TREBALL DE FINAL DE GRAU

NURSING ASSESSMENT OF DIFFERENTIAL NEEDS AND THEIR CORRELATES ACROSS NEUROIMAGING-BASED DEPRESSION SUBTYPES

Research project

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“Not all those who wander are lost.”

— J.R.R. Tolkien

AGRAÏMENTS

Aquest projecte mostra el meu esforç, disciplina i treball que he realitzat en molt de temps. No ha sigut exclusivament un treball de final de grau. L'entenc més com un treball de vida, ja que va començar fa anys, i la constància durant aquest temps és la que ha determinat el resultat final d'un treball escrit originalment essent una part de mi.

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ABSTRACT

Introduction: Depression is one of the most prevalent and incident mental disorders worldwide. Its heterogeneity complicates both diagnosis and treatment approach difficult. Recently, neuroimaging has allowed the identification of differentiated brain patterns based on anatomical structures and physiological functions, which suggests the existence of subtypes of depression, opening new doors for a more precise classification of the disorder and for treatment selection.

In this context, psychoradiology emerges as a field that merges psychiatry and radiology to study these neurobiological differences. This project explores how, from a nursing perspective, through a structured evaluation using Gordon's functional health patterns, it might be possible to identify specific needs according to depression subtype. This could contribute to the development of more effective and focused nursing interventions, promoting person-centred and evidence-based care, moving away from the current generalist paradigm in depressive disorders.

Objectives: To identify whether there are distinguishable specific needs among depression subtypes through nursing assessment based on Gordon’s patterns. To explore the relationship between the needs and the neurobiological patterns observed in neuroimaging, which could be used as a starting point to propose specific nursing interventions.

Methodology: Quantitative, observational, and cross-sectional study, not completed. The estimated sample will consist of 370 participants diagnosed with major depressive disorder, according to DSM-5-TR criteria.

Participants will be asked to complete several questionnaires. First, a sociodemographic questionnaire. Then, the FHPAST (Functional Health Pattern Assessment Screening Tool), which evaluates the needs based on the 11 functional health patterns by Gordon. Finally, the PHQ-9 will be used to assess the severity of depressive symptomatology. Functional and structural neuroimaging data will also be collected. This information will allow the classification of participants into four subtypes of depression, based on neurobiological patterns.

The data will be analysed using descriptive statistics to identify significant associations between depression subtypes and detected needs. Bivariate analysis will also be conducted to study significant relationships between variables.

Keywords: depression, psychoradiology, neuroimaging, Gordon’s patterns, nursing needs, nursing interventions, depression subtypes, functional magnetic resonance imaging.

RESUM

Introducció: La depressió és un dels trastorns mentals més prevalents arreu del món i amb més incidència. La seva heterogeneïtat complica tant el diagnòstic com el seu abordatge. En els últims anys, la neuroimatge ha permès identificar patrons cerebrals diferenciats, basats en estructures anatòmiques i funcions fisiològiques, que donen a entendre l'existència de subtipus de depressió, obrint noves portes per a una classificació més precisa tant de la malaltia com per l'elecció del tractament.

En aquest context, la psicoradiologia apareix com una branca que combina la psiquiatria i la radiologia per estudiar aquestes diferències neurobiològiques. Aquest projecte planteja com des de l'àmbit de la infermeria, a través l'avaluació estructurada utilitzant els patrons funcionals de Gordon, es podrien identificar necessitats específiques segons el subtipus de depressió. Això podria facilitar el desenvolupament d'intervencions infermeres més eficaces i focalitzades, amb una atenció centrada en la persona i basada en l'evidència, i allunyar-se del paradigma actual de la generalització dels trastorns depressius.

Objectius: Identificar si existeixen necessitats específiques diferenciables entre els subtipus de depressió, a través de l'avaluació infermera basada en els patrons de Gordon. Explorar la relació entre les necessitats i els patrons neurobiològics observats en neuroimatge, i que es podrien utilitzar com a punt de partida per proposar intervencions infermeres específiques.

Metodologia: Estudi quantitatiu, observacional i transversal, no finalitzat. La mostra estimada serà de 370 participants i estarà composta per persones diagnosticades de trastorn depressiu segons els criteris DSM-5-TR.

Els participants hauran de respondre diversos qüestionaris. Primerament, un qüestionari sociodemogràfic. Seguidament, el FHPAST (Functional Health Pattern Assessment Screening Tool), que avalua les necessitats segons els 11 patrons funcionals de Gordon. Finalment, el PHQ-9, utilitzat per valorar la gravetat de la simptomatologia depressiva. També es recollirà informació a través de proves de neuroimatge funcional i estructural. Aquesta informació permetrà classificar els participants entre quatre subtipus de depressió, segons els patrons neurobiològics.

Les dades seran analitzades mitjançant estadística descriptiva per a identificar associacions significatives entre el subtipus de depressió i les necessitats detectades. Paral·lelament, es farà una anàlisi bivariant per estudiar relacions significatives entre variables.

Paraules clau: depressió, psicoradiologia, neuroimatge, patrons de Gordon, necessitats infermeres, intervencions infermeres, subtipus de depressió, ressonància magnètica funcional.

INTRODUCTION

Major depressive disorder is one of the most common mental health conditions worldwide. It affects more than 280 million people globally, which represents a great and leading cause of disability, disease, and even death.

Depression does not exclusively involve emotional suffering, as it can be apparent. This kind of disorder has an impact on sleep hygiene, appetite, concentration, human relations, overall health, and even physical symptoms.

It is frequently undiagnosed due to the lack of clear and homogeneous symptomatology to be diagnosed. Patients usually present somatic or nonspecific conditions that lead health care professionals to focus on secondary problems, and not the actual primary cause.

Advances in pharmacological and psychotherapeutic treatments have brought innovative lines of addressing depressive disorders, apart from the classical approach. However, many patients do not respond to first-line interventions, causing long waiting lists in mental health care, and translating into worsening of patients' condition.

This suggests that depression may not be a single, homogeneous and generalised disorder, but rather a heterogeneous group of conditions and syndromes with different causes, biological and social bases, which present different clinical and different personal needs to one another.

In this context, psychoradiology, an emerging field of neuroimaging, has gained exponential interest as a tool to understand the nature of depressive disorders and other mental disorders, as well as a base to study the structure and function of the different cerebral areas, regions, and structures.

The most recent studies in the field of psychoradiology have shown that different patterns of brain activity or volume changes in specific brain areas may help identify meaningful information.

These findings could revolutionise the area of psychiatry, especially for those cases of resistant depression, unspecific symptomatology, and even the possibility of understanding mental disorders as different subgroups, with different needs and treatment possibilities.

However, these findings have not yet been integrated into clinical practice, in particular in nursing care. Neuroimaging provides objective biological data, while nurses are still used to assess how depression affects the daily life of individuals.

Through Gordon’s Functional Health Patterns, we can offer a structured method to evaluate any possible need from a holistic perspective.

Connecting neuroimaging-based depression subtypes with Gordon’s functional patterns opens a wide door to a more personalised, individualistic, and interdisciplinary approach.

Combining both biological data and psychosocial information, perhaps health care professionals will be able to reduce the depression incidence and prevalence, along with improving the health and life conditions of individuals who suffer from depression.

Personally, this seems essential to me. Unfortunately, I am closely in touch with relatives, friends, and loved ones who were diagnosed with depression. They either were not diagnosed for a long period of time, or their first intervention and treatment did not result in effectiveness.

New technologies and medical fields offer the chance to help all those people who do not yet understand what they are going through, are misjudged, criticised, or feel helpless. This project intends to make more visible the urge to properly address mental disorders, while making an attempt to empower nurses to actively participate in the process of diagnosing and addressing depression from a holistic view.

Additionally, from a very young age, I have encountered quite an interesting, even hypnotising, field of diagnosis through images. The possibility that offers to immerse in a living human body, traveling across any imaginable structure while participating in someone's health process, feels just great.

If only my work could make one person’s life better, I would be completely satisfied. Better if it could help more and more people to improve their health, the way health care professionals address patients in one of the most critical moments of life. Even if it can be used to divulge the potential of psychoradiology and the implication of nurses in mental health, I would be thankful for the chance I have been given.

For all these, this project aims to introduce psychoradiology into the field of nursing, while giving nurses an open wide variety of tools to use in mental health care facilities to provide appropriate and accurate health assistance.

1. FRAMEWORK

1.1. DEPRESSION

It is widely known that mental health disorders are affecting more and more people. It does not exclusively disturb the feelings and resting state of the person, but extends to every aspect and dimension of their lives.

1.1.1. Epidemiology of depression

Depression is a public health problem of great relevance. It is estimated that its prevalence and incidence reach 280 million people abroad, which represents 5% of the adults. Its relation is 2:1, more frequent in women than in men (1).

Risk factors are not yet clear, however familiar history of depression is linked to higher chances, added to neurobiological alterations, psychosocial effects, and comorbidities of chronic diseases or mental disorders (2,3).

Unfortunately, it contributes greatly to suicide, either attempt or commitment, which makes understandable the staggering number of 700.000 suicides per year (1). It also causes an important economic impact, not only to the very own person, but also to the public health system.

1.1.2. Biopsychosocial perspective of depression

Particularly, the prevalence of depression is increasing at an alarming rate, interfering with people's routines, social networks, emotions, coping abilities, and many other aspects. Hence, it should not be considered an uncomplicated health problem, for it can completely disable a person, causing individuals to isolate themselves from society, falling deeper into one's struggles (4).

Behavioural patterns have been the main aim of the diagnostic and treatment process of depressive disorders, specifically identifying those that apparently most people with Major Depressive Disorder (MDD) have.

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR), at least five simultaneous irregular patterns must be exhibited by an individual, at least for two weeks, to be considered a possible depressive disorder. Exemplifications are insomnia/hypersomnia, emptiness feeling/hopelessness, death-related thoughts, loss or gain of weight without a willingness or a diet, and finally, heavy fatigue (5).

It seems evident that these alterations can and will affect oneself lifestyle, hindering the normal functionality, in both social and personal matters. Hence, those patterns must include not only functional abnormalities but also a biopsychosocial perspective of depression. There is also the belief that there should be a biological organic

viewpoint. Consequently, an integrative biopsychosocial approach seems much more logical.

Thus, nurses' role within MDD is relatively undefined, and more specifications could help nurses to address properly mental health disorders. A complete image of the person, not only behavioural patterns, and a holistic approach from nurses can help patients by offering solutions to other problems that modern medicine does not comprise.

Current approaches barely cover any other aspect that is not psychiatric, especially antidepressants. However, the person can still suffer from isolation, anxiety, social distancing, and other conditions that represent the complete image of depression.

The biopsychosocial perspective aims to integrate both biomedical and psychosocial visions within a systemic approach, providing newer methodologies for depression treatment. Unfortunately, there have not been many scientific studies trying to demonstrate its effectiveness. Therefore, further investigation in this line would bring a new perspective on how to approach mental disorders (6).

Anyways, future research could apport more information and evidence on this topic, perhaps giving nurses the chance to actively participate in mental health disorders.

Specifically focusing on each dimension, biologically speaking, depression causes neurochemical alterations, stronger in dopamine and serotonin. There are multiple physiological processes involved in depression, such as the Hypothalamic-Pituitary-Adrenal Axis (HPA Axis), cortisol and corticosteroids release, and more.

Lack of regular levels of neuronal hormones creates negative feedback loops in brain activity. Therefore, mood is dysregulated, forcing the person to enter a spiral of self-negative consciousness, worsening the hormonal segregation.

These alterations begin to affect the psychological dimension. Psychologically speaking, the impact is tremendously vital. Emotions, thoughts, and conducts are altered by depressive disorders, causing the individual to feel lost, not knowing how to react to their own discomfort, this concluding to a deterioration of the disorder.

Cognitive distortions such as pessimism or rumination tend to bind the person to hopelessness and sadness, amplifying the adversities and staying focused on the negative. Thence, it is equally essential to treat psychological discomfort with therapy and use antidepressants for the biological symptoms.

Depressive disorders are shackled to negative emotions. Deprivation of basal emotions intensifies the individual's unease. When exposed prolongedly, the emotional impact can evolve to anhedonia, the incapacity of feeling any gratification

or pleasure. For this reason, emotion management with cognitive-behavioural therapy can help people taking awareness of their emotions, identify them, and reduce the anxiety caused by them (7).

Strongly related to the segregation of cortisol, psychological discomfort can lead to chronic anxiety, for unease increases cortisol hormone liberation, which at the same time produces a physiological response in the body of an increase in nervousness. Once again, a loop that involves not only biological facts but also psychological ones.

