients had been diagnosed as probable or definite ALS according to the revised criteria of El Escorial (Brooks, et al., 2000). Patient with invasive ventilation at baseline support were excluded, as well as subjects with a secondary disease.

All patients and carers gave informed consent to participate in the study.

Participants were recruited at the NEMO - NEuroMuscular Omnicenter, Niguarda Cà Granda Hospital, Milan, a clinical service specialized in treatment and management of neuromuscular disorders, with a multidisciplinary care. Criteria for diagnosis and severity of disease were assessed by an independent neurologist with a subspecialty interest in ALS.

Study design

A repeated measures design was used to perform this study. Subjects were subsequently recruited and assessed at a baseline (T1), after four (T2), eight (T3) and twelve (T4) months. Demographic data, as well as information about home assis-

tance was assessed at baseline and verified at every step. Subjects completed psychological questionnaires at every assessment.

ALS patients compiled the State-Trait Anxiety Inventory, the Beck Depression Inventory, the Italian Pain Questionnaire, the McGill Quality of Life Questionnaire, the ALS-Specific Quality of Life Questionnaire Revised and were assessed for the ALS Functional Rating Scale Revised by the center's neurologist. Caregivers compiled the State-Trait Anxiety Inventory, the Beck Depression Inventory, the McGill Quality of Life Questionnaire and the Zarit Burden Inventory.

Measurements

State-Trait Anxiety Inventory

The State-Trait Anxiety Inventory (STAI) is a self-report assessment device that includes separate measures of state and trait anxiety. We used only the trait form, composed by 20 items. Trait anxiety denotes "relatively stable individual differences in anxiety proneness..." (Spielberger, Gorsuch, & Lushene, 1970, p. 6) and refers to a general tendency to respond with anxiety to perceived threats in the environment. Scores were summed to give a total anxiety score (out of a possible 80). The internal consistency reported in non-psychiatric samples and is very high (Spielberger, et al., 1970).

Beck Depression Inventory-II

The Beck Depression Inventory-II (BDI-II) consists of 21 items to assess the intensity of depression in clinical and normal patients (Beck, Steer, & Brown, 1996). Each item has a list of four or more statements arranged in increasing severity about a particular symptom of depression (range from 0 = no depression to 63 = severe depres-

sion). The BDI-II contains two sub-scales, one focused on somatic aspects of depression, the other focused on psychological symptoms.

Italian Pain Questionnaire

Pain was assessed with the Italian Pain Questionnaire (QUID) (De Benedittis, Massei, Nobili, & Pieri, 1988; Maiani & Sanavio, 1985), a self-report instrument that evaluate pain characteristics. It includes a 5-point scale for evaluating present pain intensity (PPI: slight, moderate, strong, very strong, unbearable) and a semantic interval scale consisting of 42 pain descriptors, divided into four main classes: sensory (S), affective (A), evaluative (E), mixed (M) and 16 sub-classes corresponding to those of the McGill Pain Questionnaire (Melzack, 1975).

McGill Quality of Life Questionnaire

The McGill Quality of Life Questionnaire (MQoL) is a 16-item questionnaire, with each question rated from 0 (not at all) to 10 (extremely), developed by Cohen and colleagues (S. R. Cohen, et al., 1997; S. R. Cohen, Mount, Strobel, & Bui, 1995). It includes five domains, two of which are health related, physical well being (MG-PhWB) and physical symptoms (MG-PhS), and three are non-health related, existential well being (MG-EWB), psychological symptoms (MG-PsyS) and social support (MG-SS). For each domain, the score is the mean of the values of the relative items. Moreover, the patient is also asked to indicate his/her self perceived QoL in the past two days in a single item scale (MG-SIS), rated from 0 (very bad) to 10 (excellent). MG-SIS was administered before the completion of the MQoL scale. MQoL has been effectively used in patients with ALS (Chio, et al., 2004; Lou, et al., 2003) and provides good psychometric characteristics and is well accepted by patients with various types of chronic disorders (S. R. Cohen, Mount, Tomas, & Mount, 1996)

Amyotrophic Lateral Sclerosis Specific Quality of Life Questionnaire-revised

The ALS-Specific Quality of Life Questionnaire revised (ALSSQoL-r) is a questionnaire specifically developed to assess QoL in people with ALS (Simmons, et al., 2006). Designed to reflect the patient's own assessment of QoL, is based among MQoL structure, but it more specific for ALS population, including items that patients with ALS identified as being of importance to them in semistructured interviews (Simmons, Felgoise, & Bremer, 2004). ALSSQoL-r is composed by 46 items and each question is rated with a 10-point likert scale. Together with an overall score, it includes different sub-scales: Negative Emotion, Interaction with People and the Environment, Intimacy, Religiosity, Physical Symptoms and Bulbar Symptoms. The questionnaire has been translated into Italian and validation in a sample of Italian patients with ALS is in progress (Pagnini, Simmons, Felgoise, Lunetta, & Corbo, 2010).

Amyotrophic Lateral Sclerosis Functional Rating Scale-revised

The ALS Functional Rating Scale-revised (ALSFRS-r) is a 10-item, 48-point scale that measures bulbar function, upper extremity function, lower extremity function, and respiration (Cedarbaum, et al., 1999). Scores range from 0 (severe impairment) to 48 (normal functioning). ALSFSR-r was compiled by an experienced neurologist with a subspecialty interest in ALS.

Zarit Burden Inventory

The Zarit Burden Inventory (ZBI) is a 22-item questionnaire with responses ranging from 0 to 4 and a total score range from 0 to 88 (Zarit, Reever, & Bach-Peterson, 1980). No cutoff scores have been established, but higher scores reflect higher care-

giver burden (Cifu, et al., 2006). It is often used in the literature as a measure of caregiver burden.

Data analysis and statistical calculations

Data collected from caregivers and patients were analyzed with PASW Statistics 17.0 (SPSS Inc, 2007).

At first assessment, all psychological variables presented an equality or normality of variance, measured with Levene's test. Considering the number of the subjects at T1, parametric tests have been used to analyze means distributions and correlations, with Pearson's *r*. All correlations were two-tailed. A *p* level of .05 was considered significant, but *p* values were calculated with Bonferroni's adjustment, considering the number of simultaneous tests.

Considering dropouts during the course of the study, samples in T3 and T4 are insufficient to allow the use parametric tests. So, non-parametric tests would be preferable for the analysis of longitudinal data. Friedman's Test have been used to analyze trends for longitudinal data. This test is a non-parametric randomized block analysis of variance that is an alternative to the repeated measures Analysis of Variance (ANOVA used as a Trend Analysis), when the assumption of normality or equality of variance is not met or when sample size is too small. This test uses the ranks of the data rather than their raw values to calculate the statistic. Since this test does not make a distribution assumption, it is not as powerful as the ANOVA (Sokal & Rohlf, 1995). The null hypothesis in this test is that the distribution of the ranks of each type of score is the same. The test statistic for the Friedman's test is a Chi-square with *a*-1 degrees of freedom, where *a* is the number of repeated measures. Tukey multiple comparisons test was used as Post-hoc in order to decide which groups are significantly different from each other.

The comparison between subjects with or without home assistance has been made with Analyses of Covariance (ANCOVAs) for cross-sectional data and Multiple Analyses of Covariance (MANCOVAs) for longitudinal data.

Analysis of covariance is a more sophisticated method of Analysis of Variance (Field, 2009), based on inclusion of supplementary variables (covariates) into the model. This lets account for inter-group variation associated not with the "treatment" itself, but with the covariates. In this study, included covariate was the loss of physical functions.

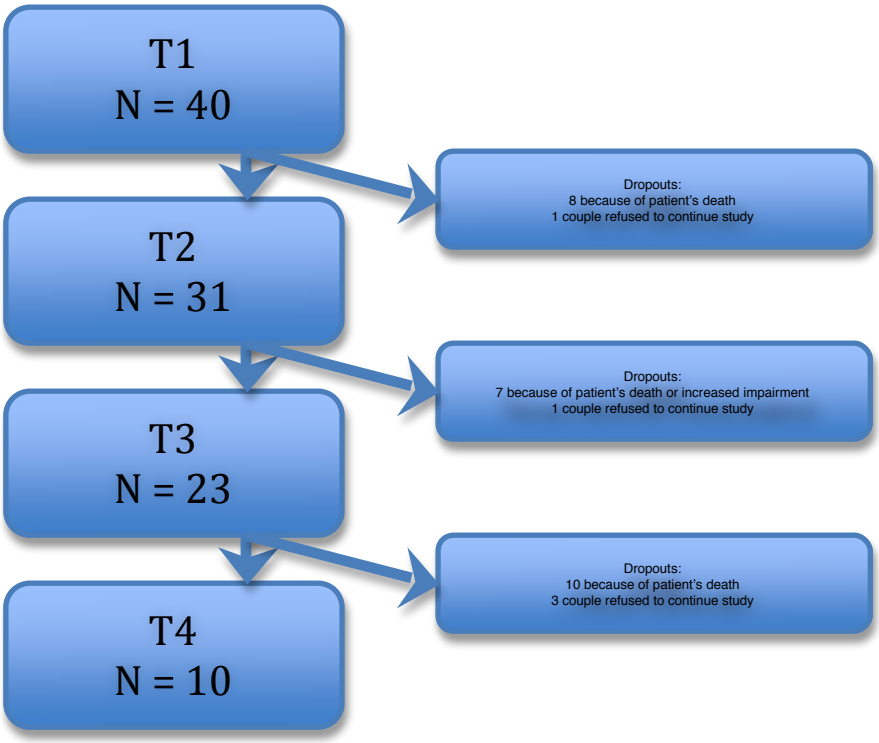
Multivariate analysis of covariance (MANCOVA) is an extension of Analysis of Covariance (ANCOVA) to cover cases where there is more than one dependent variable and where the dependent variables cannot simply be combined (Stevens, 2002). In this study, different assessment times were considered multiple dependent variables. Even if data characteristics would suggest the use of non-parametric statistic, MANOVA is robust to a large extent to violation of parametric assumptions and can therefore be used in similar analysis (Dimitrov & Rumrill, 2005).

Chapter 3 - Results

Response rate and dropouts

Response rate at first assessment was 100%, no ALS patient or caregiver refused to participate in this study. At T2 participants were 62 (31 ALS patients and 31 caregivers), T3 and T4 included, respectively, 23 and 10 patient-caregiver couples (see Fig. I). Mean dropout rate was 30,9%. Dropouts were mainly due to patient's death (66,7%) or related to a worsening of clinical conditions (22,2%) that prevented data gathering. A small percentage of patient-caregiver couples (11,1%) refused to continue study participation. During the final phase of the research, given the effort required for tests compilation, patients were only assessed with MQoL and ALSSQoL-r.

