

Moral judgements in obsessive-compulsive disorder: a narrative mini-review

Mehrnaz Hosseinzadeh, Elma Azhdehakosh and Adib Valibeygi *

Fasa Neuroscience Circle (FNC), Student Research Committee, Fasa University of Medical Sciences, Fasa, Iran.

* Correspondence: a.valibeygi@fums.ac.ir ; Tel.: +98-916-208-4125

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ABSTRACT: Obsessive-compulsive disorder (OCD) is a prevalent mental disorder characterized by intrusive thoughts (obsessions) and ensuing rituals (compulsions). Although OC patients exhibit various cognitive and behavioral problems, rigid and hypersensitive moral judgments are known to be one of the most striking problems in these patients. There is evidence indicating that OC patients often tend to make deontological judgments in moral dilemmas, significantly more than the healthy population. Therefore, numerous studies are dedicated to understanding the underlying cognitive processes responsible for such variation of moral judgments in OCD, which are reviewed and discussed in the current paper. First, it is previously discussed that abnormal moral judgments in OCD are due to executive dysfunctions. These dysfunctions include impaired cognitive control resulting in the domination of strong, uncontrolled emotional responses, impaired cognitive flexibility resulting in the inability to switch between aspects of a scenario, and decreased capacity and overload of working memory and its inability to resist the interfering information. The dual-process theory also emphasizes and acknowledges the role of executive functions in moral judgments. Second, it is thought that disobeying moral norms results in the abnormal feeling of deontological guilt in OC patients, to which these patients are highly sensitive. Feeling of guilt is also thought to be correlated with OCD symptomatology. The third impairment contributing to abnormal moral judgments in OCD is known to be the abnormal feeling of disgust for moral violations and immoral unwanted intrusive thoughts, which is regarded as one of the major causes of OCD symptoms. Finally, the abnormal fear of responsibility and being criticized due to not acting morally is regarded as one of the primary impairments contributing to the abnormal moral judgments in OCD. In conclusion, this review sheds light on the most striking cognitive and affective impairments contributing to abnormal moral judgments in OCD.

Keywords: moral judgments; moral decision making; obsessive-compulsive disorder; executive function; dual-process theory

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1.0 INTRODUCTION

Obsessive-compulsive disorder (OCD) is a common mental disease which brings up the patient with unwanted intrusive thoughts. These patients show a

faulty appraisal of intruding thoughts (obsessions) that results in compulsory rituals, such as washing or checking behaviors. Based on the Diagnostic and Statistical Manual of Mental Disorders Fifth Edition

(DSM-5), despite the overlapping symptoms which OCD shares with depression and anxiety disorders, the distinct features of OCD and related disorders make it a separate class of mental disorders ([American Psychiatric Association, 2013](#); [Freeston et al., 1996](#)).

A well-functioning social group is dependent on the appropriate judgment of the morality of behaviors to shape and ensure effective interactions ([Guglielmo, 2015](#)). Numerous studies have investigated the quality of life and functional impairments in OCD patients, indicating significant impairments in work, social, and family life compared to healthy subjects. OCD patients especially have more difficulty in social interactions including making new friends and being among a group of strangers ([Piacentini et al., 2003](#)). Human complex social systems rely on two important components: an integrative system of rules, values and moral norms, and complex culture of practicing and reinforcing these norms such as blame, inculcation, praise, and reconciliation ([Voiklis et al., 2017](#)). The underlying social cognitive processes, including the feeling of guilt, responsibility, disgust, reward learning, valuation, empathy, caring and justice sensitivity, are fundamental for sculpturing and maintaining this complex moral network. These processes are found to be influenced by normal and pathological variations ([Yoder et al., 2018](#)). Such variations may help explain observed impairments in social interactions and the integration of psychopathically affected individuals, particularly OCD patients.

Cognitive therapy is among the various treatments employed for dealing with OCD. Adopting a suitable cognitive therapy procedure requires a thorough understanding of cognitive and behavioral models. Various terms are utilized for evaluating OC symptoms from the cognitive aspect, including cognitive flexibility and working memory, which are reviewed and discussed in the present study ([Twohig et al., 2006](#); [Wilhelm et al., 2005](#)).

One of the other discussed OCD topics is the potential relevance between OCD and different types of emotions such as fear ([Freeston et al., 1996](#)), anxiety ([Obsessive Compulsive Cognition Working Group, 1997](#)), guilt ([Melli et al., 2016](#)), and disgust ([Stein et al., 2010](#)) which can influence moral judgments. Generally, emotions are considered as internal intruding experiences that OCD patients face. Anxiety and fear have been accounted for as the main emotions involved in OCD ([Chiang & Purdon, 2019](#)). Also, despite the increasing focus on

guilt and disgust among the recent studies, there are associations with OCD that remain to uncover.