The social dimension is highlighted within depression because of the influence of social factors, maintenance of the disorder, and personal well-being. A strong and functional supportive social network is key when affronting a depressive disorder, as well as social interaction and cultural context. Social isolation and loneliness are facts that promote the chronicity of depressive disorders and worsening of the negative symptoms (8).

Social isolation might be one of the most relevant items to take into consideration in a depressive disorder. People who live alone or lack a solid social network have a higher risk of developing depressive disorders and suffering from heavier symptoms.

Solitude also affects emotional well-being and is strictly and directly linked to organic problems such as cardiovascular diseases, hypertension, mental health disorders, and more. Therefore, it is decisive to address this topic professionally and with a holistic view, spotting each item that can be intervened in.

With bare hesitation, we can tell that social support is the most important protective factor against depressive disorders. Being around relatives, loved ones, even sharing experiences with strangers, can help reduce the sensation of desperation. Furthermore, it brings feelings of belonging and emotional security (4).

Social support is one of the best ways to prevent depression, and even easing the symptoms, mitigating the discomfort, thus stabilising the biological and physiological aspects, giving a sensation of wellbeing.

Familiar and cultural approaches should also be taken into consideration, for they significantly influence how a person reacts to depression. Familiar dynamics, a whole social image of the person, and how the person’s culture stigmatizes mental health, can help health care professionals personalize interventions to adjust how to address the depression treatment (4).

Social responses to psychological and psychiatric matters are robustly connected to how someone will respond to a depressive disorder, the severity of symptoms, and psychological and biological dimension abnormalities. Hence, a complete exam of the

social dimension of the individual can bring quite useful information and data on how to handle the personal situation individually.

Nursing interventions are indispensable to achieving a biopsychosocial approach. Nurses have the ability to address each dimension properly, providing complete care for patients' health issues. We should not consider each dimension separately, as they directly affect one another, altering the outcomes and expectations. However, for purposes and to clear up aspects, nurses have different interventions for each dimension.

On the biological dimension, interventions target the mechanisms underlying depression, neurochemical imbalances, hormonal dysregulation, and biological abnormalities.

In particular, education on pharmacological treatment, explaining to patients the importance of proper adherence to prescribed treatment, side effects, and so on. Promoting healthy habits is one of the most crucial features. Physical activity and sleep hygiene enhance neuroplasticity, reducing hormonal dysregulation and regulating neurotransmitters such as dopamine and serotonin, and even reducing inflammation associated with depression (6).

On the other hand, the psychological dimension addresses thought patterns, negative emotions, and emotional regulation strategies. Cognitive Behavioural Therapy, emotional support, and validation are techniques aimed at helping patients identify and modify negative thoughts and cognitive distortions, actively listening to them, validating their emotions, and providing a safe space (9).

Identifying negative emotions is not the whole process, but it ends with redirecting emotions to self-compassion and constructive techniques. Assisting patients in developing a compassionate attitude toward themselves, incorporating activities they fancy, promoting and reinforcing positive abilities.

Lastly, on the social dimension, nurses' strategies require strengthening support networks, promoting social integration, and reducing isolation. Support groups where patients can share experiences with one another and learn from others facilitate the identification of negative patterns, giving the chance to work on those specific aspects (7).

Family interventions and the reduction of stigma go hand in hand. Involving family members in the therapeutic process, specifically by educating and teaching them how to provide effective support and how depression affects and influences family dynamics that stigmatize depression and the patient (4,7).

Organizing educational campaigns to reduce social stigma associated with mental health disorders, and encouraging positive social interactions can provide patients safer feelings of belonging, creating opportunities to participate locally, improving the outcomes, and acquiring the newest methodologies to face depression.

The evolution of new technologies has revolutionized social interactions, offering healthcare professionals opportunities for innovative interventions. On one hand, digital platforms and tools of telemedicine, online therapy and educational applications, and videos have made mental health resources more accessible for those individuals with poorer opportunities, and more visible for those people to whom mental health is unknown. These technologies allow patients and professionals to monitor symptoms, access educational content, and even perform online sessions.

On the other hand, new technologies imply new risks. The availability of information has led to misinformation, creating the wrong idea of mental health or even romanticizing disorders. Non-professional individuals often speak from their own experience, and loads of young people usually tend to address social media to access information. This leads to potential harm in those seeking accurate and actual guidance (10).

Moreover, the digital world has become a new channel for cyberbullying, online harassment, and social comparison. People experiencing depression are particularly vulnerable to the negative effects of these interactions, which can worsen the current personal situation, increasing feelings of isolation or worthlessness. Plus, the option to remain anonymous on those platforms creates toxic environments that may deepen the personal situation, forcing the person to struggle even harder.

Thus, even though technology opens doors for innovative interventions for healthcare professionals, it is important to use it wisely and with caution.

1.1.3. Gordon’s Functional Health Patterns

One nursing assessment tool in mental health, and the most used, are Gordon’s Functional Health Patterns. Developed by Marjory Gordon (11) in 1987, they provide a comprehensive framework for assessing patients’ overall health status. They consist of 11 patterns, covering social, biological, and psychological dimensions of health. They allow nurses to gather information in a systematic approach, identifying either actual or potential health issues.

Basically, each pattern represents a specific area of human functionality. Throughout structured questions and observations, nurses can assess and decide how to address the specific area affected. Patterns are listed below:

1. Health Perception and Health Management
2. Nutrition and Metabolism
3. Elimination
4. Activity and Exercise
5. Sleep and Rest
6. Cognition and Perception
7. Self-perception and Self-Concept
8. Role Relationship
9. Sexuality and Reproduction
10. Coping-Stress Tolerance
11. Values and Beliefs

Their importance relies on facilitating the identification of actual problems and potential issues, giving nurses the chance to prevent the emergence of any disability, disease, or other issues. By addressing each health pattern, nurses can ensure that all aspects are considered, leading to more efficient, effective, and individualized strategies (12,13).

Therefore, nurses play a vital role in implementing the biopsychosocial model in the treatment of depression. Specific interventions addressing the three dimensions can tackle the multifaceted disorder and promote a complete understanding, not only for the patients but also for healthcare professionals.

Integration of innovative strategies, such as new technologies, enhances the positive impact of nursing care. Cooperation with families and communities strengthens the support for people with mental disorders, providing new possibilities to tackle their situation.

1.2. INTRODUCTION TO PYSCHORADIOLOGY

Said the importance of promoting and granting a biopsychosocial approach to mental health disorders, principally depression, there is some information that must be considered beforehand.

Some studies addressing and treating depressive disorders focus mainly on the psychological dimension, and great attention is given to the social one. It is acceptable to say that these could be the most distressing aspects for patients, as they directly affect their emotional and interpersonal functioning. Consequently, it is understandable that nurses are involved in addressing the psychological and social dimensions (14,15).

Most nursing interventions in depressive disorders aim to alleviate this discomfort. These interventions help manage the main symptoms of depression, such as hopelessness, desperation, isolation, and sadness. Moreover, they can address the psychological origins of the disorder, not only keeping at bay the symptoms but also contributing to putting an end to the problem.

However, few interventions specifically address the biological dimension of care. Limited research has been conducted in this area, resulting in clinical guidelines and protocols that often overlook or lack biologically oriented nursing strategies. To achieve a holistic approach, it is essential to expand research on the biological origins and effects of depressive disorders, particularly regarding how nurses can address this dimension (15).

Specifically, nurses should be taught and trained on interventions that target the biological dimension of depression. For instance, promoting healthy habits such as physical activity and sleep hygiene has proved to regulate neurochemical imbalances and enhance neuroplasticity, thus empowering individuals to actively participate, decide, and constructively and coherently make a critique of their health process.

By providing nurses the knowledge and tools to address all dimensions of depression, significant advancements in patient care could be achieved. This holistic and complete approach would not only improve outcomes but also elevate the role of nurses in mental health treatment, reaching the standards required by the biopsychosocial model.

1.3. BASICS OF NEUROANATOMY OF BEHAVIOURAL PSYCHOBIOLOGY

In order to get to understand how depression affects the anatomy of the brain, we need to acknowledge how our nervous system actually relates and responds to stimuli in the first place.

1.3.1. Neuroanatomy of emotions

According to neuroimaging studies, each emotion has a distinct activation pattern. The aim is to read the brain structures' activation during the experience of different emotions (16).

The amygdala is located in the medial inner part of the temporal lobes. There are basically twelve subnuclei with several connections involved in different functions. It has cortical and subcortical connections, and its functions include negative emotions recognition, rapid responses such as vegetative behavioural, fear conditioning, and memory modulation.

When damaged, the nucleus of the amygdala cannot condition the fear and negative emotions recognition, leading to a lack or excessive feeling of fear towards different

situations, which implies that the person might experience stronger decompensated emotions.

The insula is generally involved in experiencing and mimicking the emotional state of others, outstandingly those implicated in admiration and compassion processes. This is automatically shown as the capacity of being sympathetic and the ability of empathy (16).

The anterior insula is sensibly activated during personal feelings of disgust, either oneself own or others' disgust. It is strongly connected to the hypothalamus, the amygdala, the cortex, and the grey matter.

The frontal lobe is perhaps the most common region to manifest anatomic abnormalities, including the anterior cingulate cortex (ACC), prefrontal cortex, and orbitofrontal cortex.

Stimulation of the anterior cingulate cortex generates the sense of joy and the unconscious act of smiling, which is also activated by observing someone else smiling, helping us to understand how others feel. The ACC is also correlated with empathy for pain, mediated by its affective qualities (16).

This is a major in depressive disorders, for the anterior cingulate cortex is strongly associated with happiness/sadness and suffering from hopelessness and pain. Damage to this area can easily lead to anhedonia and excessive feelings of suffering.

The prefrontal cortex plays a particular critical role in regulating emotions, especially in suppressing negative thoughts, and decision-making processes. In depressive disorders, its abnormal activity can lead to difficulty concentrating, mood regulation, excessive rumination, and low self-esteem.

Orbitofrontal cortex is strongly involved in inhibiting irrelevant neural activity, feelings, and the reward-punishment network, which explains motivational emotions run. Dysregulation in depressive disorders can produce incapacity to make decisions, an emphasis on negative aspects of personal situations, and changes in response to different stimuli.

The hippocampus is strongly associated with memory recall and reward processes. It is quite affected by many hormones, in particular glucocorticoid levels and the hypothalamic-pituitary-adrenal axis, which relates to stress levels and increased cortisol. This contributes to the difficulty in forming positive memories and reinforces negative experiences (17,18).

The thalamus is an information nucleus that relates to memory and emotions. Structural dysfunctions can lead to amnesia and amnestic symptoms. Strongly related,

the hypothalamus is central to stress response via the hypothalamic-pituitary-adrenal axis, which controls the production of cortisol and stress levels. Hence, in depressive disorders, hormonal dysregulation can lead to sleep disturbances, appetite abnormalities, and low energy.

Striatum disruptions may produce suicidal behaviour and strong impulsivity, associated with depression severity and reduced reward system. Putamen is contained by the striatum, related to the hate circuit, mood regulation, and cognitive processes, which may cause a decrease in the emotion control ability.

The parietal lobe is involved in sensorial integration, organization, evaluation of future responses, and attention processing. In major depressive disorder, this can explain the disconnection from reality that some patients experience, body perception, and even incoherent mental processes (19).

Other anatomical structures that are affected by depressive disorders include, for example, the gyrus of the brain surface. The cingulate gyrus is strongly associated with emotion regulation and decision-making, affecting empathy capacity and response to emotional harm. The temporal gyrus is related to social perception, affecting the ability to socialize and avoid self-isolation.

Grey matter is associated with the hippocampus, amygdala, and cingulate gyrus, this making that alterations in grey matter can lead to a lack of memory, concentration, mood regulation, and hyperactivity in response to negative stimuli.

White matter in depressive disorders can contribute to difficulties in the connectivity of the neuronal network, causing white matter hyperintensities, causing abnormalities in the anterior cingulate-prefrontal circuit (amygdala, prefrontal cortex, anterior cingulate), affecting emotional and cognitive processes (16).

Substantia nigra is a hidden structure of the midbrain, part of basal ganglions, and when affected by depression it can surpass to dopamine levels reductions weakening dopaminergic circuits, causing anhedonia and fatigue.

Whether we were to use an example, in emotionally significant situations of daily life, the amygdala provides a rapid and automatic evaluation of potentially dangerous aspects. The prefrontal cortex associates the elements of the situation with those of past situations and triggers a representation of the corresponding emotional state.

Meanwhile, the somatosensory cortex is activated when a detailed and overall representation of the bodily state is needed and associated with the emotion required. It is likely that these three structures are involved in a complex set of processes, such as decision-making and social interaction with others (16).

To summarise up, grey matter is related to altered memory, increased response to negative stimuli, and mood dysregulation. White matter to disconnection between cerebral areas, complicating integration of emotional and cognitive processes. Substantia nigra to lack of pleasure, demotivation, psychomotor slowing (Table 1).