Figure 1. Flow chart of patient-caregiver couples attending study



Subject characteristics at T1 - Demographic characteristics

The ALS patients group was initially composed by 16 (40%) female and 24 (60%) males (Fig. 2); ages ranged from 29 to 82 years, with a mean age of 61,73 years (Table 2). The mean length of illness of about 15 months and mean ALSFRS-r was 34,87 (range from 29 to 46). Most of patients attended high school (19, 47,5%) and primary school (15, 37,5%), while a minority were graduates (5, 12%) o post-graduates (1, 2,5%). Subjects with ALS were mainly pensioned (13, 32,5%), but before diagnosis (and sometimes even after diagnosis), subjects with ALS worked as employees (10, 25%), laborers (8, 20%), managers (5, 12,5%) or professionals (4, 10%); one (2,5%) was unemployed.

The first symptom of the disease, in this sample, is mainly located in lower (19, 47,5%) and upper (14, 35%) limbs, while 7 subjects (17,5%) presented a bulbar onset (Fig. 4).

Caregivers group was composed by 28 (70%) females and 12 (30%) males (Fig. 3). Age ranged from 30 to 89 years, with a mean age of 55,64 years. Educational levels (Fig. 6) were slightly higher than patients, with most subjects who attended high school (17, 42,5%) and less than a third of subjects with primary school license (13, 32,5%); a quarter of this sample were graduates (7, 17,5%) or post-graduates(3, 7,5%).

About a half of caregivers worked as employee (12, 30%) or laborer (7, 17,5%), with some professionals (5, 12,5%) and managers (4, 10%) and 3 subjects (7,5%) unemployed. Nine people (22,5%) were pensioned (Fig. 7).

Caregiver were mainly spouses (33, 82,5%), with a minor percentage (7, 15,7%) of sons of patients (Fig. 5).

The presence of a direct-care home worker was indicated by 15 patient-caregiver couples (37,5%). among whom 5 (12,5%) received a part-time assistance financed by municipality and 10 (25%) had a payed care worker, full-time (6, 15%) or part-time (4, 10%). The average amount of money spent by families for this service was 321 euros for part-time assistance and 810 euros for full-time care. During assessment times, 3 patient-caregiver couples at T2, 1 at T3 and 1 at T4, began to have a direct-care home worker. Demographic characteristics of subjects are reported in table 2.

During the course of research, demographic characteristics have remained relatively stable, despite dropouts. The only notable modification is about patient's mean age, which was lower in follow-up assessments (T4 and T3) than T1, but without having a statistical significant result.

Figure 2. Gender of ALS patients

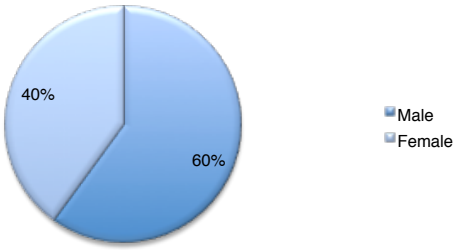


Figure 3. Gender of caregivers

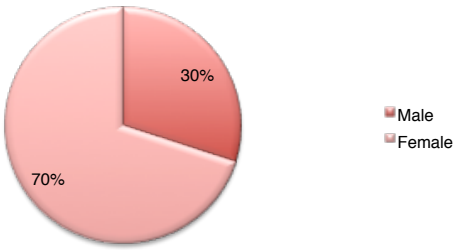


Figure 4. Onset of the disease

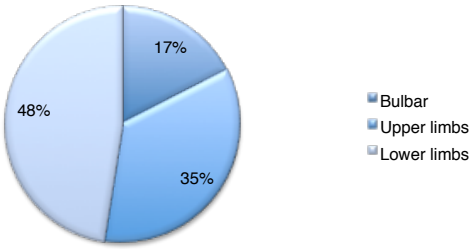


Figure 5. Carer type

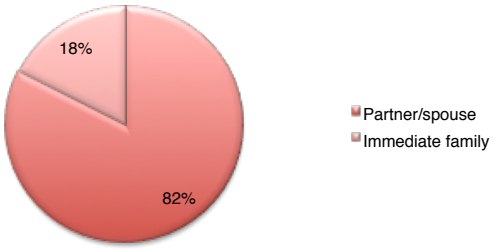


Table 2. Demographic characteristics of sample

	ALS Patients (n = 40)	Caregivers (n = 40)
Sex (n, %)		
Female	16 (40%)	28 (70%)
Male	24 (60%)	12 (30%)
Age (Mean, SD)	61,73 (11,5)	55,64 (12,3)
Educational level (n, %)		
Primary school	15 (37,5%)	13 (32,5%)
High school	19 (47,5%)	17 (42,5%)
Graduated	5 (12,5%)	7 (17,5%)
Post-graduate	1 (2,5%)	3 (7,5%)
Work (n, %)		
Unemployed	1 (2,5%)	3 (7,5%)
Laborer	7 (17,5%)	7 (17,5%)
Employee	10 (25%)	12 (30%)
Professional	4 (10%)	5 (12,5%)
Managing	5 (12,5%)	4 (10%)
Pensioned	13 (32,5%)	9 (22,5%)
Mean length of illness	15 months	
ALSFRS-r (mean, SD)	34,87 (7,78)	
Carer type (n, %)		
Partner/spouse		33 (82,5%)
Immediate family		7 (17,5%)
Onset of the disease (n, %)		
Bulbar	7 (17,5%)	
Upper limbs	14 (35%)	
Lower limbs	19 (47,5%)	

Figure 6. Educational level

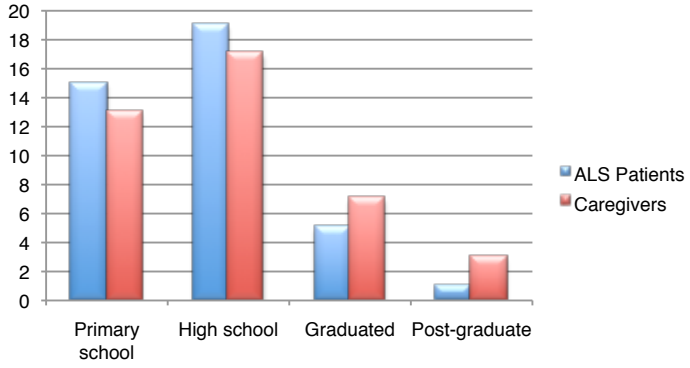
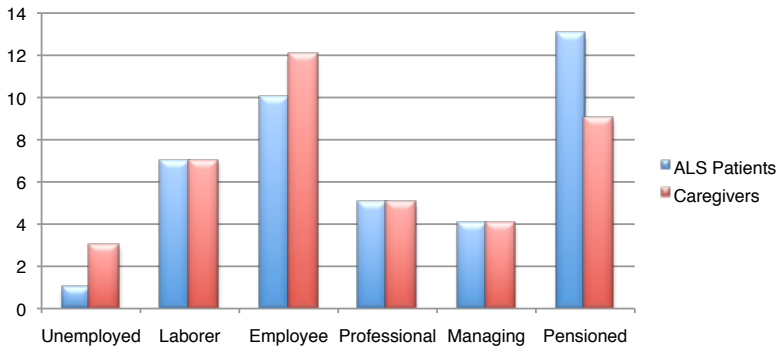


Figure 7. Work



Subject characteristics at T1 - Psychological data

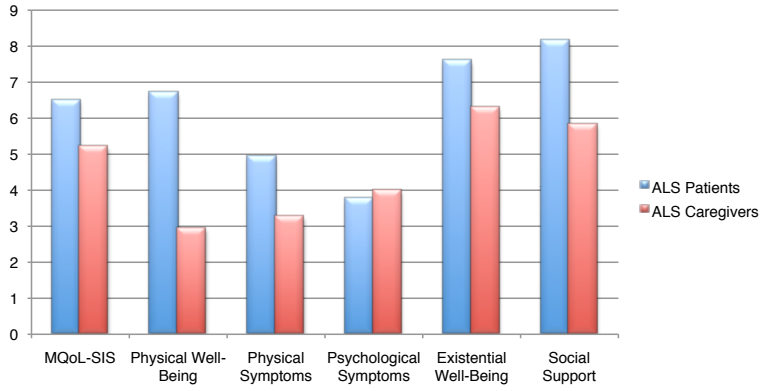
At first assessment, average scores of STAI indicated mild levels of anxiety for ALS patients and caregivers, respectively 40,26 (*s.d.* 11,45) and 40,41 (13,79). BDI scores were slightly higher than general population's ones; average score of ALS patients was 12,87 (8,03) while caregivers' mean score was 8,9 (8,78). Considering only psychological items from BDI-II, ALS patients had a mean score of 7,07 (5,56) and caregivers obtained 5,67 (6,2). The scores at somatic sub-scale of BDI-II were 5,8 (3,12) for ALS patients and 3,22 (3,16) for their caregivers.

The average score for ZBI, as indicated by caregivers, was 19,25 (15,52).

Quality of life, as measured with MQoL-SIS was rated 6,48 (1,78) by ALS patients and 5,2 (2,6) for caregivers (Fig. 8). ALS patients scored 6,69 (2,54), 4,91 (2,16), 3,74 (1,99), 7,58 (1,58) and 8,13 (1,57), respectively, for Physical Well-Being, Physical Symptoms, Psychological Symptoms, Existential Well-Being, Social Support. For the same factors, caregivers scored respectively 2,92 (3,32), 3,25 (2,89), 3,96 (2,83), 6,28 (2,56) and 5,81 (3,01). Scores for all questionnaires are indicated in table 3.

In comparison with people who abandoned study, subjects who remained in the study until the end (T4) presented, at T1, higher scores at ALSFRS-r and lower scores at BDI-II for ALS patients and higher levels of ZBI for caregivers. All subjects who left study before T4 indicated lower level of QoL (MG-SIS, ALSSQoL-r) than the others.

Fig. 8. McGill Quality of Life Questionnaire



Patient scores on the ALSSQoL-r presented a mean total score of 5,77 (1,27) and the average scores of subscales were: 6,32 (1,71) for Negative Emotion, 7,06 (1,73) for Interaction with People & Environment, 4,47 (2,14) for Intimacy, 5,53 (3,22) for Religiosity, 6,27 (1,3) for Physical Symptoms, 6,78 (2,5) for Bulbar Function (Fig. 9).