In the present review, we focus on the most striking aspects of distorted cognitive processes in OC patients, which cause their abnormal behavior in moral decision making. We searched PubMed and Google Scholar using keywords: “obsessive-compulsive disorder,” “moral judgments,” “cognitive flexibility,” “working memory,” “cognitive control,” “responsibility,” “disgust” and “guilt.” We had no limitation of publication year in the literature search, but most of the papers we considered were published in recent ten years. To improve the quality of the review, we focused on the papers published by reputable international journals.

2.0 NEUROBIOLOGICAL BASIS OF OCD

Cortico-striato-thalamo-cortical (CSTC) circuit is known to be one of the most important neural circuits involved in the neurobiology of OCD. It is previously discussed that hyperactivity of this circuit, including anterior cingulate and orbitofrontal cortices (OFC), anterior thalamus, and striatum, is correlated with the severity of OCD symptoms ([Huey et al., 2008](#); [Pittenger et al., 2011](#)). Also, decreased activity of Dorsolateral Prefrontal Cortex (DLPFC) (which is known to be involved in working memory) is observed in OCD patients ([Gaikwad, 2014](#); [Saxena et al., 1998](#)).

On the other hand, there is evidence of anatomical and structural differences between the brains of patients with OCD and healthy individuals, including increased caudate nucleus grey matter volume, bilateral increase of putamen size, decrease of left anterior temporal lobe, and decrease of right middle temporal gyrus volume in patients with OCD, as revealed by Voxel-based morphometry studies ([Besiroglu et al., 2011](#); [Pittenger et al., 2011](#); [Radua et al., 2010](#)). It is noteworthy that increased caudate nucleus grey matter volume is specific to OCD, but not other anxiety disorders ([Pittenger et al., 2011](#)).

Many studies are devoted to understanding the pathophysiological basis of OCD. It is suggested that serotonin plays a considerable role in this disorder and serotonergic circuits contribute to symptomatology of OCD. This is why Selective Serotonin Reuptake Inhibitors (SSRIs) are widely used as a treatment for OCD ([Greenberg et al., 1997](#); [Gaikwad, 2014](#); [Pittenger et al., 2011](#)). However, the precise mechanism of their action remains unknown and requires further investigations. Glutamate, an important neurotransmitter of the CSTC

circuit, has also drawn considerable attention in terms of the role of its dysregulation in the pathogenesis of OCD. This neurotransmitter is believed to serve a causal role in the onset of OCD ([Pittenger et al., 2011](#)).

It is discussed that OCD risk has a significant association with polymorphism and mutations in some genes, including serotonin transporter and glutamate related genes ([Nestadt et al., 2010](#)). Additionally, it is shown that more than half of the children with OCD have first degree relatives with this disorder ([Gaikwad, 2014](#)). Therefore, OCD is remarkably associated with genetic factors, but still, further investigations are required to identify the exact role of these mutations in prevalence and risk of OCD.

Regarding the neurobiological and pathophysiological basis of OCD, several treatments are currently being used. Cognitive-behavioral therapy and pharmacological therapy (e.g., administration of SSRIs) are the commonly used treatments ([Gaikwad, 2014](#); [Pittenger et al., 2011](#)). In severe refractory cases, neurosurgical interventions, including Deep Brain Stimulation (DBS) ([Greenberg et al., 2010](#)) and anterior cingulotomy ([Gaikwad, 2014](#)), would be beneficial.

3.0 MORAL JUDGMENTS IN PATIENTS WITH OCD

There are several lines of evidence suggesting that OC patients usually prefer deontological over utilitarian judgments while facing moral dilemmas. In other words, they often focus on doing the right action (e.g., deontological view), rather than achieving the best outcomes. Conversely, compared to OC patients, healthy individuals have more tendency to focus on increasing overall happiness, decreasing overall suffering, and generally achieving the best outcomes (e.g., utilitarian view) ([Mancini & Gangemi, 2015](#); [Whitton et al., 2014](#)). OC patients adhere to moral norms more strictly, so they prefer to violate altruistic and utilitarian principles, but not moral norms and rules ([Mancini & Gangemi, 2015](#); [Whitton et al., 2014](#)). This moral rigidity and hypersensitive moral judgment, which is not seen in the healthy population, reflects impaired cognitive processes in these patients. Several investigations reported the underlying mechanisms and cognitive processes responsible for such altered judgments, particularly in moral dilemmas. There are neuroimaging studies that have focused on the neural basis of distorted cognition in OCD patients. One of these studies, recruiting fMRI, revealed increased activity of medial OFC, left DLPFC and middle temporal gyrus in OCD patients ([Harrison et al., 2012](#)). Nonetheless, there are yet more brain regions believed

to be associated with OCD pathogenesis that will be reviewed in the next sections.