Even though psychological unease is the most general symptom, used to diagnose depressive disorders, and thence the most treated ones, as stated in the biopsychosocial perspective, there are plenty of other dimensions of the person affected, which can be explained by cerebral functionality and neuroanatomy basics (20).

Table 1. Biological function and psychiatric linkage of basic cerebral structures identified throughout neuroimaging techniques. Adapted from: Sources (16–19).

Structure	Biological function	Psychiatric linkage
Frontal lobe	Cognitive functions, motor control	Planification difficulty
Parietal lobe	Organization, future expectations, sensorial integration	Disconnection from reality and body perception
Grey matter	Information processing	Lack of memory, intense response to negative stimuli
Thalamus	Information flow of the brain	Amnesia, high cortisol levels, chronic stress
Hippocampus	Memory recall and reward processes	Difficulty of forming positive memories
Amygdala	Negative emotions recognition, rapid responses	Fear disorders, anxiety
Prefrontal cortex	Executive control, decision making, impulse inhibition	Emotional dysregulation, deconcentration, low self-esteem
Anterior cingulate cortex	Mood regulation	Rumination, impulsivity
Orbitofrontal cortex	Inhibition of irrelevant data	Decision-making difficulty
Insula	Mimicking emotional states	Hypoactivity of alexithymia
Anterior Insula	Disgust feelings, pain response	Mood disorders
Striatum	Reward circuit, motor control	Suicidal behaviour, high impulsivity
Putamen	Hate circuit, cognitive processes	Emotional decontrol, psychomotor slowness
Cingulate gyrus	Decision making, empathy capacity, emotional harm	Rumination, cognitive decontrol

1.3.2. Neuroanatomy of sexuality

As mentioned beforehand, we cannot understand depressive disorders by studying independently each dimension of the person, but as a whole, including social interactions, sexuality, and other factors.

And, luckily, our understanding of the brain neuroanatomy can also explain how depression affects other areas, not only the emotional (21).

Depression is strongly linked with brain modifications, neurotransmitters, and hormonal changes. Alterations in the hypothalamus can increase or decrease specific hormones secretion, meaning that sexual conduct might be modified by the depressive disorder.

In males, abnormalities in gonadotropin hormone secretion can directly affect semen quality. Also, changes in the medial amygdala can produce alterations in sexual conduct. Actually, weight loss in the medial preoptic area can even suppress sexual desire, thus leading to no libido (21).

In females, follicle-stimulating hormone and luteinising hormone levels can be distorted, provoking irregularities in their menstrual cycle. The key structure in female sexual conduct is the medial hypothalamus, progesterone and oestradiol can activate and deactivate this nucleus and hence inhibit the sexual conduct of females.

In both, oxytocin, dopamine, and serotonin levels can be altered and interfere with the regular functioning of the person. Hormones are influenced by the brain, but they produce an impact on the brain as well.

Reward neural pathways are key to emotional bonding. They are the main reason why we feel attachment to others. When suffering from depression, there might be hyperactivity or hypoactivity of this, therefore producing the feeling of obsession, or, on the contrary, the incapacity to feel attached to others. In these pathways, the main neural structures involved are the insula, anterior cingulate cortex, hippocampus, and grey matter (22).

Depression is even related to sexual dimorphism, which lately has been an increasingly explored topic to make research with.

1.3.3. Neuroanatomy of social interaction

The amygdala processes the perception of emotions, particularly fear and hostility. It receives information directly through the infratemporal cortex, recognizes faces, and sends information to the central nucleus, expecting responses. It also transmits information to the ventral striatum and to the hippocampus.

In depressed patients, lesions in the amygdala cause hindrance in focusing on the eye-nose-mouth triangle when looking at faces and struggling to recognize expressions. However, if given specific instructions, they can improve.

The basal ganglia coordinate the feeling of disgust, while the reward pathways control joy. For example, first-time mothers show activity in the infratemporal cortex when seeing their child's face. They also exhibit increased activity in reward areas such as the nucleus accumbens when seeing happy faces (23).

Emotional resonance, or embodied experience, is the motor reproduction of another's action, which helps us replicate their sensation within ourselves, thereby facilitating empathy and understanding what they feel.

In this complex system, the anterior insula helps integrate the bodily sensations, emotions, and cognition. The anterior cingulate cortex, on the other hand, integrates motivation and willingness.

Social speaking, empathy is one of the most important aspects to take into account. Empathy is understood as a set of phenomena that allow us to experience what others are feeling. It includes experiencing others' emotions as our own, thinking about what they might be feeling or thinking, and having the motivation to help a third party (8).

However, it is important to differentiate it from sympathy, which is doing things to please others. Also, there has been identified two different types of empathy, in which participate different brain regions.

Emotional empathy is the ability to effortlessly place ourselves in another's situation and tune into their emotions. The inferior frontal gyrus is the main area on which emotional empathy relies.

Cognitive empathy is the ability to understand that others may have beliefs, desires, or intentions different from our own, and that we shall not interfere. In this type of empathy, the activity depends on the ventromedial prefrontal cortex (23).

People with lesions in the inferior frontal gyrus retain cognitive empathy but lack emotional empathy, whereas those with lesions in the ventromedial prefrontal cortex lose cognitive empathy but retain emotional empathy.

Some specific regions of the brain help us experience pain, such as the anterior cingulate cortex, sensorimotor cortex, and others, whilst the anterior insula and the cerebellum assist us in feeling and observing pain experienced by others.

One of the most important aspects of social interaction is mirror neurons. Cells in parietotemporal and premotor areas of the brain activate when seeing someone

performing an action. Basically, these neurons help replicate the action, providing us with clues on how to proceed.

The mirror neuron system is part of a frontoparietal system for sensorimotor integration and imitation. Imitation involves information to ensure that what is being executed matches what is intended to be done (24).

These neurons encode highly abstract aspects of stimuli, those related to action and those related to intention. Due to their role in processing abstract aspects, it is suggested that they might have contributed to the emergence of language.

In depressed patients, this is quite vital, for mirror neurons' plasticity can be reduced by mental health disorders. When neuroplasticity is decreased in several brain regions, the mirror neurons system's role in empathy, imitation, and understanding others' emotions and intentions is affected. They are also related to anhedonia and reduced engagement (25).

Social isolation and the difficulty in feeling positive emotions can dramatically affect one's day-to-day life. Research in different areas could help us understand different alterations of cognitive function, memory, language, numerical processing, executive function, and more.

1.4. BASICS OF NEUROPHYSIOLOGY IN DEPRESSIVE DISORDERS

It is important to acknowledge how physically the brain operates and regulates our mood and behavioural concepts. Despite the importance of the brain structures, anatomically speaking, it is also quite important to understand how the brain functions physiologically.

Lack of neurotransmitters such as serotonin, dopamine, and noradrenaline contributes to the onset of depressive disorders. These can produce a negative effect on the synaptic plasticity and neural circuits remodelling (26).

Synaptic plasticity reduction and alterations of the functional connectivity between specific cerebral areas can cause a hyperconnectivity of the default-mode network, which robustly contributes to rumination, negative thoughts, and overthinking.

Serotonin regulates several processes in the central nervous system, including memory, mood regulation, anger, stress, fear, sexual desire and pleasure, sleep, behaviour, and gastrointestinal homeostasis. However, it is involved in many other functions. Serotonin causes pupil dilation and an increase in intraocular pressure.

It has a positive inotropic effect, increasing calcium in cardiac myocytes. It plays a role in vasodilation and vasoconstriction. It also increases pulmonary vascular resistance,

gut motility, pancreatic secretion, and some genitourinary effects. Hence, and once again, the importance of a holistic perspective of the disease and the integration of nurses within the process, even in psychoradiology (27).

Physiology and depressive disorder act as a positive feedback circle. Depressed state might cause stress, which itself alters the stress response of the HPA axis, reducing neurogenesis and exacerbating depressive symptomatology. This also happens in sleep deprivation and depression.

Dysfunction in neural circuits that regulate mood, emotions, reward system, motivation, stress response, might be one of the organic causes of depression. Hypoactivity in the dorsolateral and medial prefrontal cortex produces abnormalities in emotional and cognitive regulation.

Hyperactivity of the amygdala towards negative stimuli contributes to the increase of decompensated anxiety and the negative feedback emotional system. The anterior cingulate cortex is highly associated with dysfunction in the reward system and mood regulation.

In depressive disorders, hippocampus volume might be reduced by several hormonal changes, which are solidly linked to memory loss, concentration hindering, and difficulty in the processing of emotions. On the other hand, abnormalities in the nucleus accumbens and ventral areas affect motivation, positive emotions recognition, and even anhedonia (28).

It is widely known that insomnia is one of the most prevalent symptoms of major depressive disorders, for approximately 60 to 90 percent of the patients with depression suffer from sleeping difficulty. Hence, the importance of the awareness of the pathophysiological factors that intervene in sleeping deprivation, insomnia, and hypersomnia.

Synaptic plasticity deterioration, neurotransmitter imbalances, and subtle inflammation affect mood, contribute to the appearance of depressive symptoms, and produce sleep disturbances.

The REM phase appears earlier and is prolonged throughout the night, slow-sleep waves, which are essential for mental and physical restoration and resting, are diminished. The inducers of this phenomenon are the dysfunction in neuromodulating networks, such as dopaminergic, serotonergic, and GABAergic, that decrease neural activity of the ventrolateral preoptic nucleus, perpetuating insomnia (29).

Over the last decades, research has aimed to prove that depression can cause a response of the immune system, causing inflammation. Specifically, there is an abnormal activation of cytokines, thus producing a full-on reaction in the human body.

Cytokines possess the ability to alter neurotransmitter networks, affecting synthesis, reuptake, and liberation of serotonin, dopamine, and glutamate. Even though they are not exclusively activated in depressive disorders, aiming to treat inflammation properly with anti-inflammatories is important to avoid resistant depressive disorders.

HPA alterations can produce hypercortisolism, provoking resistance to glucocorticoids and perpetuating inflammation. It is important to mention the microglia, the immune cells of the brain, that play a crucial role in neuroinflammation. In major depressive disorders, microglia can be mistakenly activated, contributing to cerebral inflammation, causing synaptic plasticity and neural functioning to be altered. According to some studies, cerebral markers such as high levels of protein translocator have been found in prefrontal cortex areas and anterior cingulate cortex areas (30).

Nevertheless, alterations of the physiological abnormalities can be corrected by providing proper treatment and medication. Not only psychiatrists are able to help the patients. With oriented interventions, nurses can intervene within the process. Actually, neuroimaging can also provide quite useful information, differentiating distinct abnormalities and, with that information, deciding the best way to proceed. Hence, the importance of psychoradiology techniques and the integration of nurses in this process.

1.5. BIOMARKERS OF DEPRESSION

Apart from specific neural information, there are other biological characteristics that can be objectively measured, and they provide significant information about normal processes, pathological states, and treatment responses. These are called biomarkers. Their characteristics are that they are measurable, specific, and diagnostic or predictive.

Major depressive disorder is frequently related to low-grade chronic inflammation. Scientific evidence proves that cytokines are consistent in patients with depression, affecting not only immune system-related structures but also neuronal, emotional, and cognitive functions (31).

For example, high levels of certain hormones and proteins are strongly linked to anhedonia, hopelessness, and neuroinflammation. In addition, increased levels of C-reactive protein are associated with the least response to antidepressant treatment (31).

In the HPA axis, cortisol is usually a key hormone in the stress response. Its provided data is quite significant due to the firm linkage to anxiety in depressive disorders. Cortisol level is one of the most compelling predictors of MDD.

Structural and functional abnormalities in neuroimaging studies, such as the hippocampus, amygdala, and prefrontal cortex, are parameters of robust interest to analysis.

Scientific evidence highlights the importance of studying and acknowledging the functionality of biomarkers, taking into consideration that depression is a multifaceted disease that cannot be understood solely by biological factors, but as a whole. In order to properly diagnose depression, a combination of all documented facts of the person shall be used (32).

1.6. PSYCHORADIOLOGY AND NEUROIMAGING STUDIES FOR DEPRESSION

When studying the structure and function of the brain, there are different techniques that provide us with useful information. However, each test is specific for different aims, depending on what we need to focus on. Therefore, importance lies in understanding the difference between the vast number of neuroimaging tests we have.

1.6.1. Magnetic Resonance Imaging (MRI)

Magnetic Resonance Imaging is a non-invasive imaging procedure that produces high-resolution two or three-dimensional detailed anatomical and physiological images. It is often used for disease detection, diagnosis, and treatment monitoring.