Fig. 9. ALS Specific QoL Questionnaire

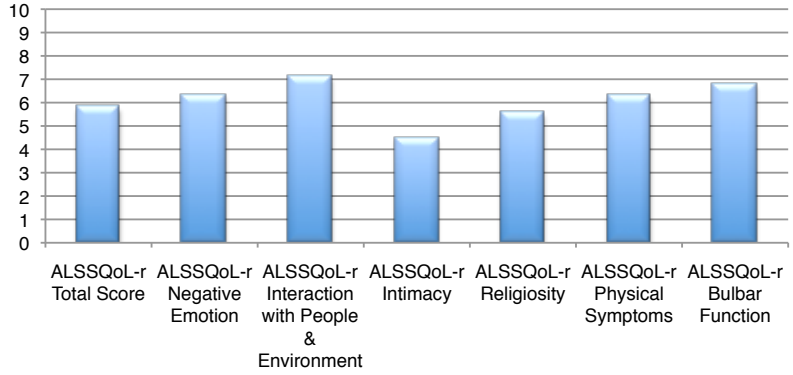


Table 3. Questionnaires scores at T1

	ALS Patients			Caregivers		
	Mean	SD	Median	Mean	SD	Median
STAI	40,26	11,45	39	41,25	13,79	40
BDI-II	12,87	8,03	11	8,90	8,78	6
BDI-II-S	5,79	3,12	6	3,23	3,16	2
BDI-II-Psy	7,08	5,56	5	5,68	6,2	4
MG-SIS	6,49	1,78	6	5,20	2,6	6
MG-PhWB	6,69	2,54	7	2,93	3,32	2
MG-PhS	4,91	2,16	4	3,25	2,89	3
MG-PsyS	3,74	1,99	4	3,96	2,83	4
MG-EWB	7,58	1,58	8	6,28	2,56	7
MG-SS	8,13	1,57	9	5,81	3,01	7
ALSSQoL-r	5,77	1,27	6			
ALSSQoL-NE	6,32	1,71	7			
ALSSQoL-IPE	7,06	1,73	7			
ALSSQoL-I	4,48	2,14	5			
ALSSQoL-Rel	5,54	3,22	6			
ALSSQoL-PhS	6,27	1,3	6			
ALSSQoL-BS	6,79	2,5	7			
ZBI				19,26	15,52	18

STAI = State-Trait Anxiety Inventory - Trait form; BDI-II = Beck Depression Inventory-II; BDI-II-S = Beck Depression Inventory-II Somatic Subscale; BDI-II-Psy = Beck Depression Inventory-II Psychological Subscale; MG-SIS = McGill Quality of Life Questionnaire (MQoL) Single Item Scale; MG-PhWB = MQoL Physical Well-Being; MG-PhS = MQoL Physical Symptoms; MG-PsyS = MQoL Psychological Symptoms; MG-EWB = MQoL Existential Well-Being; MG-SS = MQoL Social Support; ALSSQoL-r = ALS Specific Quality of Life Questionnaire Revised; ALSSQoL-NE = ALSSQoL Negative Emotion; ALSSQoL-IPE = ALSSQoL Interaction with People & Environment; ALSSQoL-I = ALSSQoL Intimacy; ALSSQoL-Rel = ALSSQoL Religiosity; ALSSQoL-PhS = ALSSQoL Physical Symptoms; ALSSQoL-BS = ALSSQoL Bulbar Function; ZBI = Zarit Burden Inventory.

Results from Italian Pain Questionnaire indicate that 19 patients (51,2%) experienced pain. Among patients with pain, 6 of them (28%) rated their Present Pain Intensity as “light”, 10 (47,6%) described it as “moderate”, 3 (14,3%) considered it “strong” and other 2 (9,5%) declared to experience a “very strong pain”. The most used adjectives

to describe pain were “nagging” (90,5%), “sore” (85,7%), “periodic” (76,2%), “annoying” (66,7%), “exhausting” (61,9%), “enduring” (57,1%), “debilitanting” (52,4%) and “worrying” (52,4%). No subject indicated its pain as “pounding” or “tearing” and only one subject (4,8%) reported “oppressive” and “suffocating” as descriptors. Table 4 reports frequencies of pain descriptors.

Table 4. Pain descriptors for ALS patients

Descriptor	Category	Sub-category	N	%*	%**
Nagging	Evaluative	Interference on daily life	19	47,5	90,5
Sore	Sensory	Dullness	18	45	85,7
Periodic	Sensory	Temporal I	16	40	76,2
Annoying	Evaluative	Overall evaluation	14	35	66,7
Exhausting	Affective	Affective tension	13	32,5	61,9
Enduring	Mixed	Sensory- Evaluative	12	30	57,1
Debilitanting	Affective	Affective tension	11	27,5	52,4
Worrying	Evaluative	Overall evaluation	11	27,5	52,4
Pulsing	Sensory	Temporal II	10	25	47,6
Spreading	Sensory	Spazio Temporal	10	25	47,6
Troublesome	Evaluative	Interference on daily life	10	25	47,6
Fluctuating	Sensory	Spazio Temporal	9	22,5	42,9
Stubborn	Mixed	Sensory-Affective Evaluative	9	22,5	42,9
Heavy	Sensory	Constrictive pressure	8	20	38,1
Distressing	Affective	Fear	8	20	38,1
Hurting	Affective	Negative emotional impact	8	20	38,1
Steady	Sensory	Spazio Temporal	7	17,5	33,3
Tender	Sensory	Brightness	7	17,5	33,3
Smarting	Sensory	Brightness	7	17,5	33,3
Disabling	Evaluative	Interference on daily life	7	17,5	33,3
Penetrating	Sensory	Punctate pressure	6	15	28,6
Constrictive	Sensory	Constrictive pressure	6	15	28,6
Wretched	Affective	Negative emotional impact	6	15	28,6
Persistent	Sensory	Temporal I	5	12,5	23,8
Burning	Sensory	Sensory: Miscellaneous	5	12,5	23,8
Tormenting	Evaluative	Overall evaluation	5	12,5	23,8
Dull	Sensory	Dullness	4	10	19,0
Piercing	Sensory	Sensory: Miscellaneous	4	10	19,0
Agonizing	Affective	Fear	4	10	19,0
Inexpressible	Evaluative	Overall evaluation	4	10	19,0
Sharp	Mixed	Sensory- Evaluative	4	10	19,0
Exasperating	Mixed	Sensory-Affective Evaluative	4	10	19,0
Nauseating	Affective	Autonomic	3	7,5	14,3
Unbearable	Evaluative	Overall evaluation	3	7,5	14,3
Stabbing	Sensory	Punctate pressure	2	5	9,5
Biting	Sensory	Constrictive pressure	2	5	9,5
Gnawing	Mixed	Sensory-Affective Evaluative	2	5	9,5
Torturing	Mixed	Sensory-Affective Evaluative	2	5	9,5
Suffocating	Affective	Autonomic	1	2,5	4,8
Oppressive	Affective	Negative emotional impact	1	2,5	4,8
Pounding	Sensory	Temporal II	0	0	0,0
Tearing	Sensory	Sensory: Miscellaneous	0	0	0,0

*on the overall sample
** within patients suffering of pain

Correlations between variables

There was a high degree of correlation between variables (Tables 5-7).

Patient's STAI, BDI-II, for both somatic and psychological subscales, and MG-PsyS were positively related with each other and negatively related with MG-SIS, MG-PhWB, MG-EWB, MG-SS and ALSSQoL-r score and subscales (with the exception of PhS and BS). Positive correlation were found between MG-SIS, MG-EWB, MG-SS, ALSSQoL-r, ALSSQoL-NE, ALSSQoL-IPE, ALSSQoL-I, ALSSQoL-Rel in patient's scores (Table 5). ALSFRS-r was positively related with BDI-II somatic subscale and MG-PhS and negatively with MG-SIS. PPI presented a positive relation with ALSFRS-r and a negative one with MG-SIS. MG. ALSSQoL-PhS was negatively related with BDI-II (and both subscales), MG-PhS and ALSFRS-r, while there was a positive correlation with ALSSQoL-r, and MG-PhWB.

Caregiver's STAI, BDI-II (and subscales), MG-PhS, MG-PsyS and ZBI were positively related with each other (Table 6) and negatively correlated with MG-SIS, MG-PhWB, MG-EWB, MG-SS. These latter 4 variables were positively related with each other.

Caregivers' anxiety, depression (in both somatic and psychological features) and burden were positively related with depression and anxiety in ALS patients and negatively related with patient's MG-SIS, MG-PhWB, MG-PsyS, MG-EWB, MG-SS, ALSFRS-r, ALSSQoL-r, ALSSQoL-NE, ALSSQoL-IPE, ALSSQoL-I, ALSSQoL-Rel (see table 7). Caregivers' MG-SIS, MG-EWB and MG-SS presented a negative correlation with patients' STAI, BDI-II, MG-PhS, ALSFRS-r, and a positive correlation with patients' MG-SIS, MG-PhWB, MG-EWB, MG-SS, ALSSQoL-r, ALSSQoL-NE, ALSSQoL-IPE, ALSSQoL-I, ALSSQoL-R. Patient's PPI had no significant correlation with caregiver's psychological variables, as well as ALSSQoL-PhS, while ALSSQoL-BS was related with carer's STAI, BDI-II and MG-SS.

	STAI	BDI-II	BDI-II-S	BDI-II-Psy	MQoL-SIS	MG-PhWB	MG-PhS	MG-PsyS	MG-EWB	MG-SS	ALSFRS-r	ALSSQoL-r	ALSSQoL-NE	ALSSQoL-IPE	ALSSQoL-I	ALSSQoL-R	ALSSQoL-PhS	ALSSQoL-BS	PPI
STAI	1																		
BDI-II	.608**	1																	
BDI-II-S	.496**	.865**	1																
BDI-II-Psy	.600**	.959**	.689**	1															
MQoL-SIS	-.498**	-.654**	-.567**	-.629**	1														
MG-PhWB	-.472**	-.432**	-.395*	-.402*	.525**	1													
MG-PhS	109	191	.193	232	-264	-.322*	1												
MG-PsyS	.776**	.603**	.573**	.550**	-.423**	-.501**	.64	1											
MG-EWB	-.446**	-.435**	-.174	-.560**	.411**	268	-102	-272	1										
MG-SS	-.398*	-.463**	-.415**	-.437**	.424**	268	-242	-273	.700**	1									
ALSFRS	-276	-290	-.412**	-239	-.49	-.51	-.364*	.41	.153	.120	1								
ALSSQoL-r	-.716**	-.573**	-.484**	-.557**	.543**	.606**	-219	-.568**	.554**	.574**	.74	1							
ALSSQoL-NE	-.829**	-.604**	-.472**	-.607**	.583**	.538**	-191	-.722**	.515**	.442**	.49	.798**	1						
ALSSQoL-IPE	-.608**	-.427**	-.395*	-.395*	.479**	.467**	-.51	-.359*	.528**	.608**	-.93	.879**	.600**	1					
ALSSQoL-I	-.342*	-.421**	-.199	-247	.310*	.269	-.39	-174	.348*	.345*	.128	.655**	294	.604**	1				
ALSSQoL-R	-.367*	-8	-.621**	-.529**	.487**	.223	.129	-263	.336*	146	.46	.588**	.389*	.522**	.387*	1			
ALSSQoL-PhS	-236	-.439**	-.481**	-.364*	.116	.434**	-.312*	-.371*	.278	.267	-.12	.378*	.250	.246	.91	.129	1		
ALSSQoL-BS	-69	-280	-.91	-.353*	.146	248	-.465**	.40	-.88	.121	.242	.271	.104	.108	.2	-.139	12	1	
PPI	223	165	.103	.181	.352*	-.206	.105	.185	-.243	-.112	.370*	-.178	.166	-.162	-.256	-.185	235	24	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 5. Correlations within ALS patients' variables