In the following section, we discuss various ethical points of view and how they matter in understanding the mental processes of moral decision making in OC patients.

4.0 UTILITARIAN AND DEONTOLOGICAL JUDGMENTS

There are two well-known and frequently used moral dilemmas that can distinguish utilitarian and deontological thinking: the footbridge dilemma and the switch dilemma. Footbridge dilemma is defined as follows:

A trolley is heading toward five workmen working on a track. If the trolley proceeds its way, it will run over these five workmen and kill them. There is also a footbridge spanning the track with a heavy person standing on it. The only way to rescue the five workmen on the track is to push the heavy person off the footbridge. The trolley will run over and kill him, but his heavy body will stop the trolley from proceeding its course, and the five workmen will be saved.

This dilemma, which is a personal dilemma ([Greene & Haidt, 2002](#)), asks an individual whether it is morally permissible to sacrifice one person (by direct physical contact) to save five or not. Studies show that most people tend to disagree ([Greene et al., 2001](#)). It means that people will not allow killing one person deliberately in this manner, even if this course of action saves more lives. In other words, they mostly focus on the unpleasant action of killing one person deliberately, rather than the overall beneficial outcomes. This is known as the deontological point of view. Switch dilemma is defined as follows:

A trolley is headed toward five workmen working on a track. If the trolley proceeds its way, it will run over these five workmen and kill them. But there is also an alternate track for the trolley, on which one workman is working. The only way to save five workmen is hitting a switch, which redirects the trolley toward only workman working on the alternate track leading to his death but rescuing five other workmen.

This dilemma also asks an individual whether it is morally permissible to sacrifice one person to save five but in a different course of action than the footbridge dilemma. Previous studies have shown that most

people say yes ([Greene et al., 2001](#)). Indeed, in the switch dilemma, which is an impersonal dilemma ([Greene & Haidt, 2002](#)), most people prefer to follow utilitarianism principles, which means that they agree to save five at the expense of one.

As explained above, both footbridge and switch dilemma evaluate the moral permissibility of sacrificing one life to save five. While most responses to the former are deontological, responses to the latter are often utilitarian. This discrepancy is well explained by Waldmann and Dieterich ([Waldmann & Dieterich, 2007](#)). They used a scenario in which a bomb is about to explode and kill 9 people. There were two variants of this scenario. In the agent-intervention variant, individuals were asked whether it is morally acceptable to throw a bomb in a place where one person will be killed. In the patient-intervention variant, they were asked whether it is morally acceptable to push a person on the bomb, leading to his/her death but saving 9 people. Interestingly, they observed that most people think it is morally acceptable to throw the bomb leading to kill one and save 9, while it is not morally acceptable to push a person on the bomb, leading to the same result. They introduced the term “intervention myopia” for this phenomenon. It means that when individuals focus on the locus of the intervention, they tend to neglect the background happenings. When one is focusing on throwing a person on the bomb, he/she will pay less attention to the outcomes outside the attention focus (e.g., saving 9 people). Thus, this action would be considered to be immoral. Conversely, in the agent-intervention condition, the locus of attention is an object (bomb), not a person, leading individuals to a different judgment ([Nakamura, 2012](#); [Waldmann & Dieterich, 2007](#)).

This is also the case in the switch and footbridge dilemmas. They both have the same outcome, but people prefer to take action in the switch, but not footbridge dilemma, because in the former the locus of attention and action is an agent (e.g., the switch), while in the latter the locus of attention and action is a person (e.g., the victim). When focusing on a victim, deontology is preferred, while when focusing on an object, utilitarianism is preferred. What matters is the causal path and the locus of attention, while the background happenings and outcomes are less considered ([Nakamura, 2012](#); [Waldmann & Dieterich, 2007](#)). People also prefer indirect to direct harm. In the

footbridge dilemma, the harmful action is taking place directly and with physical contact on a victim, without asking for consent, which violates moral norms ([Nakamura, 2012](#); [Waldmann & Dieterich, 2007](#)). Emotional engagement is also another determinant factor accounting for this difference. It is argued that pushing someone off the bridge leading to her/his death evokes stronger emotional responses compared to just hitting a switch ([Greene et al., 2001](#)).