The contrast between grey and white matter makes MRI one of the best tests for checking the central nervous system. It shows how the brain responds to different stimuli, enabling researchers to study both the functional and structural brain abnormalities in psychological disorders (33).

Longitudinal relaxation time (T1) images show fat as bright and fluid as dark, which is useful for anatomical details. On the contrary, longitudinal relaxation time (T2) images are exactly the opposite. T2 are often used for detecting pathologies and inflammation (34,35).

In psychiatry, the most useful MRI technique is the functional MRI, or fMRI. Functional magnetic resonance imaging measures brain activity by detecting changes associated with blood flow. This test relies on the fact that neuronal activity and blood flow are associated. The more neural activation in a region, the more blood it needs (36).

The primary form of fMRI is blood-oxygen-level dependent contrast that is used to map neural activity in the brain. Red and yellow colours indicate an increase in signals, while blue tones show a decrease in activity (37,38).

1.6.2. Positron Emission Tomography (PET)

Positron emission tomography is a brain imaging technique that detects emissions from radioactive compounds injected into the bloodstream. These molecules

accumulate in different brain regions, and their activity is captured by PET scanners to create two or three-dimensional images (39).

PET is useful for studying brain function, as it reveals blood flow, oxygen, and glucose metabolism, providing information about neural activity. Metabolic changes precede structural alterations, given for example, in depressive disorders. (40)

In psychiatry, numerous neuroreceptors of interest have been labelled and identified through PET Scans. Dopamine, serotonin and cholinergic receptors have been used in studies examining the state of those receptors in patients with psychiatric disorders and healthy controls (41).

1.6.3. Machine Learning

The Learning-Machine methodology is a set of computational techniques that enable algorithms to learn patterns from data, without being explicitly programmed for it. It is used to consider cerebral data, aiming to improve diagnosis, classification and treatment for psychiatric disorders.

In psychiatry, there have been used support vector machines from fMRI results to differentiate patients with depressive disorders from healthy controls. This, based on cerebral patterns identified by a machine learning technique (42).

Machine learning gives a new approach to surpass traditional approaches limitations in psychiatric disorders. This could detect occult patterns that cannot be seen using DSM-5-TR, which considers subjective clinical criteria.

Furthermore, learning-machine can actually identify different phenotypes in biological mechanisms to differentiate subtypes of depressive disorders. Identifying inflammatory biomarkers, functional neuroimaging and neurotransmitter levels, machine learning can successfully separate patients into subgroups. This is a topic to examine, for using the newest technology can help establish different types of depressive disorders and their approach (43).

The most used model for learning-machine studies is Deep Learning, or Deep Neural Network. Basically, Deep Learning analyses fMRI images to detect abnormalities in cerebral connectivity, associated with depressive disorders, and utilises behavioural patterns to understand the person and the disorder (44–46).

1.7. INTERPRETATION OF PSYCHORADIOLOGICAL NEUROIMAGING RESULTS

Even though interpretation of radiological results is basically a radiologist's task, it is positive that nurses could acquire some knowledge on understanding what those results mean. This can be helpful also in other medical wards like traumatology, or

surgical procedures where, for example, during a laparoscopic procedure, if there is a bleeding, anatomical knowledge of nurses can help determining whether a small vein has been perforated, or a major blood vessel, giving the proper time to anticipate any material needed by surgeons. Hence, the importance of nurses understanding basic imaging interpretation.

In depressive disorders, there can be some specific techniques that can be used to explore the brain. Nurses working closely related to psychiatric patients should at least know what each procedure shows, and how it works. Also, nurses working on nuclear medicine must know how to proceed on each test, how to detect if there is any problem while taking the images and worry about the patients' wellbeing.

Because of high heterogeneity in severity of depression, symptoms and treatment response, selecting the proper most individualised therapy becomes crucial. Deep learning, once trained, can collect large neuroimaging data, in addition to behavioural and social patterns, and integrate them with clinical aspects to reach an accuracy of approximately 80% (47).

Scientific evidence found that MDD patients show abnormalities in both brain structure and connectivity in some specific regions. In other words, structural and functional differences in brain imaging can be identified in depression. Specifically, consistent abnormalities in the hippocampus, putamen and more importantly, the subgenual cingulate cortex, which plays a key role in mood regulation and emotional processing, are a usual target for treatments of depressive disorders (48).

Furthermore, alterations in the right amygdala were found, showing unusual activity in MDD patients compared to healthy individuals, concretely in emotion processing, highlighting its importance in both symptoms and treatment approaches.

Barely half of the patients with MDD have a response to treatment with antidepressants, which generates new necessities and points out the urge to establish new treatments, because of the disorder's recurrence (49).

Being able to predict the response to treatment and the recurrence of depression opens new doors to psychiatry and nursing. Despite of that, there is a need to integrate new clinical data, along with genetic, neurobiological and psychosocial studies.

According to MRI and fMRI research, there is a clear correlation between depressive disorder and structural and functional abnormalities of certain brain regions.

Understanding what those regions are related to can help determine which treatment to choose and what nursing measures can be applied, depending on the most affected area (16) (Table 2).

Table 2. Functional and structural alterations in brain regions in MDD. Adapted from: Sources (16,50–52).

Brain region	Activity	Volume	Symptoms	Findings and effects
Frontal Lobe	↓	↓	Decision-making problems, poor emotional control, apathy	Reduced cortical thickness and activity. Orbitofrontal cortex dysfunction affects emotional regulation.
Anterior Cingulate Cortex	↑/↓	↓	Mood regulation issues, anhedonia	The subgenual region is hypoactive, contributing to sadness. Increased dorsal ACC activity is observed in emotional conflict processing.
Hippocampus	↓	↓	Memory problems, heightened stress response	Linked to chronic stress. Volume can increase with antidepressant treatment.
Amygdala	↑	Variable	Emotional hyperreactivity, anxiety, exaggerated fear responses	Hyperactivity, notably to negative stimuli, contributes to anxiety and emotional reactivity
Thalamus	↓	↓	Emotional regulation difficulties, cognitive impairments	Decreased volume in depression affects communication with cortical areas.
Putamen	↓	↓	Anhedonia, low motivation	Reduced volume and functional activity in the reward system, despairing pleasure responses.
Parietal Lobe	↑	↑	Difficulties integrating sensory and cognitive information	Increased cortical thickness in the superior parietal lobe, possibly as a compensatory mechanism.

Further into this topic, some researchers have identified differences between male and female brains. This can be helpful to even make more individualized treatments, and avoid the bias that currently exists and sadly affects females' treatments (50,51).

Men with depression tend to exhibit reduced volume in the amygdala and caudate nucleus and alterations in white matter. On the other hand, women present increased activity in the orbitofrontal cortex. Additionally, cerebral perfusion and neural connectivity differ between sexes, suggesting that hormonal and social factors influence the neurobiological differences in depression.

We can extend neuroimaging tests in depression for other psychiatric disorders that might also show signs of depressive disorders, such as bipolar and unipolar disorders. Bipolar disorder exhibited reduced grey matter in two different brain regions, an increase within network connectivity, and heightened function. Furthermore, bipolar individuals are influenced by emotional and sensory processing, while unipolar ones are closely associated with reduced feeling experiencing (52).

Moreover, these structural and functional abnormalities have shown some sort of pattern, giving health professionals the chance to group the patterns within four different subtypes of depression (53,54) (Table 3).

The first biotype of depression identified is related to a decrease in fronto-amygdala connectivity, linked to increased anxiety and emotional regulation issues. The second one shows a reduction in connectivity in the anterior cingulate cortex, associated with fatigue and lack of motivation.

The third subtype shows hyperconnectivity in thalamus and striatal network, linked to anhedonia and psychomotor retardation. Finally, the fourth type presents a mixed connectivity pattern, which has been associated with symptoms of both anxiety and anhedonia.

These patterns suggest that depression is not a homogeneous disorder, since there exist neurobiological differentiated bases of subtypes, which could exponentially increase the precision in diagnosing, and above all, treatment selection (55).

For example, the first biotype could benefit from therapies aimed at reducing amygdalar hyperactivity, such as selective serotonin reuptake inhibitors and cognitive behavioural therapy. On the other hand, the second biotype could respond better to treatments that increase dopamine, such as bupropion and transcranial magnetic stimulation.

This way, each subtype could be addressed individually with psychological, psychiatric, and nursing interventions focused on what improves better, and not as the current treatments that are mainly general.

Table 3. MDD biological subtypes identified through fMRI techniques. Adapted from: Sources (53–55).

Subtype	Common name	Functional Alterations	Neurophysiology	Symptoms associated
Biotype 1	Anxious depression	Decrease in connectivity between prefrontal cortex and amygdala	Hyperactivity of the amygdala, reducing inhibitory control	Heighten anxiety, difficulty to regulate negative emotions, rumination
Biotype 2	Apathic depression	Reduction of connectivity of the anterior cingulate and orbitofrontal cortex	Decrease of dopaminergic activity in motivation network	Fatigue, demotivation, lack of interest
Biotype 3	Anhedonia depression	Hyperconnectivity in thalamus striatal nets	Decrease in synaptic plasticity	Anhedonia, psychomotor retard
Biotype 4	Mixed depression	Alteration in the amygdala and the thalamus	Hyperactivity in the HPA Axis and dysfunction in regulation of fear and reward network	Anxiety, anhedonia, emotional lability

As a whole, neuroimaging can be utilized to differentiate between a healthy individual and a patient with depression, particularly in cases of endogenous depression with a genetic hereditary basis.

Furthermore, neuroimaging could be crucial when distinguishing between different subtypes of depression, allowing for a more precise classification of each disorder, and identifying the best individualized approach. This could help nurses creating clinical guidelines for each subtype, and applying specific interventions, improving the diagnosis process and therapeutic treatment.

2. BIBLIOGRAPHY

1. Depresión [Internet]. Organización Mundial de la Salud; [cited 2025 March]. Available from: https://www.who.int/es/health-topics/depression

2. Cerecero-García D, Macías-González F, Arámburo-Muro T, Bautista-Arredondo S. Síntomas depresivos y cobertura de diagnóstico y tratamiento de depresión en población mexicana. Salud Pública México [Internet]. 2020 November [cited 2025 March] ;62(6):840–850. Available from: https://www.saludpublica.mx/index.php/spm/article/view/11558/11984

3. Salud Mental [Internet]. Organización Panamericana de la Salud; 2025 [cited 2025 March]. Available from: https://www.paho.org/es/temas/salud-mental

4. Chen LK. Biopsychosocial Perspectives of Loneliness and Social Isolation. Arch Gerontol Geriatr [Internet]. 2022 May [cited 2024 December];100:104671. Available from: https://www.sciencedirect.com/science/article/pii/S0167494322000528?via%3Dihub

5. American Psychiatric Association, editor. Diagnostic and statistical manual of mental disorders: DSM-5-TR™. Fifth edition, text revision. Washington, DC: American Psychiatric Association Publishing; 2022. 1050 p.