	STAI	BDI-II	BDI-II-S	BDI-II-Psy	MQoL-SIS	MG-PhWB	MG-PhS	MG-PsyS	MG-EWB	MG-SS	ZBI
STAI	1										
BDI-II	.794**	1									
BDI-II-S	.746**	.862**	1								
BDI-II-Psy	.737**	.967**	.704**	1							
MQoL-SIS	-.578**	-.518**	-.384*	-.533**	1						
MG-PhWB	-.427**	-.569**	-.481**	-.555**	231	1					
MG-PhS	.417*	.554**	.492**	.528**	-224	-.561**	1				
MG-PsyS	.708**	.749**	.716**	.689**	-.527**	-.571**	.621**	1			
MG-EWB	-.363*	-.351*	-327	-.520**	.420**	238	-201	-.380*	1		
MG-SS	-.635**	-.492**	-.532**	-.421*	.348*	274	-194	-.403*	.442**	1	
ZBI	.653**	.560**	.704**	.430**	-.315*	-.447**	.378*	.531**	-.434**	-.630**	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 6. Correlations within caregivers' variables

		Patients' variables																	
		STAI	BDI-II	BDI-II-S	BDI-II-Psy	MQoL-SIS	MG-PhWB	MG-PhS	MG-PsyS	MG-EWB	MG-SS	ALSFRS-r	ALSSQoL-r	ALSSQoL-NE	ALSSQoL-IPE	ALSSQoL-I	ALSSQoL-R	ALSSQoL-PhS	ALSSQoL-BS	PPI
Caregivers' variables	STAI	.412*	.357*	.401*	.320*	-.345*	-.369*	.331*	.312*	-.441**	-.483**	-.447**	-.526**	-.340*	-.366*	-.415*	-.446**	141	-.445**	276
	BDI-II	.359*	.437*	-.463**	.332*	-.356*	-.308*	.330*	.376*	-.413*	-.366*	-.390*	-.317*	-.372*	-.348*	-.451**	-.460**	113	-.398*	288
	BDI-II-S	.563**	.391*	-.412*	.318*	-.393*	-279	264	.402*	-.551**	-.321*	-.407*	-.344*	-.398*	-308	-.386*	-.427*	31	-218	265
	BDI-II-Psy	.311*	.362*	-.482**	.386*	-.323*	-.386*	.339*	.335*	-301	-.371*	-.341*	-.392*	-.382*	-.352*	-.468**	-.370*	143	-.322*	271
	MQoL-SIS	-.418*	-.315*	.329*	-.338*	.319*	.328*	-.449**	-.311*	.483**	.388*	.385*	.347*	.358*	.341*	.410*	.481**	-147	.339*	-.339*
	MG-PhWB	290	92	-130	151	-50	-197	203	13	-.330*	-92	-236	-.325*	-178	-188	-269	-149	-72	-.336*	-259
	MG-PhS	6	-79	-238	-94	-117	-153	144	-63	-.342*	-174	-85	-.367*	-135	-.341*	-.340*	-.480**	25	-61	185
	MG-PsyS	.352*	115	205	164	-179	-69	241	219	-.491**	-276	-275	-.458**	-.379*	-.390*	-.364*	-.343*	105	-297	144
	MG-EWB	-.323*	-276	.317*	-.405*	.338*	.322*	-.387*	-.325*	.566**	.333*	276	.508**	.399*	.383*	.412*	.595**	244	-297	-222
	MG-SS	-.459**	-.436**	-.362*	-.452**	.400*	.403*	.310*	-.363*	274	.475**	.384*	.331*	.320*	.393*	268	279	38	.337*	179
	ZBI	.398*	.523**	.350*	.416*	.417*	.341*	.363*	-.437*	-.578**	-.399*	-.583**	-.364*	-.335*	-.336*	-.328*	-.402*	-137	-147	261

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 7. Correlations between variables from ALS patients and caregivers

Analysis of longitudinal trends for psychological variables

Trends in longitudinal data have been analyzed with Friedman Test and Tukey multiple comparisons test as Post-hoc. All data indicate a significant increase of psychological distress, with a decreasing of QoL, for both ALS patients and their caregivers (see table 8 and figures 10-20).

In particular, from T1 to T3 (or whenever possible, T4) a significant increasing of STAI, BDI-II (with both subscales), MG-PhS and MG-PsyS was found in ALS patients. Conversely, MG-SIS, MGPhWB, MG-EWB, MG-SS and all ALSSQoL scores decreased.

Similar trends were found in caregivers' scores, with an increasing of STAI, BDI-II (with both subscales), MG-PsyS and ZBI. There was a decreasing in caregivers' scores at MG-SIS, MG-EWB, MG-SS and in all ALSSQoL-r subscales, with the exception of ALSSQoL-Rel.

Values at MG-PhWB and MG-PhS for caregivers group showed no statistical modifications during time.

Table 8. Medians values of longitudinal data

		TI	T2	T3	T4	Friedman's Chi-Square (df=3)	Sig.
ALS Patient	STAI	38,00	41,50	44,76		10,08	p<.01
	BDI-II	11,00	14,00	15,00		11,38	p<.01
	BDI-II-S	6,00	7,00	7,00		7,37	p<.05
	BDI-II-Psy	5,00	4,50	8,50		12,91	p<.01
	MG-SIS	6,50	6,00	5,50	5,00	7,73	p<.05
	MG-PhWB	7,00	5,00	5,00	5,00	8,17	p<.05
	MG-PhS	5,00	3,00	5,02	6,00	8,02	p<.05
	MG-PsyS	3,50	4,00	4,00	3,75	8,93	p<.05
	MG-EWB	7,58	7,25	7,19	7,33	8,23	p<.05
	MG-SS	8,50	7,75	7,37	5,50	9,96	p<.05
	ALSSQoL-r	6,04	5,36	5,35	5,22	7,98	p<.05
	ALSSQoL-NE	6,73	5,85	5,71	5,23	9,72	p<.05
	ALSSQoL-IPE	7,41	7,00	7,09	7,64	9,59	p<.05
	ALSSQoL-I	4,79	3,86	4,29	4,43	8,56	p<.05
	ALSSQoL-Rel	5,63	6,13	6,88	6,00	5,43	NS
	ALSSQoL-PhS	6,17	5,92	5,33	4,25	10,54	p<.05
	ALSSQoL-BS	7,00	6,20	5,90	3,10	10,83	p<.05
Caregivers	STAI	39,50	40,00	45,00	46,50	7,06	p<.05
	BDI-II	6,00	12,00	10,00	14,50	6,88	p<.05
	BDI-II-S	2,00	4,00	3,00	6,00	6,39	p<.05
	BDI-II-Psy	4,00	5,00	6,00	10,00	7,45	p<.05
	MG-SIS	6,00	6,00	5,00	3,00	8,37	p<.05
	MG-PhWB	1,00	5,00	4,50	4,50	6,36	NS
	MG-PhS	3,17	3,67	4,00	2,67	7,23	NS
	MG-PsyS	3,88	4,75	4,63	5,63	9,12	p<.05
	MG-EWB	7,00	6,50	6,25	5,17	8,25	p<.05
	MG-SS	6,50	7,50	6,75	5,75	8,74	p<.05
	ZBI	17,50	23,00	29,00	31	11,87	p<.01

STAI = State-Trait Anxiety Inventory - Trait form; BDI-II = Beck Depression Inventory-II; BDI-II-S = Beck Depression Inventory-II Somatic Subscale; BDI-II-Psy = Beck Depression Inventory-II Psychological Subscale; MG-SIS = McGill Quality of Life Questionnaire (MQoL) Single Item Scale; MG-PhWB = MQoL Physical Well-Being; MG-PhS = MQoL Physical Symptoms; MG-PsyS = MQoL Psychological Symptoms; MG-EWB = MQoL Existential Well-Being; MG-SS = MQoL Social Support; ALSSQoL-r = ALS Specific Quality of Life Questionnaire Revised; ALSSQoL-NE = ALSSQoL Negative Emotion; ALSSQoL-IPE = ALSSQoL Interaction with People & Environment; ALSSQoL-I = ALSSQoL Intimacy; ALSSQoL-Rel = ALSSQoL Religiosity; ALSSQoL-PhS = ALSSQoL Physical Symptoms; ALSSQoL-BS = ALSSQoL Bulbar Function; ZBI = Zarit Burden Inventory.

Figure 10. ALS Patients - STAI

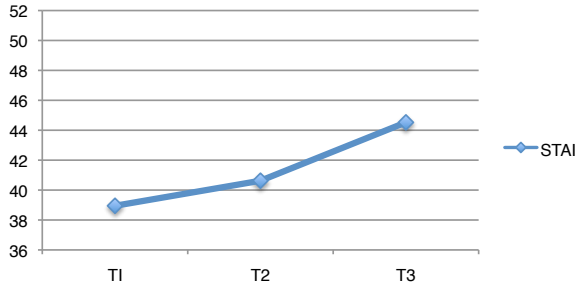


Figure 11. Caregivers - STAI

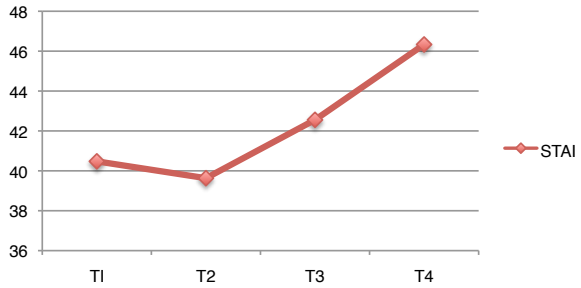


Figure 12. ALS Patients - BDI-II

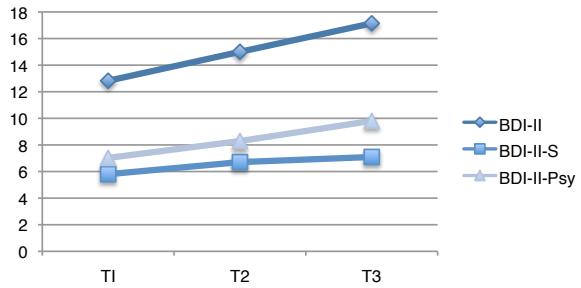


Figure 13. Caregivers - BDI-II

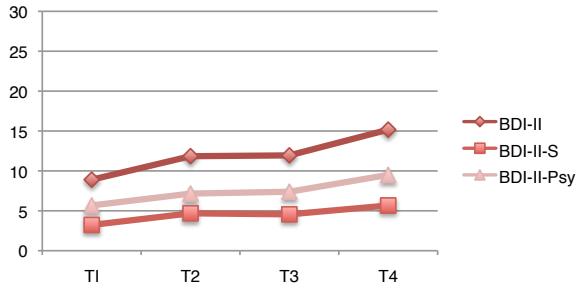


Figure 14. ALS Patients - MQoL (1)