5.0 COGNITIVE IMPAIRMENTS CONTRIBUTING TO ABNORMAL MORAL JUDGMENTS IN OC PATIENTS

In order to investigate moral judgment as a complex form of decision-making, there are lots of factors and components worth considering. In this study, we aim to establish a synthetic model of cognitive and affective components contributing to moral judgment in OCD patients (Figure 1).

5.1 Executive functions

Executive functions are among very important cognitive processes that underlie selecting, modifying, and controlling behavior in response to information and make the behavior more goal-directed. There are several basic executive functions, including inhibitory cognitive control, cognitive flexibility, and working memory. A handful of studies indicate executive function impairment in neuropsychological disorders, including OCD ([Baddeley, 1986](#); [Baddeley & Hitch, 1974](#)).

5.1.1 Inhibitory cognitive control and emotional response

“Dual-process theory” suggests that two distinct processes, controlled cognitive and automatic emotional processes, are involved in moral judgments. According to this theory, automatic emotional responses to dilemmas are associated with propensity for deontological options, while controlled cognitive responses are associated with favoring utilitarian options ([Greene, 2009](#); [Greene et al., 2001](#); [Lieberman et al., 2002](#)). Therefore, the domination of automatic emotional responses over-controlled cognitive processes leads to favoring deontological options. Conversely, to make a utilitarian judgment, emotions should be suppressed, and non-emotional controlled cognitive processes should override automatic emotional responses. Therefore, impairments in such inhibitory cognitive control result in a higher propensity for deontological judgments. Since many of