6. Garcia-Toro M, Aguirre I. Biopsychosocial model in Depression revisited. Med Hypotheses [Internet]. 2007 January [cited 2024 December];68(3):683–691. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0306987706001976

7. Hong S, Lee S, Song K, Kim M, Kim Y, Kim H, et al. A nurse-led mHealth intervention to alleviate depressive symptoms in older adults living alone in the community: A quasi-experimental study. Int J Nurs Stud [Internet]. 2023 February [cited 2024 December];138:104431. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0020748922002607

8. Nezlek JB, Imbrie M, Shean GD. Depression and everyday social interaction. J Pers Soc Psychol [Internet]. 1994 December [cited 2025 January];67(6):1101-1111. Available from: https://pubmed.ncbi.nlm.nih.gov/7815303/

9. Decker V, Tofthagen C. Depression: Screening, Assessment, and Interventions in Oncology Nursing. Clin J Oncol Nurs [Internet]. 2021 August [cited 2025 January];25(4):413–21. Available from: http://cjon.ons.org/cjon/25/4/depression-screening-assessment-and-interventions-oncology-nursing

10. Lee EE, Torous J, De Choudhury M, Depp CA, Graham SA, Kim HC, et al. Artificial Intelligence for Mental Health Care: Clinical Applications, Barriers, Facilitators, and Artificial Wisdom. Biol Psychiatry Cogn Neurosci Neuroimaging [Internet]. 2021 September [cited 2025 May];6(9):856–864. Available from: https://linkinghub.elsevier.com/retrieve/pii/S245190222100046X

11. Gordon M. Manual of Nursing Diagnosis. 13th ed. Burlington. Jones & Bartlett Publishers; 2009.

12. Onyango F. Gordon's Functional Health Patterns: A Nursing Guide [Internet]. Nurses Delight; 2023 [cited 2025 March]. Available from: https://nursesdelight.com/gordons-functional-health-patterns-a-nursing-guide/

13. Bitencourt GR, Souza PA, Ferreira AFM, Fernandes LLRA, Silva CS, Souza OS,Corrêa DBSF. Functional patterns of health nursing theoryin the hospital context: evaluation according to Meleis. Glob Acad Nurs [Internet]. 2023 March [cited 2025 May];4(1):336-341. Available from: https://doi.org/10.5935/2675-5602.20200336

14. Huang X, Gong Q, Sweeney JA, Biswal BB. Progress in psychoradiology, the clinical application of psychiatric neuroimaging. Br J Radiol [Internet]. 2019 September [cited 2025 February] ;92(1101):20181000. Available from: https://academic.oup.com/bjr/article/doi/10.1259/bjr.20181000/7449166

15. Kuri M. Psicoradiología: El futuro del diagnóstico y tratamiento psiquiátrico [Internet]. 2019 [cited 2025 February]. Available from: https://revistas.anahuac.mx/index.php/masciencia/article/view/1237/1177

16. Zhang F, Peng W, Sweeney JA, Jia Z, Gong Q. Brain structure alterations in depression: Psychoradiological evidence. CNS Neurosci Ther [Internet]. 2018 November [cited 2025 January];24(11):994–1003. Available from: https://onlinelibrary.wiley.com/doi/10.1111/cns.12835

17. Maller JJ, Broadhouse K, Rush AJ, Gordon E, Koslow S, Grieve SM. Increased hippocampal tail volume predicts depression status and remission to anti-depressant medications in major depression. Mol Psychiatry [Internet]. 2018 August [cited 2025 February];23(8):1737–1744. Available from: https://www.nature.com/articles/mp2017224

18. Mtui E, Gruener G, Dockery P. Neuroanatomía clínica y neurociencia. 8th ed. Elsevier; 2022.

19. Crossman AR. Neuroanatomía. Texto y Atlas en Color. 6th ed. Philadelphia: Elsevier; 2019.

20. Gratton C, Kraus BT, Greene DJ, Gordon EM, Laumann TO, Nelson SM, et al. Defining Individual-Specific Functional Neuroanatomy for Precision Psychiatry. Biol Psychiatry [Internet]. 2020 July [cited 2025 January];88(1):28–39. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0006322319318293

21. Mosack V, Steinke EE, Wright DW, Walker C, Medina M, Moser DK, et al. Effects of Depression on Sexual Activity and Sexual Satisfaction in Heart Failure. Dimens Crit Care Nurs [Internet]. 2011 July [cited 2025 January];30(4):218–225. Available from: http://journals.lww.com/00003465-201107000-00014

22. Reynaert C, Zdanowicz N, Janne P, Jacques D. Depression and sexuality. Psychiatr Danub [Internet]. 2010 [cited 2025 January];22(1):111-113. Available from: https://hrcak.srce.hr/file/382013

23. Guhn A, Merkel L, Hübner L, Dziobek I, Sterzer P, Köhler S. Understanding versus feeling the emotions of others: How persistent and recurrent depression affect empathy. J Psychiatr Res [Internet]. 2020 November [cited 2025 January];130:120–7. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0022395620308554

24. Schmidt SNL, Hass J, Kirsch P, Mier D. The human mirror neuron system—A common neural basis for social cognition? Psychophysiology [Internet]. 2021 May [cited 2025 January];58(5):13781. Available from: https://onlinelibrary.wiley.com/doi/10.1111/psyp.13781

25. Iacoboni M, Dapretto M. The mirror neuron system and the consequences of its dysfunction. Nat Rev Neurosci [Internet]. 2006 December [cited 2025 January];7(12):942–951. Available from: https://www.nature.com/articles/nrn2024

26. Schrantee A, Ruhé HG, Reneman L. Psychoradiological Biomarkers for Psychopharmaceutical Effects. Neuroimaging Clin N Am [Internet]. 2020 February [cited 2025 February];30(1):53–63. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1052514919300851

27. Bamalan OA, Moore MJ, Al Khalili Y. Physiology, Serotonin. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 January]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK545168/

28. Spellman T, Liston C. Toward Circuit Mechanisms of Pathophysiology in Depression. Am J Psychiatry [Internet]. 2020 May [cited 2025 January];177(5):381–390. Available from: https://psychiatryonline.org/doi/10.1176/appi.ajp.2020.20030280

29. Hutka P, Krivosova M, Muchova Z, Tonhajzerova I, Hamrakova A, Mlyncekova Z, et al. Association of Sleep Architecture and Physiology with Depressive Disorder and Antidepressants Treatment. Int J Mol Sci [Internet]. 2021 January [cited 2025 January];22(3):1333. Available from: https://www.mdpi.com/1422-0067/22/3/1333

30. Beurel E, Toups M, Nemeroff CB. The Bidirectional Relationship of Depression and Inflammation: Double Trouble. Neuron [Internet]. 2020 July [cited 2025 January];107(2):234–256. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0896627320304311

31. Harsanyi S, Kupcova I, Danisovic L, Klein M. Selected Biomarkers of Depression: What Are the Effects of Cytokines and Inflammation? Int J Mol Sci [Internet]. 2022 December [cited 2025 February];24(1):578. Available from: https://www.mdpi.com/1422-0067/24/1/578

32. Nedic Erjavec G, Sagud M, Nikolac Perkovic M, Svob Strac D, Konjevod M, Tudor L, et al. Depression: Biological markers and treatment. Prog Neuropsychopharmacol Biol Psychiatry [Internet]. 2021 March [cited 2025 February];105:110139. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0278584620304553

33. Rinck P. Magnetic Resonance in Medicine: A peer-reviewed critical introduction [Internet]. 14th ed. 2024 [cited 2025 February]. Available from: https://www.magnetic-resonance.org/

34. Budinger TF, Bird MD. MRI and MRS of the human brain at magnetic fields of 14 T to 20 T: Technical feasibility, safety, and neuroscience horizons. NeuroImage [Internet]. 2018 March [cited 2025 February];168:509–31. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1053811917300903

35. McRobbie DW. MRI from picture to proton. 2nd ed. Cambridge, UK: Cambridge University Press; 2006.

36. Peterson BS, Trampush J, Maglione M, Bolshakova M, Brown M, Rozelle M, et al. ADHD Diagnosis and Treatment in Children and Adolescents [Internet]. Rockville (MD): Agency for Healthcare Research and Quality (US); 2024 [cited 2025 February]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK603001/

37. Das S, Yi W, Ding M, Mangun GR. Optimizing cognitive neuroscience experiments for separating event- related fMRI BOLD responses in non-randomized alternating designs. Front Neuroimaging [Internet]. 2023 [cited 2025 February];2:1068616. Available from: https://www.frontiersin.org/journals/neuroimaging/articles/10.3389/fnimg.2023.1068616/full

38. Huettel SA, Song AW, McCarthy G. Functional magnetic resonance imaging. 2nd ed. Sunderland: Sinauer Associates; 2008.

39. Bailey DL, editor. Positron emission tomography: basic sciences. New York: Springer; 2005.

40. Sarikaya I. PET studies in epilepsy. Am J Nucl Med Mol Imaging [Internet]. 2015 October [cited 2025 February] ;5(5):416–430. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC4620171/

41. Catafau AM, Searle GE, Bullich S, Gunn RN, Rabiner EA, Herance R, Radua J, Farre M, Laruelle M. Imaging cortical dopamine D1 receptors using [11C]NNC112 and ketanserin blockade of the 5-HT 2A receptors. J Cereb Blood Flow Metab. 2010 May [cited 2025 February];30(5):985-993. Available from: https://pubmed.ncbi.nlm.nih.gov/20029452/

42. Davatzikos C. Machine learning in neuroimaging: Progress and challenges. NeuroImage [Internet]. 2019 August [cited 2025 February];197:652–656. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1053811918319621

43. Walter M, Alizadeh S, Jamalabadi H, Lueken U, Dannlowski U, Walter H, et al. Translational machine learning for psychiatric neuroimaging. Prog Neuropsychopharmacol Biol Psychiatry [Internet]. 2019 April [cited 2025 February];91:113–21. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0278584618304500

44. Squires M, Tao X, Elangovan S, Gururajan R, Zhou X, Acharya UR, et al. Deep learning and machine learning in psychiatry: a survey of current progress in depression detection, diagnosis and treatment. Brain Inform [Internet]. 2023 December [cited 2025 February];10(1):10. Available from: https://braininformatics.springeropen.com/articles/10.1186/s40708-023-00188-6

45. Sui J, Liu M, Lee JH, Zhang J, Calhoun V. Deep learning methods and applications in neuroimaging. J Neurosci Methods [Internet]. 2020 June [cited 2025 February];339:108718. Available from: https://doi.org/10.1016/j.jneumeth.2020.108718

46. Xu M, Ouyang Y, Yuan Z. Deep Learning Aided Neuroimaging and Brain Regulation. Sensors [Internet]. 2023 May [cited 2025 February] 23;23(11):4993. Available from: https://doi.org/10.3390/s23114993

47. Squarcina L, Maria Villa F, Nobile M, Grisan E, Brambilla P. Deep learning for the prediction of treatment response in depression. J Affect Disord [Internet]. 2021 Februaru [cited 2025 February];281:618–622. Available from: https://doi.org/10.1016/j.jad.2020.11.104

48. Gray JP, Müller VI, Eickhoff SB, Fox PT. Multimodal Abnormalities of Brain Structure and Function in Major Depressive Disorder: A Meta-Analysis of Neuroimaging Studies. Am J Psychiatry [Internet]. 2020 May [cited 2025 February];177(5):422–434. Available from: https://psychiatryonline.org/doi/10.1176/appi.ajp.2019.19050560

49. Kang SG, Cho SE. Neuroimaging Biomarkers for Predicting Treatment Response and Recurrence of Major Depressive Disorder. Int J Mol Sci [Internet]. 2020 March [cited 2025 February];21(6):2148. Available from: https://pubmed.ncbi.nlm.nih.gov/32245086/

50. Battel L, Swartz J, Anes M, Manfro PH, Rohde LA, Viduani A, et al. Neuroimaging adolescents with depression in a middle-income country: feasibility of an fMRI protocol and preliminary results. Rev Bras Psiquiatr Sao Paulo 1999[Internet]. 2020 [cited 2025 February];42(1):6–13. Available from: https://pubmed.ncbi.nlm.nih.gov/31389498/

51. Mohammadi S, Seyedmirzaei H, Salehi MA, Jahanshahi A, Zakavi SS, Dehghani Firouzabadi F, et al. Brain-based Sex Differences in Depression: A Systematic Review of Neuroimaging Studies. Brain Imaging Behav [Internet]. 2023 October [cited 2025 February];17(5):541–569. Available from: https://pubmed.ncbi.nlm.nih.gov/37058182/

52. Siegel-Ramsay JE, Bertocci MA, Wu B, Phillips ML, Strakowski SM, Almeida JRC. Distinguishing between depression in bipolar disorder and unipolar depression using magnetic resonance imaging: a systematic review. Bipolar Disord [Internet]. 2022 August [cited 2025 February];24(5):474–498. Available from: https://pubmed.ncbi.nlm.nih.gov/35060259/

53. Arnone D, Wise T, Cleare A, Young A, Herane A. Diagnostic and therapeutic utility of neuroimaging in depression: an overview. Neuropsychiatr Dis Treat [Internet]. 2014 August [cited 2025 February];1509. Available from: https://doi.org/10.2147/NDT.S50156

54. Drysdale AT, Grosenick L, Downar J, Dunlop K, Mansouri F, Meng Y, et al. Resting-state connectivity biomarkers define neurophysiological subtypes of depression. Nat Med [Internet]. 2017 January [cited 2025 March];23(1):28–38. Available from: https://www.nature.com/articles/nm.4246

55. Milaneschi Y, Lamers F, Peyrot WJ, Abdellaoui A, Willemsen G, Hottenga JJ, et al. Polygenic dissection of major depression clinical heterogeneity. Mol Psychiatry [Internet]. 2016 April [cited 2025 March];21(4):516–22. Available from: https://www.nature.com/articles/mp201586

56. Neshovski R, [Internet]. United Nations Sustainable Development; [cited 2025 March]. Available from: https://www.un.org/sustainabledevelopment/

57. Verdú C, Mateo MA. Tècniques qualitatives d'investigació. Alacant: Universitat d'Alacant, Secretariat de Promoció del Valencià; 2006.