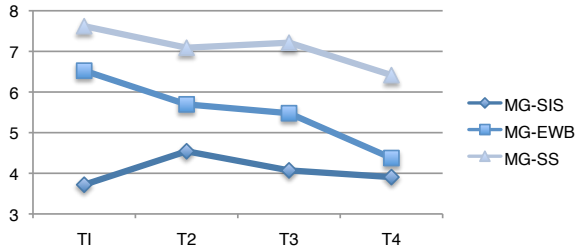


Figure 15. Caregivers - MQoL (1)

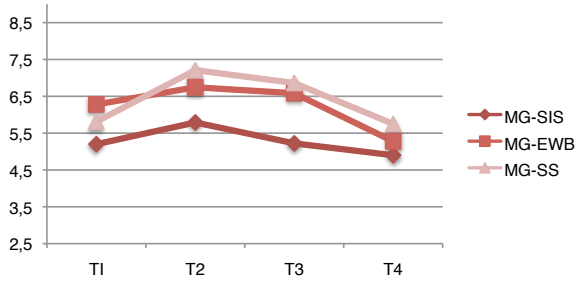


Figure 16. ALS Patients - MQoL (2)

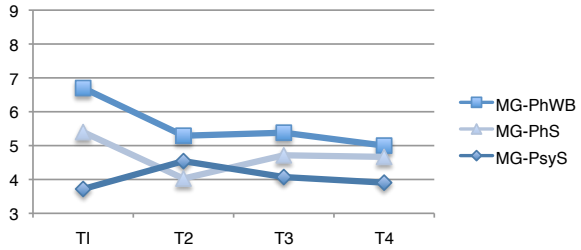


Figure 17. Caregivers - MQoL (2)

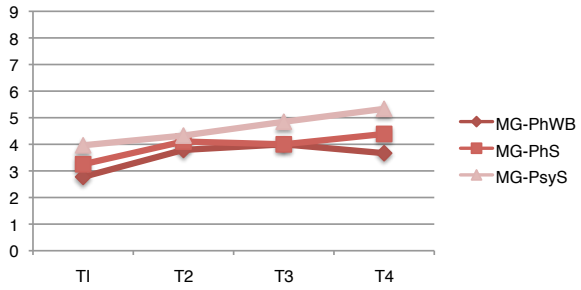


Figure 18. ALS Patients - ALSSQoL-r (1)

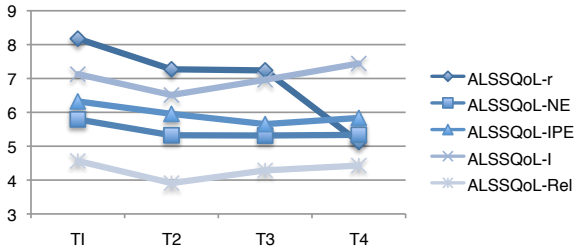


Figure 19. ALS Patients - ALSSQoL-r (2)

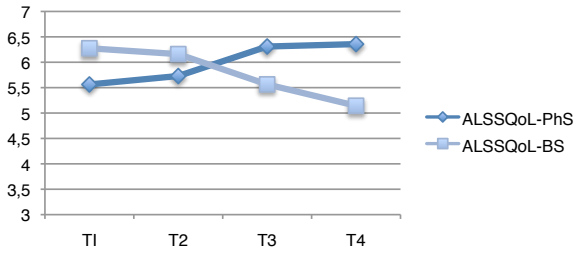
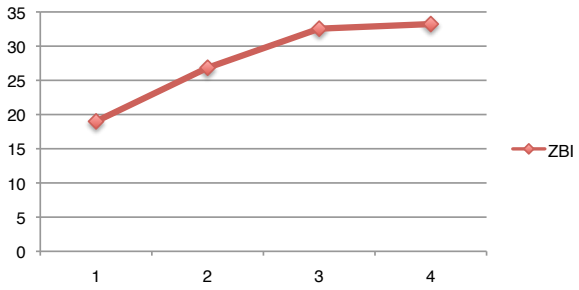


Figure 20. Caregivers - ZBI



Differences between ALS patients and caregivers with or without direct-care home assistance: cross-sectional differences

Comparing subjects' scores at T1, for both ALS patients and caregivers, with and without home assistance with Independent Samples T-test, no statistical differences between groups were found for any psychological variable, but ALSFRS-r were lower in patients with assistance.

In order to balance the influence of physical impairments among psychological variables, one-way ANCOVAs were conducted, with ALSFRS-r as covariate and psychological scores as dependent variables, comparing the two groups.

With the effect of ALSFRS-r adjusted, all patients' and caregivers' psychological scales and sub-scales were significantly different (see table 9). There were no significant differences in patients' physical subscales and in caregivers' MG-EWB.

Patients and caregivers with direct-care home assistance reported higher scores in QoL variables and lower in depression, anxiety and caregivers' values of burden were lower.

Table 9. Differences between subjects with or without home assistance at baseline

		Subjects WITHOUT assistance (n=25)		Subjects WITH assistance (n=15)		F test for ANCOVA Analysis (df=1, 39)	Sig.
		Mean*	SD*	Mean*	SD*		
ALS patients	STAI	40,84	9,36	35,10	10,54	4,51	p<.05
	BDI-II	13,45	6,80	11,05	5,26	4,23	p<.05
	BDI-II-S	6,15	4,26	5,20	3,98	5,62	p<.01
	BDI-II-Psy	7,31	5,81	5,84	5,31	6,71	p<.001
	MG-SIS	6,18	1,76	7,15	1,8	5,94	p<.01
	MG-PhWB	6,00	3,45	8,00	3,63	4,75	p<.05
	MG-PhS	5,22	2,12	5,23	2,2	1,76	NS
	MG-PsyS	3,77	1,98	3,66	2,59	6,32	p<.001
	MG-EWB	7,63	1,52	7,77	1,64	4,64	p<.05
	MG-SS	8,10	2,51	8,44	2,63	5,21	p<.05
	ALSSQoL-r	5,62	2,14	6,19	2,48	5,01	p<.05
	ALSSQoL-NE	6,10	2,68	6,81	2,74	4,11	p<.05
	ALSSQoL-IPE	6,77	2,70	7,72	1,76	4,65	p<.05
	ALSSQoL-I	4,72	1,17	4,44	1,11	5,58	p<.01
	ALSSQoL-Rel	5,37	2,07	6,04	2,37	5,72	p<.01
	ALSSQoL-PhS	6,24	2,42	6,34	2,18	3,12	NS
	ALSSQoL-BS	6,23	3,42	8,04	3,58	0,56	NS
Caregivers	STAI	40,324	11,48	39,75	12,83	5,25	p<.05
	BDI-II	8,0162	7,99	8,518	7,57	4,19	p<.05
	BDI-II-S	2,5909	2,31	3,677	2,01	4,67	p<.05
	BDI-II-Psy	5,4253	3,95	4,841	3,45	4,12	p<.05
	MG-SIS	5,2944	2,51	5,408	2,69	5,46	p<.01
	MG-PhWB	2,908	2,16	2,011	2,48	4,95	p<.05
	MG-PhS	3,07	1,77	3,42	3,01	2,34	NS
	MG-PsyS	4,03	1,95	3,352	1,71	4,29	p<.05
	MG-EWB	6,5124	2,65	5,985	2,47	6,62	p<.001
	MG-SS	5,6131	2,14	6,39	1,88	6,24	p<.001
	ZBI	18,37	16,08	16,53	14,36	6,98	p<.001

* means and standard deviations are weighted for ALSFRS-r scores

STAI = State-Trait Anxiety Inventory - Trait form; BDI-II = Beck Depression Inventory-II; BDI-II-S = Beck Depression Inventory-II Somatic Subscale; BDI-II-Psy = Beck Depression Inventory-II Psychological Subscale; MG-SIS = McGill Quality of Life Questionnaire (MQoL) Single Item Scale; MG-PhWB = MQoL Physical Well-Being; MG-PhS = MQoL Physical Symptoms; MG-PsyS = MQoL Psychological Symptoms; MG-EWB = MQoL Existential Well-Being; MG-SS = MQoL Social Support; ALSSQoL-r = ALS Specific Quality of Life Questionnaire Revised; ALSSQoL-NE = ALSSQoL Negative Emotion; ALSSQoL-IPE = ALSSQoL Interaction with People & Environment; ALSSQoL-I = ALSSQoL Intimacy; ALSSQoL-Rel = ALSSQoL Religiosity; ALSSQoL-PhS = ALSSQoL Physical Symptoms; ALSSQoL-BS = ALSSQoL Bulbar Function; ZBI = Zarit Burden Inventory.

Differences between ALS patients and caregivers with or without direct-care home assistance: longitudinal differences

Multiple Analysis of Co-Variance for Repeated Measures were used to examine the difference between subjects with or without home assistance during time. Group modification (subjects who accessed home assistance during study period) was considered, with database adjustments. Dependent variables were psychological outcomes of questionnaires. In order to control the influence of physical impairment (as previously reported), ALSFRS-r (assessed at T1) was used as a covariate for all analysis. Whenever Mauchly's test indicated that the assumption of sphericity had been violated, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity.

Results indicate (see table 10 and figures 21-48) that psychological well-being is higher in subjects (both patients and caregivers) with home care than is people without this assistance. All analyzed variables present significant differences between the two groups, with the exceptions of physical indicators, MG-PhS (both patients and caregivers groups), ALSSQoL-PhS and ALSSQoL-BS (only for patients group).