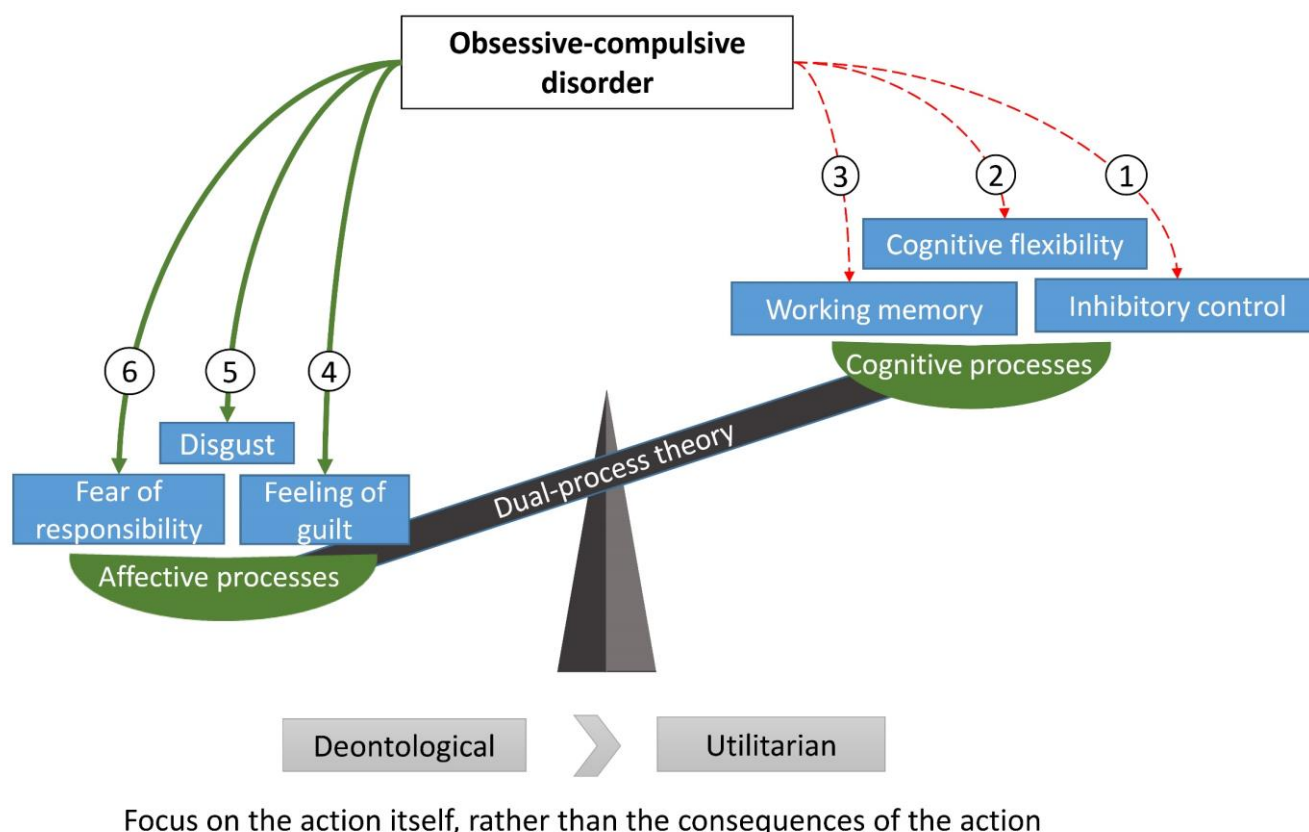


Figure 1. In this synthetic model, the moral consequences of Obsessive-Compulsive Disorder (OCD) are illustrated. **1.** Impaired inhibitory control causes uncontrolled emotional responses to overcome non-emotional processes, leading to more propensity for deontology (Greene et al., 2008). **2.** Cognitive inflexibility makes it difficult for OC patients to divert their center of attention from the action to its consequences. **3.** Working memory overload or dysfunction will lead to impulsive decision making. **4.** Patients with OCD have abnormal guilt processing. They have more sensitivity to deontological guilt rather than utilitarian. **5.** OCD patients have an intense feeling of disgust for immorality, which makes them morally sensitive. **6.** OCD patients have an inflated sense of responsibility, which evokes fear emotions and interferes with moral judgments. Taken all together, patients with OCD have more propensity for deontological moral judgments in morally charged situations.

the moral scenarios presented to subjects involve the death of one or more persons, such scenarios evoke strong emotional responses in subjects that might interfere with non-emotional cognitive processes. This point of view suggests that patients with OCD, who are characterized by a higher tendency for choosing deontological options, suffer from inflated emotional responses and deficits in inhibitory cognitive control (Greene et al., 2004; Whitton et al., 2014). Also, Whitton *et al.* showed that OC patients are more rigid compared to healthy individuals in impersonal dilemmas. This observation suggests more emotion-driven judgments of OC patients in the context in which less emotional response is expected (Whitton et al., 2014).

A recent fMRI study in a resting state imaging has demonstrated that OCD patients have relatively impaired functional connectivity of the amygdala to some other brain regions, including insula. It is argued

that this impairment in emotion regulation systems contributes to abnormal emotional processing in OCD patients (Picó-Pérez et al., 2019).

5.1.2 Cognitive flexibility

Another significant executive function is cognitive flexibility. One aspect of cognitive flexibility is the notion that in order to make a utilitarian decision, one should switch her/his attention from the action to the consequences of the action (Greene et al., 2008; Whitton et al., 2014). Switching focus between two different aspects of a scenario requires cognitive flexibility, which is impaired in OC patients (Benzina et al., 2019; Bigdeli et al., 2017; Sahin et al., 2018). Thus, they are incapable of switching their attention from the action to the outcomes of the action. This inability leads to more than usual focus on the action, which often has a negative affective load, and lower focus on the outcomes. Therefore, reduced cognitive flexibility

predicts a higher propensity for deontological judgments ([Whitton et al., 2014](#)). A recent neuroimaging study, recruiting resting-state fMRI, has revealed that dysfunction of the connectivity between dorsal caudate and salience network, including the anterior insula and dorsal ACC, is related to impaired cognitive flexibility in OCD patients. However, whether this functional impairment has a causal role in the development of OCD is yet to be determined ([Tomiyama et al., 2019](#)).

5.1.3 Working memory

Working memory is a key element in our daily lives in behaving, thinking, reasoning, writing, and perceiving. It was first defined by Baddeley as a cognitive process to temporarily store and manipulate information in order to guide our behavior. In other words, it can be regarded as a temporary workspace to store pieces of new information, reach long-term memory, mix and manipulate information and process them to guide the behavior toward goals ([Baddeley, 1986](#); [Baddeley & Hitch, 1974](#)).