58. Gengo E Silva Butcher RC, Jones DA. An integrative review of comprehensive nursing assessment tools developed based on Gordon's Eleven Functional Health Patterns. Int J Nurs Knowl [Internet]. 2021 October [cited 2025 March];32(4):294-307. Available from: https://pubmed.ncbi.nlm.nih.gov/33620162/

59. Salut mental [Internet]. Institut d'Assistència Sanitaria; [cited 2025 March]. Available from: https://www.ias.cat/ca/salutmental

60. CatSalut. Informe de població de referència 2024 [Internet]. Barcelona: Generalitat de Catalunya; 2024 [cited 2025 March]. Available from: https://catsalut.gencat.cat/web/.content/minisite/catsalut/proveidors_professionals/registres_catalegs/documents/informe-poblacio-referencia-2024.pdf

61. AQuAS. Fitxes interpretatives sobre salut mental i addiccions [Internet]. Barcelona: Agència de Qualitat i Avaluació Sanitàries de Catalunya; 2023 [cited 2025 March]. Available from: https://aquas.gencat.cat/web/.content/minisite/aquas/publicacions/2023/fitxes-interpretatives-salut-mental-addiccions-cdr-aquas2023.pdf

62. GRANMO [Internet]. DATARUS. [cited 2025 March]. Available from: https://www.datarus.eu/ca/aplications/granmo/

63. Població. Xifres de població [Internet]. Idescat [cited 2025 March]. Available from: https://www.idescat.cat/tema/xifpo

64. Sanz I, Ruymán P, Novo M, Rodríguez JA. Validación española del functional health pattern assessment screening tool (FHPAST) en atención primaria. Revista Cuidar [Internet]. 2021 [cited 2025 March];(1):59–89. Available from: https://doi.org/10.25145/j.cuidar.2021.01.06

65. Cassiani-Miranda CA, Cuadros-Cruz AK, Torres-Pinzón H, Scoppetta O, Pinzón-Tarrazona JH, López-Fuentes WY, et al. Validez del Cuestionario de salud del paciente-9 (PHQ-9) para cribado de depresión en adultos usuarios de Atención Primaria en Bucaramanga, Colombia. Rev Colomb Psiquiatr [Internet]. 2021 January [cited 2025 April];50(1):11–21. Available from: https://doi.org/10.1016/j.rcp.2019.09.001

66. Prueba ANOVA: Guía detallada con ejemplos [Internet]. [cited 2025 April]. Available from: https://www.datacamp.com/tutorial/anova-test

67. Declaración de Helsinki [Internet]. The World Medical Association; [cited 2025 April]. Available from: https://www.wma.net/es/que-hacemos/etica-medica/declaracion-de-helsinki/

68. BOE-A-2018-16673 Ley Orgánica 3/2018, de 5 de diciembre, de Protección de Datos Personales y garantía de los derechos digitales [Internet]. Available from: https://www.boe.es/buscar/act.php?id=BOE-A-2018-16673

69. BOE.es - DOUE-L-2016-80807 Reglamento (UE) 2016/679 del Parlamento Europeo y del Consejo, de 27 de abril de 2016, relativo a la protección de las personas físicas en lo que respecta al tratamiento de datos personales y a la libre circulación de estos datos y por el que se deroga la Directiva 95/46/CE (Reglamento general de protección de datos) [Internet]. Available from: https://www.boe.es/buscar/doc.php?id=DOUE-L-2016-80807

70. Jefatura del Estado. Ley 14/2007, de 3 de julio, de Investigación biomédica [Internet]. Available from: https://www.boe.es/eli/es/l/2007/07/03/14

71. Comitè d'Ètica d'Investigació amb Medicaments (CEIm) [Internet]. CAT - IDIBGI; [cited 2025 April]. Available from: https://idibgi.org/serveis/ceim/

3. OBJECTIVES

The objectives proposed are:

- To acknowledge, using nursing evaluation, whether there are identifiable different needs for each subtype of depression.
- To assess the relationship between identified needs and specific neurobiological patterns in each subtype of depression, providing a basis for targeted nursing interventions.

3.1. Sustainable development goals

Sustainable development goals (SDG) were set to establish and promote prosperity while protecting the planet, which were approved by the Agenda 2030 of World Health Organization. This research project is aligned especially with SDG 3, Good Health and Wellbeing, of its target 3.4, which aims to reduce premature mortality through the promotion of mental health. This research aims to improve the assessment and management of depression through nursing evaluation tools.

In addition, SDG 4, Quality Education, target 4.4 is also relevant to this study, by developing standardised nursing assessment methodologies to support training and education. SDG 10, Reduced Inequalities, target 10.3 is also taken into consideration by personalising nursing care according to depression subtypes and their needs (56).

4. METHODOLOGY AND MATERIALS

4.1. STUDY DESIGN

This project is designed as a cross-sectional quasi-experimental observational study that aims to determine whether different depression subtypes, identified through neuroimaging techniques, show distinct nursing needs when assessed by using Gordon's Functional Health Patterns (57).

To achieve this, data will be collected through a nursing evaluation structured strategy to collect data from depression-diagnosed patients, classified in one of the existing subtypes of depression using neuroimaging technology. Nursing evaluation will be held by structured interviews and clinical registers, documenting specific needs related to Gordon's Patterns (58).

4.2. STUDY FIELD

This project will be held within the province of Girona, in public healthcare-related centres. The selected institution is Xarxa de Salut Mental (XSM) de Girona, with its primary care facilities being Centres de Salut Mental d'Adults (CSMA).

The selected CSMA that will be included in this study are those located in the Girona shire, and some neighbouring Basic Health Areas (59).

Thus, geographically speaking, the study will take place in the following CSMAs: CSMA Girona, CSMA Santa Coloma de Farners, CSMA Blanes. According to data from 2023, approximately 3% of the adult population needed mental health care. Considering that, in total, those areas provide care to 370.000 people, approximately those CSMAs provided mental health attention to 11.000 people (60,61).

4.3. STUDY POPULATION

The population to be considered within this study will be patients diagnosed with major depressive disorder, being treated and followed up by in either Hospital Santa Caterina or one of the CSMA selected.

4.3.1. Inclusion criteria

- At least, be eighteen years old.
- Diagnosed with MDD using DSM-5-TR criteria.
- Able to provide informed consent.
- Willing to participate voluntarily.
- No recent changes in psychotropic medications for the past 6 weeks.
- Medically stable and able to complete interviews and assessments.
- Currently been diagnosed with MDD for at least one year.

4.3.2. Exclusion criteria

- Diagnosed with any other mental health disorder.
- History of neurological disorders affecting brain structure, such as strokes or neurodegenerative diseases.
- Inability to undergo neuroimaging due to metal implants, claustrophobia, pregnancy and others.
- Neuroimaging results not being clear due to inappropriate data collection throughout the neuroimaging study.
- Inability to communicate.
- Severe intellectual disability preventing proper completion of an assessment interviews.
- Current active substance abuse interfering with participation, communication or provoking brain structural or functional abnormalities.

4.3.3. Withdrawal criteria

- Willingness to abandon the study at any point.
- Acute psychiatric crisis requiring immediate hospitalisation.
- Initiation or change in psychiatric medication.
- New medical or neurological diagnosis that affects brain functionality.

4.4. SAMPLING, DATA GATHERING AND DATA ANALYSIS

4.4.1. Sample selection

The sampling method selected is non-probabilistic, intentional and convenience-based, as participants will be recruited based on their willingness to participate and fulfilment of established inclusion criteria.

This research project will follow a guided-sampling model, in which participant selection will be done from a previous delimitation based on clinical and geographical criteria. Participants will be recruited from Hospital Santa Caterina and the selected CSMAs, within XSM.

To ensure a representative sample, an equitable distribution between subgroups will be considered to grant patients who show diverse manifestations of the disorder. Selection will be done gradually, with the intention of acquiring a sufficient variability in terms of nursing need, based on Gordon's Functional Patterns.

Furthermore, patients from different age ranges and clinical profiles within the established inclusion criteria will be included, thus granting a heterogeneous and clinically relevant sample for this project.

4.4.2. Sample size

Accessibility and feasibility of participants within the selected institutions will determine the sample size. Unfortunately, sample size cannot be surely fixed beforehand, for it will depend on patients' availability and data saturation. Using GRANMO software, considering that XSM can provide attention to approximately 750.000 people, knowing that approximately 3'8% of people suffer from depression at some point, this gives that 28.500 people covered by XSM suffer from depression.

With this data, assuming an alpha-risk of 0.05 and margin of error of 0.05, it is estimated that 370 individuals will be included, thus ensuring representation of the general population, especially representation across four depression subtypes classified by neuroimaging (62,63).

4.4.3. Variables

The main aim of this study is to explore whether individuals with different subtypes of MDD, classified based on neuroimaging findings, show different patterns of needs using Gordon's Functional Patterns.

The main independent variable is going to be the subtype of depression, which will be compared against scores from the Functional Health Pattern Assessment Screening Tool (FHPAST). This questionnaire checks Gordon's 11 functional patterns, which will be used as dependent variables representing patients' specific needs (Table 4).

For each pattern, a mean score will be calculated from its items. Means will be used as dependent variables to compare functional health status and needs. Only one decimal will be used.

Sociodemographic, clinical data, and depressive symptom severity will be collected as secondary variables.

Table 4. Classification of variables within this project. Source: Self-elaborated.

		VARIABLE	TYPE
INDEPENDENT VARIABLES	MAIN	Depression subtype	Qualitative nom. polytomous
	Personal aspects	Age	Quantitative continuous
		Gender	Qualitative nom. polytomous
		Educational level	Qualitative ordinal
		Employment status	Qualitative nom. polytomous
		Marital status	Qualitative nom. polytomous
		Living situation	Qualitative nom. polytomous
		Social support perception	Qualitative ordinal
		Regular exercise	Qualitative dichotomous
	Depression aspects	Time with depression diagnosed	Quantitative discrete
		Treatment type	Qualitative nom. polytomous
		Duration of current treatment	Quantitative continuous
		Treatment adherence perception	Qualitative ordinal
		Previous hospitalisation for depression	Qualitative dichotomous
		Self-harming or a suicide attempt	Qualitative dichotomous
		Family history of depression	Qualitative dichotomous
DEPENDENT VARIABLES	Gordons Functional Patterns	Gordon's Functional Pattern 1	Quantitative continuous
		Gordon's Functional Pattern 2	Quantitative continuous
		Gordon's Functional Pattern 3	Quantitative continuous
		Gordon's Functional Pattern 4	Quantitative continuous
		Gordon's Functional Pattern 5	Quantitative continuous
		Gordon's Functional Pattern 6	Quantitative continuous
		Gordon's Functional Pattern 7	Quantitative continuous
		Gordon's Functional Pattern 8	Quantitative continuous
		Gordon's Functional Pattern 9	Quantitative continuous
		Gordon's Functional Pattern 10	Quantitative continuous
		Gordon's Functional Pattern 11	Quantitative continuous
	PHQ9	PHQ-9 total score	Quantitative discrete
		Depressive symptom severity	Qualitative ordinal

4.4.4. Sample instrumentation

For this project, the instruments used will be as follows:

1. Sociodemographic ad hoc questionnaire to collect general data from individuals (Appendix 1).

2. There will be used Functional Health Pattern Assessment Screening Tool (FHPAST), validated by Sanz et al (64). It consists of 57 questions that interrelate all 11 functional patterns to evaluate each of them, with four possible answers: Never, Sometimes, Frequently, Always. Respectively, items are rated on a 1 – 4 Likert Scale (64).

   FHPAST items are divided as follows:

- Pattern 1: 1-4, 6, 7, 12, 15, 50 (9 items).
- Pattern 2: 5, 8-11, 13, 14 (7 items).
- Pattern 3: 16, 17 (2 items).
- Pattern 4: 18-21 (4 items).
- Pattern 5: 22-24 (3 items).
- Pattern 6: 25-30, 32, 33 (8 items).
- Pattern 7: 31, 34-37 (5 items).
- Pattern 8: 38-44 (7 items).
- Pattern 9: 31, 45, 46 (3 items).
- Pattern 10: 27, 35, 57-50 (6 items).
- Pattern 11: 51, 52 (2 items).

   In items from 1 to 40, the higher the score, the better. However, from 41 on, the higher the punctuation, the worse. In the end, the higher the score, the better, even though the last 17 questions are the opposite. Hence, the best score obtainable is 177. The farther, the worse (Appendix 2).

3. Nine-item Patient Health Questionnaire (PHQ-9), validated by Cassiani-Miranda (65), will be run. It is a 9-item questionnaire used to evaluate the mental health state and the severity of the depression symptomatology. Each question can give up to 3 points, depending on the answer; Never 0, Sometimes 1, Frequently 2, Nearly daily 3 (65).

   A total score of 0 to 4 indicates no risk of suffering actual mental health disorders. 5 to 9 points indicate mild risk, 10 to 14 show moderate risk, 15 to 19 show moderately severe, and 20 to 27 show severe risk (Appendix 3).

4. Additional data will be collected from medical records, including psychiatric data, neuroimaging records and classifications, and biopsychosocial information to be considered.