Table 10. Longitudinal differences between subjects with or without home assistance

		F test for MANCOVA Analysis	Sig.
ALS patients	STAI	4,91	p<.05
	BDI-II	3,94	p<.05
	BDI-II-S	1,29	NS
	BDI-II-Psy	2,94	p<.05
	MG-SIS	4,87	p<.01
	MG-PhWB	2,53	p<.05
	MG-PhS	1,00	NS
	MG-PsyS	5,85	p<.01
	MG-EWB	5,30	p<.01
	MG-SS	3,66	p<.05
	ALSSQoL-r	3,77	p<.05
	ALSSQoL-NE	4,94	p<.01
	ALSSQoL-IPE	4,79	p<.01
	ALSSQoL-I	4,31	p<.01
	ALSSQoL-Rel	6,22	p<.01
	ALSSQoL-PhS	1,14	NS
	ALSSQoL-BS	0,02	NS
Caregivers	STAI	6,56	p<.01
	BDI-II	5,03	p<.01
	BDI-II-S	4,52	p<.01
	BDI-II-Psy	7,34	p<.01
	MG-SIS	3,23	p<.05
	MG-PhWB	4,32	p<.05
	MG-PhS	2,25	p<.05
	MG-PsyS	3,34	p<.05
	MG-EWB	1,03	NS
	MG-SS	4,71	p<.01
	ZBI	9,53	p<.01

STAI = State-Trait Anxiety Inventory - Trait form; BDI-II = Beck Depression Inventory-II; BDI-II-S = Beck Depression Inventory-II Somatic Subscale; BDI-II-Psy = Beck Depression Inventory-II Psychological Subscale; MG-SIS = McGill Quality of Life Questionnaire (MQoL) Single Item Scale; MG-PhWB = MQoL Physical Well-Being; MG-PhS = MQoL Physical Symptoms; MG-PsyS = MQoL Psychological Symptoms; MG-EWB = MQoL Existential Well-Being; MG-SS = MQoL Social Support; ALSSQoL-r = ALS Specific Quality of Life Questionnaire Revised; ALSSQoL-NE = ALSSQoL Negative Emotion; ALSSQoL-IPE = ALSSQoL Interaction with People & Environment; ALSSQoL-I = ALSSQoL Intimacy; ALSSQoL-Rel = ALSSQoL Religiosity; ALSSQoL-PhS = ALSSQoL Physical Symptoms; ALSSQoL-BS = ALSSQoL Bulbar Function; ZBI = Zarit Burden Inventory.