4.4.5. Data collection

In this project, data will be gathered through nursing structured assessments based on Gordon's Functional Patterns, with the objective of analysing different nursing needs between individuals of all four subtypes of depressive disorders.

Information will be collected in only one day. First, the fMRI will be run. Afterwards, the sociodemographic questionnaire, the FHPAST and PHQ-9. The estimated time for the three questionnaires is 20 to 30 minutes.

Beforehand, interviewers will explain the data collection process to participants. A group meeting will be held to verify inclusion and exclusion criteria and informed consent (Appendix 4).

First, a sociodemographic questionnaire to acknowledge the basic context of the individuals, get to know who they are and their current experiences.

Secondly, clinical history revision, which will gather relevant information about the diagnosis, undergoing treatments and, in the near future, depression subtype classification.

Lastly, structured nursing interviews that will be individual with each participant to identify their needs. There will be a pre-established structured questionnaire that will allow participants to share their own living experiences with depressive disorder.

After all the data has been gathered, the data will be recorded properly and anonymised through identification codes to ensure privacy, but at the same time, reliability. Once transcribed and protected, all physical information will be eliminated.

In terms of ethics and data quality, during interviews there will be granted a welcoming, secure and comfortable environment so participants can feel free to express. Interviewer will embrace a neutral and empathic attitude, avoiding any prejudices and adapting language to each participant's profile. Hence, veracity and quality of information will be granted.

4.4.6. Data analysis

A descriptive analysis will be conducted. For quantitative variables, such as the scores obtained in the eleven Gordon's Functional Health Patterns, means and standard deviations (sd) will be calculated.

For qualitative variables, such as gender or treatment type, absolute frequencies and percentages will be reported. Absolute frequencies refer to the total number of individuals of a specific category, while percentages (%) indicate the proportion of people in relation to the total sample.

Secondly, a bivariate analysis will be performed to explore relationships between variables. For two qualitative variables, the Chi-square test will be used. When comparing quantitative variables with a dichotomous qualitative variable, the student's T-test will be run (Table 5).

After this initial analysis, a deeper analysis will be performed to address the main objective of the study.

For this project, a one-way ANOVA will be conducted for each of the eleven Gordon's Patterns. It must be considered that there are four groups (depression subtypes) classified as A, B, C, and D. And there are 11 Patterns that will provide an individual mean for each.

Basically, one-way ANOVA is useful when there is an independent variable with more than two groups. In this case, subtypes of depression are divided into four groups. This will allow determining whether there are statistically significant differences in mean scores for each pattern (66).

In this case, the hypotheses are as follows:

- Null hypothesis (H_0): There are no significant differences in mean scores across the subtypes of depression, meaning $\mu A = \mu B = \mu C = \mu D$.
- Alternative hypothesis (H_1): At least one subgroup mean has a significantly different mean from the others.

The alpha risk accepted will be set at 0.05. Once the calculus has been made, if there is a result which is significant ($p < 0.05$), a post-hoc test will be conducted to determine which specific group presents statistically significant differences.

This is by accepting that the assumption testing resulted correct. By assumption, it must be understood that ANOVA can be conducted when normal deviation has been checked along with independence of observations and homogeneity of variances.

This last one, homogeneity of variances, is perhaps the most important. It will be run utilising Levene's Test, and if this assumption is not valid (meaning $p < 0.05$ in this case), ANOVA cannot be conducted.

Instead, the Kruskal-Wallis test will be done instead, which is a unidirectional non-parametric alternative of ANOVA that allows acknowledging distribution in ranges within each group is significant.

Table 5. Data analysis of each variable. Source: Self-elaborated.

		VARIABLE	ANALYSIS
INDEPENDENT VARIABLES	MAIN	Depression subtype	ANOVA / Kruskal-Wallis
	Personal aspects	Age	Mean, sd, T-Test (gender)
		Gender	Frequency, %, Chi-square (subtypes)
		Educational level	Frequencies, %; Chi-square
		Employment status	Frequencies, %; Chi-square
		Marital status	Frequencies, %; Chi-square
		Living situation	Frequencies, %; Chi-square
		Social support perception	Frequencies, %; Chi-square
		Regular exercise	Frequencies, %; Chi-square/T-Student
	Depression aspects	Time with depression diagnosed	Mean, sd, ANOVA / Kruskal-Wallis
		Treatment type	Frequencies, %; Chi-square
		Duration of current treatment	Mean, sd, T-Test
		Treatment adherence perception	Frequencies, %; Chi-square
		Previous hospitalisation for depression	Frequencies, %; Chi-square
		Self-harming or a suicide attempt	Frequencies, %; Chi-square
		Family history of depression	Frequencies, %; Chi-square
DEPENDENT VARIABLES	Gordons Functional Patterns	Gordon's Functional Pattern 1	Mean, sd, ANOVA / Kruskal-Wallis
		Gordon's Functional Pattern 2	Mean, sd, ANOVA / Kruskal-Wallis
		Gordon's Functional Pattern 3	Mean, sd, ANOVA / Kruskal-Wallis
		Gordon's Functional Pattern 4	Mean, sd, ANOVA / Kruskal-Wallis
		Gordon's Functional Pattern 5	Mean, sd, ANOVA / Kruskal-Wallis
		Gordon's Functional Pattern 6	Mean, sd, ANOVA / Kruskal-Wallis
		Gordon's Functional Pattern 7	Mean, sd, ANOVA / Kruskal-Wallis
		Gordon's Functional Pattern 8	Mean, sd, ANOVA / Kruskal-Wallis
		Gordon's Functional Pattern 9	Mean, sd, ANOVA / Kruskal-Wallis
		Gordon's Functional Pattern 10	Mean, sd, ANOVA / Kruskal-Wallis
		Gordon's Functional Pattern 11	Mean, sd, ANOVA / Kruskal-Wallis
	PHQ9	PHQ-9 total score	Mean, sd, T-Student
		Depressive symptom severity	Frequencies, %; Chi-square

4.4.7. Procedure

To ensure the project follows a structured methodology, the following procedural steps have been established:

1. **Project proposal and institutional approval**
   Meetings will be held with the heads of the selected medical services to present the study proposal. Radiology and Nuclear Medicine of Hospital Josep Trueta, the selected CSMAs, and the psychiatry head of Hospital Santa Caterina. These meetings aim to produce interest and resolve preliminary doubts, and ensure the prosperity of the project.

2. **Submission to Ethics and Research Committees**
   The project will be formally submitted to the Ethics Committee of the Biomedical Research Institute of Girona Dr. Josep Trueta (CEIm IdiBGi), awaiting for its approval to begin (Appendix 5).

3. **Formal Presentation to Participating Institutions**
   Once the approval of the ethics committee is obtained, the project will be officially presented to the hospitals and healthcare centres. Meetings will be arranged with department heads to coordinate participant recruitment and select appropriate interview locations within the facilities.

4. **Participants Recruitment**
   Participants who meet the inclusion and exclusion criteria will be selected from the specific mental health care centres. Informed consent and information sheets will be provided to all participants. Coordination with all departments and rental of external equipment will be managed at this stage.

5. **Data Collection**
   On the same day, structured interviews will be conducted, along with the neuroimaging tests. Interviews will be scheduled on weekdays, with a maximum of 5 participants per day, ensuring that neuroimaging equipment availability is not disrupted, as more patients may need it. Each session is estimated to last approximately 1 hour.

6. **Data Organization and Anonymization**
   All collected data will be systematically organized, anonymized, and prepared for analysis.

7. **Neuroimaging Interpretation and Statistical Analysis**
   A radiologist specialized in neuroimaging will interpret the results of all brain scans. This analysis will be done daily, Monday to Friday, with an estimated 10 cases per day. Simultaneously, the data obtained from Gordon's Functional

Health Patterns will be analysed with the neuroimaging findings. Statistical tests will be run. Results will be stored, saved, and categorized for further interpretation.

8. **Report Writing**
   Once clinical data and neuroimaging results have been analysed, the findings will be interpreted, aiming to identify whether distinct needs, based on Gordon's Patterns, correlate with neuroimaging subtypes of depression. Finally, a report will be drafted in a scientific study format.

9. **Dissemination and Publication**
   Once finalized, the report will be submitted to a scientific journal. Additionally, each participating institution will receive a complete report summarizing the data relevant to their centre.

4.4.8. Ethical considerations

This research project will ensure that all ethical principles established for studies involving human participation are respected. Every participant will be informed about the study's objectives, procedures, its nature, and confidentiality measures, all throughout an informed consent document (Appendix 4). Exclusively, individuals who sign the informed consent will be included in the study. This study will be submitted for an entire review to the Ethics Committee of the Biomedical Research Institute of Girona Dr. Josep Trueta.

The project will comply with the ethical guidelines of the Declaration of Helsinki, referring to the basic ethical principles of medical studies with humans. Additionally, the General Data Protection Regulation law by EU 2016/679, as well as the Spanish Organic Law 3/2018 on the Protection of Personal Data and Guarantee of Digital Rights, and Spanish Law 14/2007 on Biomedical Investigation (67–70).

Furthermore, other specific legislation will be taken into consideration, as the ethical and deontological codes of the General Nursing Council and the norms of the Spanish Medical Radiological Society.

All data collected will be anonymized using coded identifiers, and no personal data will be published in the results or linked to the analysis. Data will be stored securely on protected devices only accessible to the research team. All physical materials will be destroyed upon digitalization. This study will ensure full respect for the dignity of participants, their privacy, and autonomy throughout the entire process.

4.4.9. Timeline

For this section, each number represents the number of the step in the "*Procedure*" part. So, Number 1 corresponds to the Project proposal and institutional approval (Table 6).

Table 6. Chronogram as a Gantt chart calendar representing the procedure of the project. Source: Self-elaborated.

	2026												2027						2028
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN - JUN	
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			

4.4.10. Budget

Table 7. Budget chart dividing into sub-categories the total costs of this project. Source: Self-elaborated.

ITEM	UNIT COST	NUM. OF UNITS	TOTAL
MATERIAL AND SUPPLIES			
Paper (500 sheets)	8,9€	7	**62,3€**
Paper printing	0.01€/page	3.330	**33€**
Pens (5 pack)	4,6€	4	**18,4€**
PERSONNEL			
Radiologist (640 hours)	12€/h	640 hours	**7.680€**
Research assistant (1620 hours)	12€/h	1620 hours	**19.440€**
EQUIPMENT AND SOFTWARE			
Laptop	In-kind	1	**0€**
Software	In-kind	1	**0€**
NEUROIMAGING			
Neuroimaging rent (4 months)	400€/day	40 days	**32.000€**
DISSEMINATION			
Translation service	250€	1	**250€**
Conferences presentation	500€	1	**500€**
Article publication	400€	1	**400€**
TRAVEL AND LOGISTICS			
Transport	250€	1	**250€**
TOTAL: 60.633,7€			

The personnel participating in the research team, who are not hired professionals, will not receive any additional compensation.

The neuroimaging machinery will be hired from Hospital Dr. Josep Trueta of Girona.

4.4.11. Clinical applications

This study presents useful applications in clinical practice, especially in the field of mental health nursing. By identifying different nursing needs in each subtype of depression using validated nursing tools and comparing them with neuroimaging results, the conclusions could help move forward toward more personalized and complete nursing care plans, considering the kind of support and intervention each patient may need.

This approach is particularly useful in nursing, where care plans are based on detecting actual and potential needs and adapting supports accordingly. By using validated tools, nurses can evaluate further aspects and dimensions of the person that may not be easy to observe. Nurses can assess what the patient's issues are related to and design care strategies that match those needs.

This model can support a better understanding of the patient's condition. When a nurse detects a low score, and knowing the depression subtype and its functionality, nurses can apply targeted strategies from the beginning to avoid worsening of the needs. Small changes and early detection of symptomatology may have a large impact on the person's recovery, improvement, and well-being.

Moving on, this type of assessment, involving different professionals, can help understand the patient through a biopsychosocial approach, abandoning the classic biological perspective, and integrating communication and care for all dimensions. Instead of working separately, professionals may work as an interdisciplinary team. Neuroimaging can offer information about what is happening in the brain, nurses' assessments can translate into real needs, and psychiatrists and psychologists may offer a solution to those needs, along with other professionals.

This study could also be used as a promotion for future clinical protocols in mental health, expanding its field not only to depressive disorders, but to any mental health disorder. Psychoradiology shows that brain function and anatomical structure are closely related to how patients experience and cope with depression. Whether nurses could include this knowledge into nursing protocols, mental health disorders addressing would make the care process evidence-based and personalized, avoiding generalizations mostly caused by the lack of diagnostic and treatment protocols.

This could eventually lead to new nursing care pathways depending on the type of depression and affected patterns, and even studying how to apply this to other mental health disorders.

In conclusion, this project offers a model to combine neurobiological understanding and nursing knowledge in order to improve patient care. It encourages more precise and personalized interventions, supports interdisciplinary communication, and

promotes the development of new protocols. Its applications may benefit not only nurses, but also all professionals involved in caring for people with depression, and all mental health disorders in the future.

4.4.12. Limitations

The main limitations of this project include, in the first place, that the field of psychoradiology is still quite emerging, and the current literature apparently cannot establish clear patterns and agree on the classification and standardization of neuroimaging findings in psychiatric disorders. As a result, establishing clear subtypes of depression based on neuroimaging tests is still a challenge. More consensus would bring some stability to neuropsychiatric classification.

Secondly, the nature of some data collected, such as PHQ-9 and FHPAST, even though they are validated tools, responses may be influenced by personal situations and subjectivity, such as cognitive distortion, insights, or social bias. Furthermore, the study cannot assure causality due to the relationship between neuroimaging studies and the identified nursing needs. The study merely explores the association at the very exact moment that tests are run. Follow-up tests and interviews could bring more variability to the responses, or, on the contrary, prove the stable nature.

Lastly, due to the lack of prior research, specifically integrating both neuroimaging and Gordon's Patterns, this project may require future validation replicating in larger and more diverse samples. The study is limited to a specific geographic area that, even with hardly one million people, may not represent broader populations.

It does not intend to establish a causal relationship or test the effectiveness of specific interventions, but rather to get data and describe differences in nursing assessments across depression subtypes. Hence, and to achieve this, nursing evaluations will be conducted based on Gordon's Patterns and tests to determine their dysregulations and needs.

5. APPENDICES

5.1. APPENDIX 1: Sociodemographic self-assessment questionnaire

Source: Self-elaborated

SOCIODEMOGRAPHIC QUESTIONNAIRE

Patient ID:

Date:

Interviewer ID:

Answer the following questions about your current situation as accurately as possible.

Personal aspects

1. How old are you? _____ years.

2. With what gender do you identify? Please, mark only one.

☐ Male

☐ Female

☐ Non-binary

☐ Other (specify): _____.

3. What is your highest educational level achieved? Please, mark only one.

☐ No studies

☐ Primary school

☐ Secondary education

☐ Professional training

☐ University studies and higher education

4. What is your current employment status? Please, mark only one.

☐ Full-time job

☐ Part-time job

☐ Unemployed

☐ Student

☐ Retired

☐ Unfit for work

5. What is your marital status? Please, mark only one.

☐ Single
☐ In a relationship
☐ Married
☐ Separated/Divorced
☐ Widowed
☐ Other (specify): _____.

6. Who do you live with? Please, mark only one.

☐ Alone
☐ With my partner
☐ With my children
☐ With other family members
☐ With housemates
☐ Other (specify): _____.

7. Do you practice regular exercise, at least 30 minutes 3 times a week?

☐ Yes

☐ No

8. How would you rate the emotional support you receive from your environment?

☐ None
☐ Low
☐ Moderate
☐ High
☐ Very high

Depression related aspects

9. How much time, in months, have you been depression-diagnosed?

_____ months.

10. Are you currently receiving any treatment for the depression? You can check more than one option.

☐ No

☐ Pharmacological treatment

☐ Psychotherapy

☐ Alternative therapies (yoga, others)

☐ Other (specify): _____.

11. How long, in months, have you been with your current treatment?

_____ months.

12. How would you rate your perception of your treatment adherence?

☐ Very low
☐ Low
☐ Medium
☐ High
☐ Very high

13. Have you ever been hospitalized because of your depression?

☐ Yes

☐ No

14. Have you ever tried to self-harm or attempt to suicide?

☐ Yes

☐ No

15. Are there any family records of depression in your family?

☐ Yes

☐ No

5.2. APPENDIX 2: Functional Health Pattern Assessment Screening Tool scale sheet

Adapted from: Source (64)

FUNCTIONAL HEALTH PATTERN ASSESSMENT SCREENING TOOL

Patient ID:

Date:

Interviewer ID:

Read the following instructions carefully and ask your interviewer for any questions. Follow the directions until you have completed the questionnaire.

"This questionnaire contains statements about your present way of life or personal habits. Please respond to each item as accurately as possible and try not to skip any items. Indicate the frequency with which you engage in each behaviour by marking an X. N for Never, S for Sometimes, F for Frequently, A for Always."

QUESTION	N	S	F	A
I have enough energy to complete my everyday activities				
I do aerobic exercise at least 20 minutes three or more times a week				
I feel rested when I wake up				
I feel good about myself				
I can handle the stress in my life				
I have someone to talk to when I need help or support				
Religious or spiritual practices give meaning to my life				
I feel comfortable with my sexuality				
My health is important to me				
I can make changes in my lifestyle to improve my health				
I limit my daily intake of fat on purpose				
I feel comfortable with my weight				
I heal/recover/get better easily				
I fall asleep without difficulty				
I am hopeful about the future				
I feel in control of my life				
I like my physical appearance				
I feel good about the decisions I make				
I am satisfied with my ability to resolve problems				
I get help immediately when there are changes in my health				
I am able to adjust to life changes				
I go for an annual health check-up				

I can follow the recommendations of my nurse or doctor				
I wear my seat belt in the car				
I stay out of the sun, or I use sunscreen				
I am in excellent health				
I am happy with my life				
I can hear clearly				
I can concentrate for a long period of time				
I can understand new information easily				
The life choices I make coincide with my principles or values				
I eat 5 to 6 servings of fruit and vegetables a day				
I drink 6 to 8 glasses of water a day				
I am satisfied with what I do at work				
I am comfortable with the role I play in my family				
I am satisfied with my social life				
I feel comfortable expressing my feelings and emotions				
I feel like I can communicate easily				
I have a standard routine that I use to help myself relax				
I consider myself healthy				
It is a burden for me to participate in the activities necessary to take care of family members				
I have pain that interferes with my daily activities				
I feel stress, tension or pressure				
I have difficulty urinating				
I have trouble defecating				
When I drink alcohol, wine or beer, I feel guilty				
I use drugs				
I smoke cigarettes				
I have difficulty with my vision				
My physical ability limits my daily activities				
I have difficulty controlling my temper				
I feel unusual physical symptoms when I walk				
I worry a lot				
I feel in danger of getting hurt physically				
I feel physically unwell when I am under stress				
I have family problems that I find difficult to handle				
I fear for my safety				
TOTAL				

5.3. APPENDIX 3: Nine-item Patient Health Questionnaire scale sheet

Adapted from: Source (65).

NINE-ITEM PATIENT HEALTH QUESTIONNAIRE

Patient ID:

Date:

Interviewer ID:

Read the following instructions carefully and ask your interviewer for any questions.
Follow the directions until you have completed the questionnaire.

"Over the last 2 weeks, how often have you been bothered by any of the following problems? Please respond to each item as accurately as possible and try not to skip any items. Indicate the frequency with which you engage in each behaviour by marking an X. N for Never, S for Sometimes, F for Frequently, D for Nearly daily."

QUESTION	N	S	F	D
Little interest or pleasure in doing things				
Feeling down, depressed, or hopeless				
Trouble falling or staying asleep, or sleeping too much				
Feeling tired or having little energy				
Poor appetite or overeating				
Feeling bad about yourself or that you are a failure or have let yourself or your family down				
Trouble concentrating on things, such as reading or watching television				
Moving or speaking so slowly that other people could have noticed. Or the opposite, being so fidgety or restless that you have been moving around a lot more than usual				
Thoughts that you would be better off dead, or of hurting yourself				
TOTAL				

Score	Severity of depression
0 to 4	No risk
5 to 9	Mild
10 to 14	Moderate
15 to 19	Moderately severe
20 to 27	Severe

5.4. APPENDIX 4: Information sheet and informed consent to participate in this project

Source: Self-elaborated.

PARTICIPATION INFORMATION SHEET

Information sheet for the participant

TITLE: Assessment of Functional Health Patterns in Subtypes of Major Depressive Disorder Using Neuroimaging-Based Classification
PRINCIPAL INVESTIGATOR:
CONTACT INFORMATION: xxxx@xxxx.com

Introduction

You are being invited to participate in a research study that explores the relationship between different subtypes of Major Depressive Disorder (MDD), defined by neuroimaging, and the functional health needs identified through nursing assessment models.

Before you decide whether or not to take part, it is essential that you understand the purpose of the study, what your participation would involve, and how your rights and privacy will be protected throughout the process.

Importance of this project

This research is part of a project which aims to support the development of more personalized care plans for individuals experiencing. Your contribution could help us understand how different types of depression impact daily life, and how nursing professionals can improve the care they provide by detecting specific health patterns earlier and providing better nursing interventions.

Assignments

Should you agree to take part in this study, you will be asked to answer three questionnaires and undergo an fMRI. These include a sociodemographic form, the PHQ-9 (Patient Health Questionnaire), and the FHPAST (Functional Health Pattern Assessment Screening Tool). The entire process is expected to take between 30 and 45 minutes and can be done in a private and quiet facility.

Voluntary participation

Your participation in this research is entirely voluntary. You are under no obligation to take part, and if you choose to participate, you may withdraw at any point, without explanation and with no impact on your medical care. There are no direct risks or harms associated with this study. However, since the questions relate to your health and personal experience with depression, you could feel emotionally sensitive.

Confidentiality and privacy

The information you provide will be treated with the strictest confidentiality. All data will be anonymized and stored securely, and your name will never appear in any results, publications, or presentations. Data will be managed in accordance with the European General Data Protection Regulation (EU Regulation 2016/679) and the Spanish Organic Law 3/2018 on the Protection of Personal Data and Guarantee of Digital Rights. Only the research team will have access to the data, which will be destroyed after the study concludes.

This project has been reviewed and approved by the corresponding Research Ethics Committee, ensuring that it complies with the ethical standards protected in the Declaration of Helsinki, which implies research involving human participants worldwide.

Compensation

Your participant will not receive any kind of compensation, as it is fully voluntary. However, your participation will be greatly welcomed and could enormously help to make a great leap in improving mental health care.

Should you have any questions or concerns at any point during the study or wish to receive further clarification, you are invited to contact the principal investigator at the email address provided above.

Your time and contribution to this research are deeply appreciated. Thank you for considering your participation. Kindly,

[PRINCIPAL INVESTIGATOR SIGNATURE AND NAME]

INFORMED CONSENT SHEET

STUDY TITLE: Assessment of Functional Health Patterns in Subtypes of Major Depressive Disorder Using Neuroimaging-Based Classification

PRINCIPAL INVESTIGATOR:

CONTACT INFORMATION: xxxx@xxxx.com

I, (full name) _____, with ID _____ declare that:

- I have read and understood the participant information sheet regarding the study.
- I have had the opportunity to ask any questions about the purpose, procedures, and potential consequences of participating, and all my questions have been answered to my satisfaction.
- I understand that my participation is entirely voluntary and that I am free to withdraw from the study at any time without the need to give any reason.
- I am also aware that all data will be treated anonymously and confidentially, and that no identifying information will be made public at any point during or after the study.

I will receive a signed copy of this informed consent. I freely give my agreement to participate in the study and give my consent for the access and use of my data under the conditions detailed in the information sheet.

By signing this form, I confirm that I agree to participate in this research study under the conditions stated above.

Your signature: Investigator signature:

Place and date:
_____, __ of _____ of 2026

REVOCATION OF INFORMED CONSENT

I, (full name) _____, with ID _____, hereby revoke the previously given consent to participate in the study.

Your signature:

_____, __ of _____ of 2026

5.5. APPENDIX 5: Formal request letter for submission to the Ethics Committee of Biomedical Research

Adapted from: Source (71).

SOL·LICITU DE REVISIÓ

Benvolguts membres del Comitè d'Ètica d'Investigació amb Medicaments (CEIm),

Adjunto la documentació corresponent per a la **sol·licitud de revisió ètica del projecte de recerca** següent: Assessment of Functional Health Patterns in Subtypes of Major Depressive Disorder Using Neuroimaging-Based Classification.

Codi oficial de l'estudi:
Número EudraCT:

Documents presentats per a la seva revisió al CEIm:

- Full d'informació al participant
- Consentiment informat
- Protocol complet de l'estudi
- Pressupost estimat
- Model de qüestionaris utilitzats (PHQ-9, FHPAST, qüestionari sociodemogràfic)

En cas que sigui necessari ampliar la informació o facilitar documentació addicional, el CEIm pot adreçar-se a:
Nom i cognoms de l'investigador/a principal:
Telèfon de contacte:
Adreça:
Correu electrònic:

Cordialment,
Nom i cognoms de l'investigador/a principal:

Girona, __ de/d'_____ del 2026