Figure 21. ALS Patients - STAI

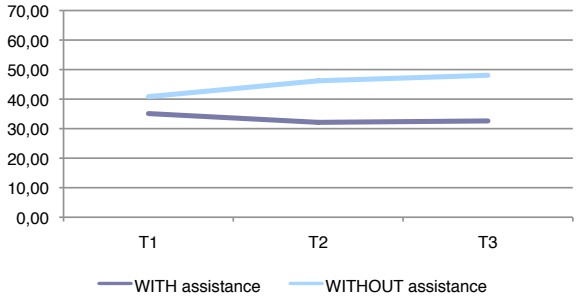


Figure 22. Caregivers - STAI

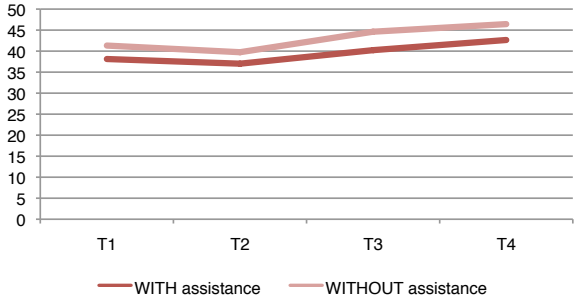


Figure 23. ALS Patients - BDI-II

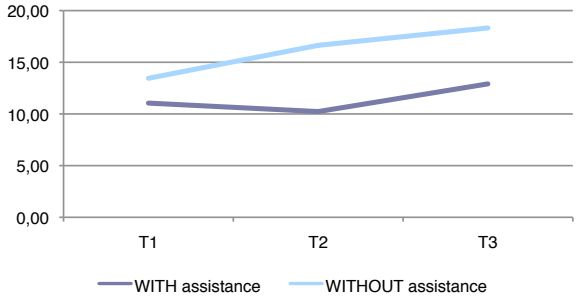


Figure 24. Caregivers - BDI-II

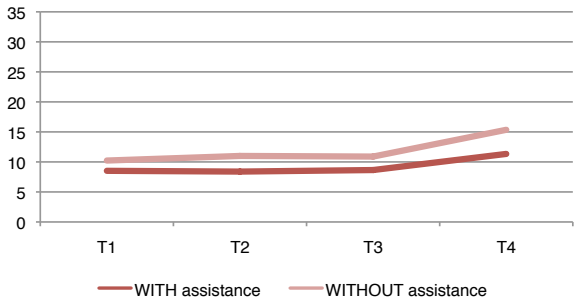


Figure 25. ALS Patients - BDI-II Somatic

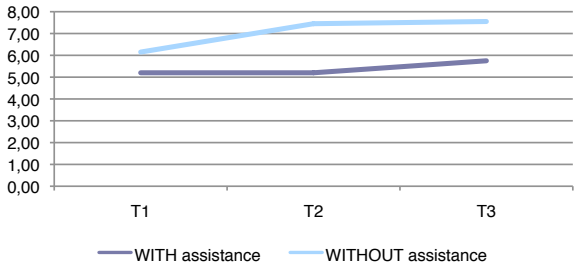


Figure 26. Caregivers - BDI-II Somatic

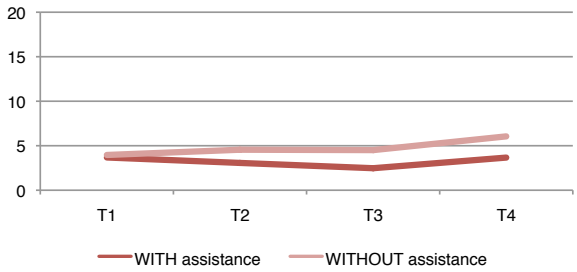


Figure 27. ALS Patients - BDI-II-Psy

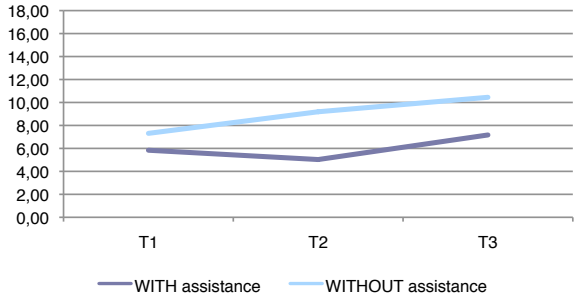


Figure 28. Caregivers - BDI-II-Psy

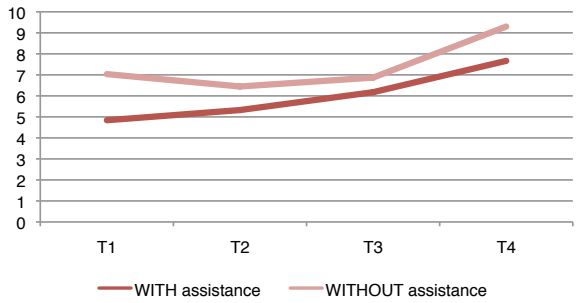


Figure 29. ALS Patients - MG-SIS

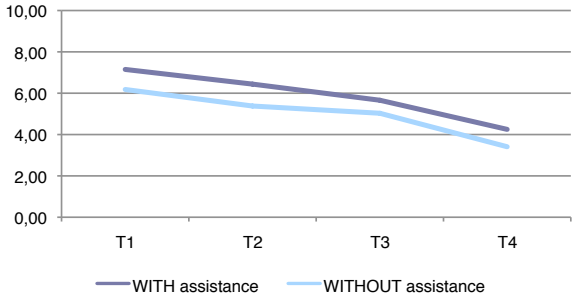


Figure 30. Caregivers - MG-SIS

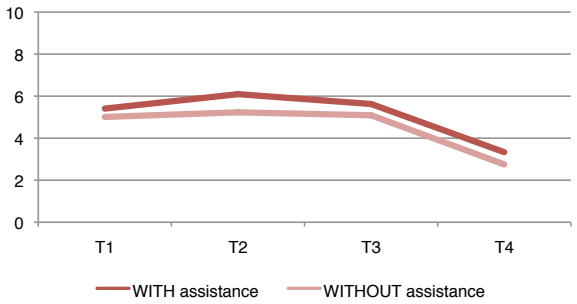


Figure 31. ALS Patients - MG-PhWB

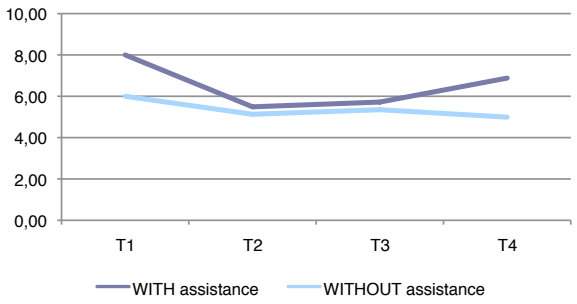


Figure 32. Caregivers - MG-PhWB

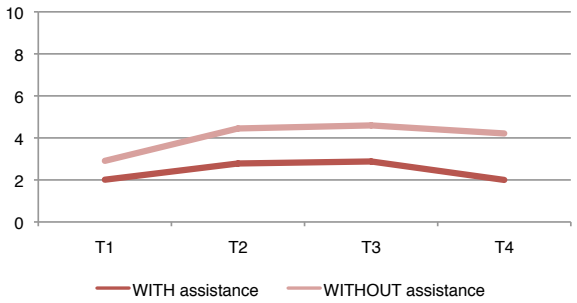


Figure 33. ALS Patients - MG-PhS

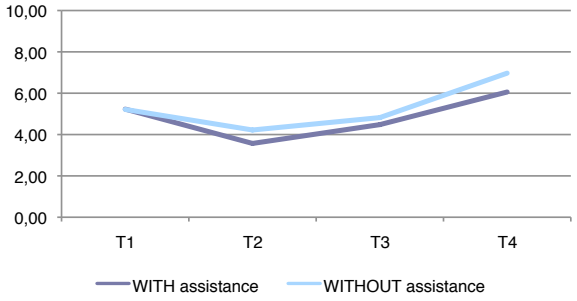


Figure 34. Caregivers - MG-PhS

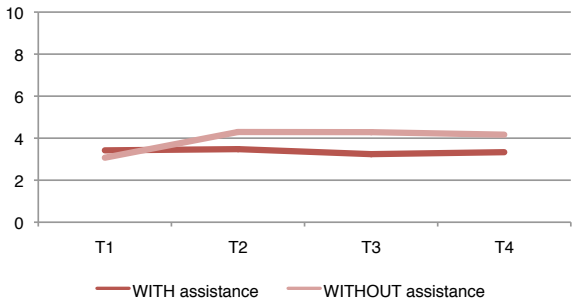


Figure 35. ALS Patients - MG-PsyS

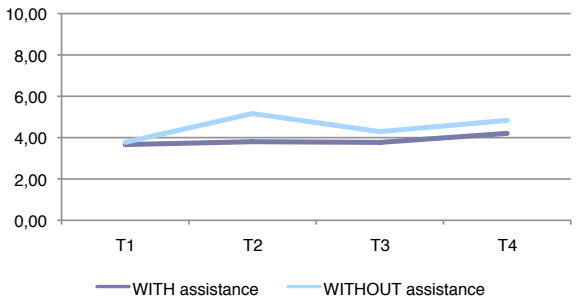


Figure 36. Caregivers - MG-PsyS

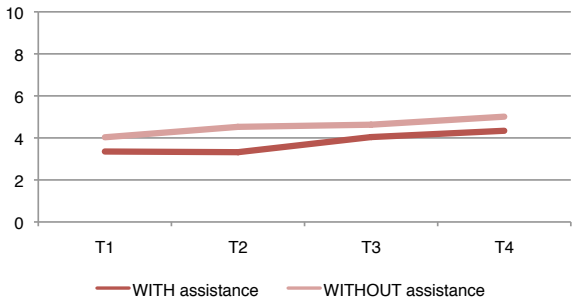


Figure 37. ALS Patients - MG-EWB

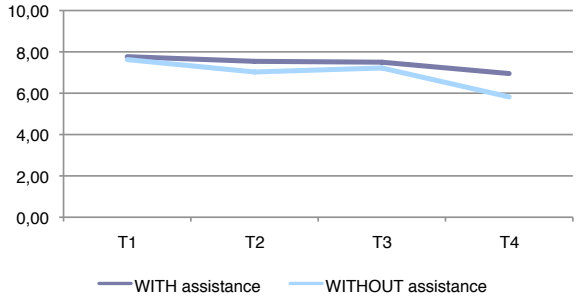


Figure 38. Caregivers - MG-EWB

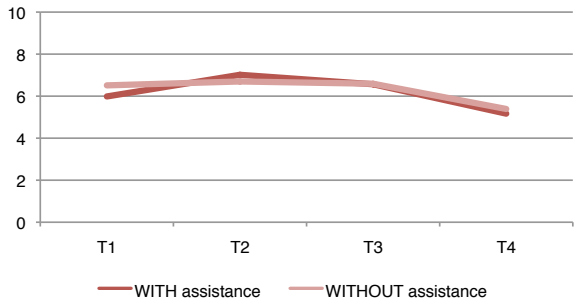


Figure 39. ALS Patients - MG-SS

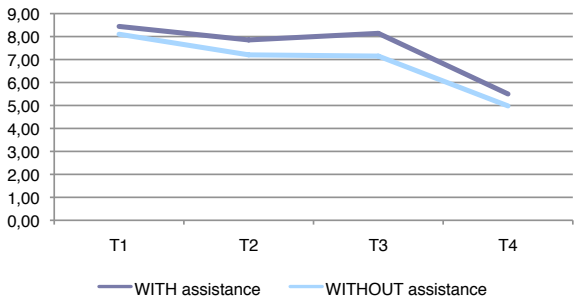


Figure 40. Caregivers - MG-SS

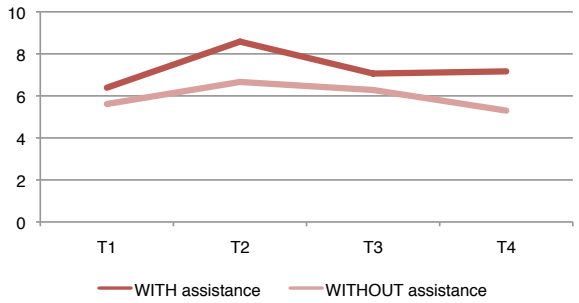


Figure 41. ALS Patients - ALSSQoL-r

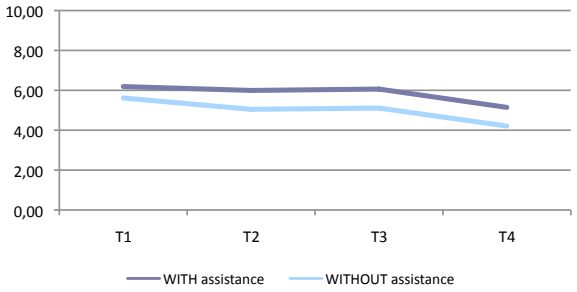


Figure 42. ALS Patients - ALSSQoL-NE

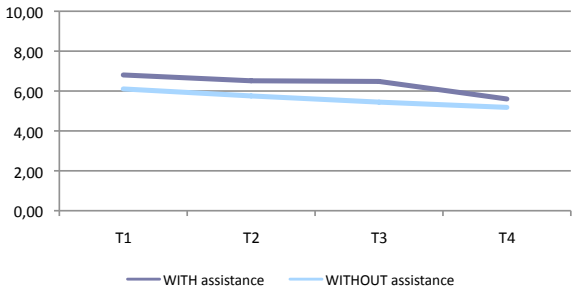


Figure 43. ALS Patients - ALSSQoL-IPE

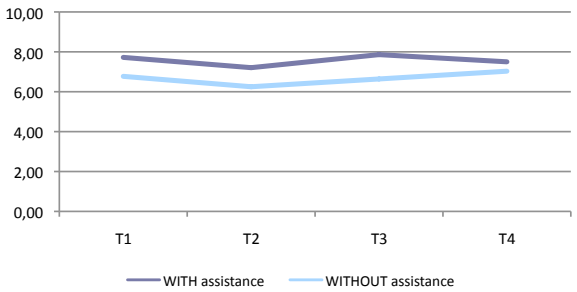


Figure 44. ALS Patients - ALSSQoL-I

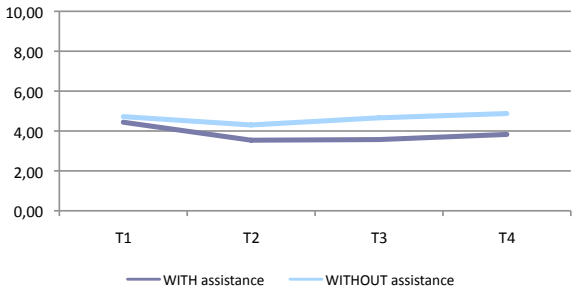


Figure 45. ALS Patients - ALSSQoL-Rel

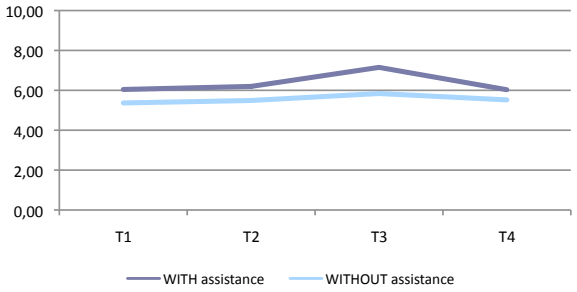


Figure 46. ALS Patients - ALSSQoL-PhS

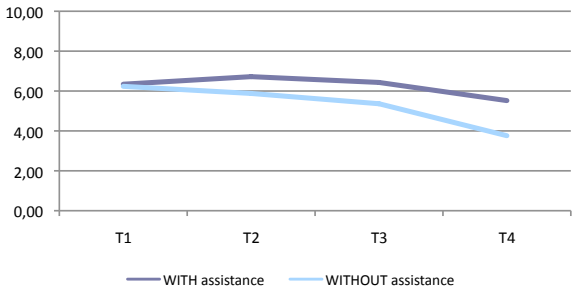


Figure 47. ALS Patients - ALSSQoL-BS

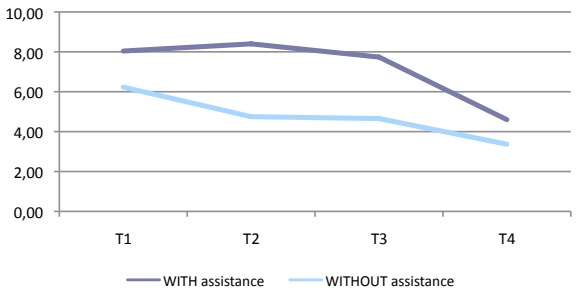
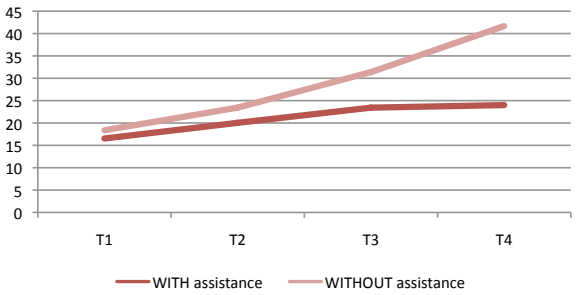


Figure 48. Caregivers - ZBI



Chapter 4 - Discussion and conclusions

In the present study, a longitudinal design was used to evaluate the impact of the presence of a direct-care home worker in ALS families on psychological well-being. The secondary aim was to address modifications of QoL and other psychological variables in ALS patients and their caregivers during time. Longitudinal data were collected over a period of one year.

For both ALS patients and caregivers, psychological variables with a “negative direction”, such as anxiety, depression, care burden, negative emotions and psychological symptoms, presented a significant positive correlation between them. Conversely, significant positive correlations were also located between variables with “positive direction”, such as QoL, existential well being, interaction with people, intimacy, religiosity, social support, physical well-being. Finally, variables with positive and negative meanings had a statistically negative relation between each other.

Comparing different assessment times, a tendency for psychological wellbeing to worsen is evidenced. Quality of life indicators, including anxiety and depression tend to get worst over time, for both patients and their caregivers.

The comparison between subjects with and without home assistance needed to be balanced with the medical condition. Subjects with assistance presented a more severe physical impairment, which in this sample, has a negative impact on QoL. With the impact of loss of functions weighted, the presence of a direct-care home worker have a positive effect among all psychological variables, for both patients and caregivers, reducing loss of QoL during time.

Nearly all psychological variables, from both patients and caregivers, were related with one another. Depression, anxiety, caregiver burden and QoL different indicators are related. Depression, anxiety and QoL are often related with each others (Rusli, Edimansyah, & Naing, 2008) and this is particularly true for hospitalized patients (Brenes, 2007; Brown, Kroenke, Theobald, Wu, & Tu) and for those who assist them (McCabe, Firth, & O'Connor, 2009). Furthermore, constructs of depression, anxiety and psychological well-being are “neighbor” and share similar traits. For example, some anxiety and depressive disorders have, as one of indicators, the loss of sleep or its poor quality (American Psychiatric Association, 1994). There is a wide literature indicating the influence of anxiety, depression and care burden among the overall QoL, in both ALS (Hecht, et al., 2003; Pagnini, Rossi, Lunetta, Banfi, Castelnuovo, et al., 2010) and other neurological diseases (Ho, Chan, Woo, Chong, & Sham, 2009).

ALS patient and caregiver’s perception of social support were positively related with QoL and negatively with burden experienced, anxiety and depression. This result suggests that the increase of social support is related to a reduction of psychological distress, confirming findings by Chio and colleagues (Chio, et al., 2004). Even if correlational studies cannot indicate any causal relation, these findings are consistent with other study on ALS caregivers indicating that levels of social support predict carer burden (Goldstein, Atkins, Landau, Brown, & Leigh, 2006b) and that carers feel the need of support from friends, voluntary and religious groups (Bolmsjo & Hermeren, 2001).

Theories of social support explain multiple mechanisms by which perceiving and receiving social support can benefit mental health. For example, the main effect model holds that involvement in caring relationships provides a generalized source of positive affect, self-worth, and belonging that keeps psychological despair at a minimum (S. Cohen, Gottlieb, & Underwood, 2000; S. Cohen & Wills, 1985). Positive affect de-

rived from social interaction such as feeling understood and cared for is a core component of emotional well-being (Lu, 1997).

Results indicate a strong relation between patient and caregiver's well-being. When patients feel better from a psychological point of view, their caregivers report higher levels of QoL. The concordance of QoL level between patients and caregivers is high. This reflects findings reported in studies of other couples coping with a chronic disease (Pakenham, Dadds, & Terry, 1995; Soskolne & Kaplan De-Nour, 1989) and suggests that attention to the mental health needs of caregivers may not only relieve their own distress but may alleviate the patient's distress as well. Perhaps observing the caregiver's burnout adds to the perception of being a burden on the part of the patient and thus exacerbates his or her own distress.

Correlational design doesn't allow causal inferences to be made. According to scientific literature (Lo Coco, et al., 2005; Roach, Averill, Segerstrom, & Kasarskis, 2009), it seems probable that well being of patient influences the one of the caregiver, and vice versa. However, QoL of both patients and caregivers are related with physical loss of functions and the progression of the disease seems to be independent by psychological characteristics (Hunter, Robinson, & Neilson, 1993). Therefore, this can be considered a causal relation.

People with ALS, when asked about the determinants of their own QoL, refer to the importance of "psychological and existential issues, social support, and spirituality" rather than physical function (Robbins, Simmons, Bremer, Walsh, & Fischer, 2001, p. 1939). A recent study (Roach, et al., 2009) found that individual differences, as well as idiosyncratic events were equally responsible for modifications of patient QoL. They suggest that characteristics such as personality, social relationships, and spirituality could be more important for QoL in ALS than the progression of the disease *per se*. Even if psychological and existential issues are surely very important for pa-

tient's well-being, the influence of physical impairment cannot be underestimated. As part of idiosyncratic differences, not all patients present the same level of resilience capacity (Rabkin, et al., 2000; Rutter, 1985). Therefore, even if some patients are able to maintain a high level of QoL, despite loss of physical functions, others may experience more difficulties in coping with illness, with a reduced psychological well-being. Results from the present study indicated that, in this sample, physical impairment has a significant impact on patient QoL. There are some outliers, that maintain a high QoL despite disease's progression but, from a statistical point of view, physical incapacitation has a negative impact among psychological well-being.

As reported, the correlation between ALS patient's physical impairments and his QoL has been investigated by few scientific studies and results are discordant. Instead, scientific literature reports more often that physical impairment of patients leads to significant decreases in QoL for caregivers, suggesting that ALS caregiving could result in decreased quality of life over time (Roach, et al., 2009). Furthermore, caregivers' levels of depression and anxiety are closely related to the degree of the patient's impairment (Bolmsjo & Hermern, 2003; Jenkinson, Fitzpatrick, Swash, & Peto, 2000). In this study, as well as in others (Chio, et al., 2005; Hecht, et al., 2003) there was a direct relationship between ALS caregiver burden and patient clinical impairment. As a consequence, caregivers' burden is likely to increase over time, paralleling disease progression.

Time progression of psychological variables, for both patients and caregivers, indicates a general worsening of QoL; anxiety, depression and burden increased during time. This is coherent with previously commented results: the increasing of physical impairment is related to a decrease of QoL, for both patients and caregivers. ALS is a progressive disease, with increasing loss of functions over time.

Patients often experience the awareness of functional impairments as a bereavement, provoking feelings of sorrow and suffering. Presented data enhance a trend for decreasing of QoL, with 4 months assessments. Considering the controversies that are reported in scientific literature, it is possible that QoL in ALS patients has a general tendency to get worst, but the progression may not be linear. Right after the arise of a new impairment, of bad news from physician, patients would come up against great strain, that can relatively decrease within days or weeks, with an adjustment to the disease over time . That can obtained with the use of denial (Moore, Moore, & Shaw, 1998) as well as optimism, flexibility, and humor as psychological defenses (Nelson, Trail, Van, Appel, & Lai, 2003), or a reduction of insight, related to patients' subtle cognitive impairment (Ringholz, et al., 2005; Wheaton, et al., 2007).

During time, patients could develop coping strategies for a quicker acceptance. That would be coherent with data in this study, because QoL decreasing is lower in late stages (T3 and T4) than first assessments (T1 and T2). Further investigations are required in order to verify the hypothesis of a non linear reduction of well being in ALS patients, maybe using reduced latency time between assessments, or with methodologies such as Ecological Momentary Assessments (Shiffman, Stone, & Hufford, 2008).

The same trend of QoL reduction was found in caregivers. Moreover, decreasing was higher and total scores were lower than ALS patients. With the exception of BDI-II scores, carers indicated a minor level of well-being. As already found by other works,

It is probable that, over time, caregivers were required to perform more physical tasks, such as transferring the patient from the bed to the wheelchair, retrieving items that the patient needed or could no longer access from remote areas of the house, or transporting respiratory-assistance or augmentative communication devices. All these tasks took a toll on their energy, leading them to report decreased QoL related

to their health, in particular for physical health. In fact, nearly 50% of European ALS caregivers score below the population norms on measures of physical health (Mockford, Jenkinson, & Fitzpatrick, 2006).

Perceived social support, another variable that appears to have substantial benefits for the mental health of those coping with ALS, decreases over time in both groups. ALS patients often experience social retreat, related to a sort of shame about their disability, because sometimes they do not want to be seen by friends and even relatives in their physical conditions. Conversely, some people are afraid to see a friend that they remember as powerful and healthy. In similar situations, social support is provided solely by immediate family and close friends. Also caregivers experience social retreat, because of the time needed to assist the patient and to respect his or her willingness to remain apart. Furthermore, sometimes caregivers are viewed by their social network as care providers more than they are people in need of care and support, as it happen in other severe diseases, like cancer (Northouse, Templin, Mood, & Oberst, 1998). Considering the importance of social support towards psychological well-being, its reduction is likely to have a negative effect on QoL. However, the similar decreasing trend of social support and QoL could be mainly referred to loss of functions. The interaction with social support, psychological well being and physical impairment should be further explored, maybe through qualitative methods, with a deep investigation of social retirement's reasons.

ALS families use to seek a direct-care home worker when patient's functional impairment begin to be severe. For this reason, a direct comparison of psychological variables between subjects with or without home assistance would have reported a great bias, considering the influence of functional deprivation among QoL. Considering and weighting physical impairments, the presence of this kind of assistance sig-

nificantly reduces the worsening of psychological well-being, for both patients and caregivers.

There could be many possible reasons, that are not necessarily mutually exclusive, for the improvement of QoL of ALS patients with a direct-care home assistant. The chance to receive help for activities of daily living, not only given by close relatives, is a protective factors for ALS patients' QoL. Basic patients' need, such as bathing, eating and dressing can be satisfied by care worker, with a minor engagement of family caregivers. Patients can therefore feel more free to ask for assistance with those needs.

Moreover, the feeling of "being a burden" for their caregivers (Chio, et al., 2005) is one of the most distressing experience for patients (Ganzini, et al., 2002). With an external figure, who's job is to assist the patient, this perception of being a load for their carers can be really reduced and this is reflected by greater scores on QoL indicators.

Daily contact between ALS patients and personal care attendants, with the relationships that is developed, often leads to an emotional engagement, were carers became a source of social support.

Caregivers gain benefit from the presence of home carers, as well as patients. Sometimes people must reduce or even renounce to their work activity, in order to assist their relatives. This could be a source of severe stress, because caregivers who need to abandon their works are forced to modify their identity, usually with a decreasing of satisfaction and QoL (Gillies & Johnston, 2004). Furthermore, the reduction or the loss of the job often causes worries for economical issues (Steen, Berg, Buskens, Lindeman, & Berg, 2009). This is because the assistance of ALS patients could require a constant physical presence of the carer. This role can be held by a direct-care home assistant, who allows the caregiver to freely decide how to use

their time, instead of being forced to stay near their relative. Without this constriction, carers can dedicate more time to their work, reducing economical issues, or just for themselves. Considering that housekeeping, feeding, and toileting are the most time-consuming duties (Chio, et al., 2006) and are tasks for direct-care home assistance, caregivers' free time would really increase. With the awareness that caring is not all above their shoulders, caregivers may feel more free to return to activities that they had abandoned. The possibility of a choice can really improve their well-being. Furthermore, the presence of another person who helps with care strongly reduce the feeling of loneliness that many caregivers experience (Levine, 1999).

There is a complete lack of scientific literature about the impact of direct-care home assistance in ALS. This is one of the first attempt to analyze the effects of the presence of a home assistant on psychological well-being of ALS patients and their caregivers. Considering results of the present work, further studies are warranted, in order to determine how to improve the positive impact of home care. In particular, present study does not define what kind of home assistance produce greatest benefits. The impact of home assistant's preparation and the duration of home care should be investigated too. Furthermore, there is no consensus, yet, on QoL modification through time for ALS patients. The hypothesis of a non-linear decreasing needs to be verified in other longitudinal researches. Further studies within this field are therefore required.

Limitations

These results should be interpreted with caution as the study has a number of limitations. The sample sizes were small, but it was in line with other single-center studies of ALS population (Goldstein, et al., 2006b; Rabkin, et al., 2000). There is a potential concern over sample attrition, although similar attrition rate has been reported in

other studies (Goldstein, et al., 2006a; Johnston, et al., 1999). In particular, data from T4, considering the number of remained subject, must be considered carefully, even if these data are coherent with trends indicated by previous assessment.

Study included only ALS patient-caregiver couples, in order to investigate psychological issues from both categories. However, this is a limitation for the generalization of the work, because ALS patients who are completely alone were not included.

The assessment of depressive and anxious symptoms were carried out with standardized instruments, widely used in ALS literature (Bromberg, 2007). However, there could be limits related to the lack of standardization within this field. For example, depression, especially somatic sub-score, may be over-emphasized because of illness-related physical symptoms.

A final limitation can be related to the institution that hosted the research. Recruited subjects may have represented a restricted range of ALS population, because they were receiving multidisciplinary care, which has been shown to have a positive impact on QoL (Van den Berg, et al., 2005).

Conclusions

Confirming previous studies' findings, this work indicates that ALS has a huge effect on QoL, for both people with the disease and their closer caregivers. As far as disease progresses, psychological well-being decreases and, conversely, depression and anxiety increase for both ALS patients and their caregivers. Caregivers experience an augment of burden, during time. These effects on QoL could be related to the worsening of physical symptoms.

The presence of a direct-care home assistant has a positive effect on patients and caregivers QoL and psychological well-being, also reducing depression, anxiety and burden.

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