Despite the lack of an integrative conclusion on executive functions in OCD, there is a hypothetical abnormality in cortico-basal-ganglia-thalamo-cortical loops (CBGTC loops) which involves impaired recruitment of striatum. Unless the quite same performance in different declarative and non-declarative memory tasks among OCD patients and control subjects, neuroimaging studies reveal that OCD patients might use the hippocampus which is involved in explicit learning to compensate deficit in striatum-related or implicit memory ([Maia et al., 2008](#)). More importantly, DLPFC, which is the major brain region known to play a significant role in working memory, is found to have altered activity in OCD. While some studies indicate decreased DLPFC activity in OCD patients ([Gaikwad, 2014](#)), another finding does not agree ([Harrison et al., 2012](#)). Therefore, more studies are required to resolve or explain this contradiction. Thus, there is a subtle deficit in complex non-verbal working memory tasks, as has been shown in several other studies ([Deckersbach et al., 2002](#); [Jaafari et al., 2013](#); [Purcell et al., 1998](#)). This explanation is consistent with obsessions as hyperawareness of their actions and pathological overload of working memory which may be feeble in resisting the interfering information, as an important function of intact working memory ([Barkley, 1997](#)), and also compulsions which can be regarded as striatum-dependent habit learning system overload and maladaptive use ([Maia et al., 2008](#)). The concept of working memory impairment in OCD was also tested in

the neurocomputational approach, and [Verduzco-Flores et al. \(2009\)](#) model of working memory was promising in explaining the symptoms of OCD ([Maia & McClelland, 2012](#)).

Previously discussed dual-process theory that was well investigated in moral decision-making by [Greene \(Greene et al., 2004\)](#) can be associated with moral decision making in the way that personal dilemmas provoke a more emotional response, but impersonal dilemmas acquire more deliberative reasoning and working memory. This concept is consistent with studies that indicate people with high working memory capacity are more rational (decision making based on situation and consequences of action, known as utilitarian), better in overcoming salient emotional response, and their reaction time is longer than other groups, showing involved deliberative reasoning ([Frankenstein, 2016](#); [Moore et al., 2008](#)). It is discussed that the relationship between moral reasoning ability and working memory is more accurate than its relationship with age ([Gibbs, 2019](#)). The other important reason for how moral development can be associated with working memory when an investigation is performed on its bidirectional relation with social development which is the fundamental component of moral learning and reinforcement ([de Wilde et al., 2016](#)). A study by [Hinson et al.](#) on delay discounting process showed that overloaded working memory due to either rich information scenarios or reduced working memory capacity would lead to impulsive decision making which in case of moral decision making would be the deontological approach ([Hinson et al., 2003](#)). In pursuit of developing a framework on how human does moral judgments and particularly how this complex system develops, [Garrigan et al.](#) developed the Social Information Processing-Moral Decision-Making (SIP-MDM) framework, that was designed to incorporate almost every related component of moral maturation and moral decision making, working memory as one of the most important executive functions which are shown to affect appropriate moral maturation. They regard working memory as one of the critical components in moral development ([Garrigan et al., 2018](#)).

5.2 Feeling of guilt

The feeling of guilt plays a critical role in moral decision making. Deontological guilt points to the notion that one should not violate the moral norms ([Basile & Mancini, 2011](#); [Sunstein, 2005](#)). For example, in the case of the footbridge dilemma, the feeling of deontological guilt does not permit to push the person off the bridge

since killing a person in violation of a moral norm, regardless of the consequences and benefits of this action. It is also said that you do not have to play God: "Who are you to decide who dies and who remains alive?" Therefore, refraining from killing one person in order to adhere to moral norms and the rule of "Do not play God" are considered as ways to avoid the feeling of deontological guilt ([Mancini & Gangemi, 2015](#); [Sunstein, 2005](#)). On the other hand, altruistic guilt points to the feeling of guilt, due to not sharing others unpleasant fate, even if no moral rule is disobeyed ([Basile & Mancini, 2011](#)). As previously discussed, OC patients are more sensitive to deontological guilt than non-OCD individuals, so they decide to avoid this feeling (e.g., they prefer inaction to action) ([Mancini & Gangemi, 2015](#)).

To identify the underlying brain dysfunctions accounting for abnormal guilt processing in OC patients, Basile *et al.* (2014) carried out an fMRI study. First, they found that OC patients are more sensitive to deontological guilt, which is in line with previous findings. Secondly, compared to the control group, patients with OCD showed decreased activity in some brain regions, including ACC and insula, which are involved in deontological guilt processing while they were presented with a guilt stimulus, especially deontological. It is consistent with the neural efficiency hypothesis, which explains that frequent activation of a brain network might result in increased efficiency and therefore, decreased intensity of response to stimuli. Similarly, in the case of OCD, related brain networks are repeatedly activated due to guilt stimuli, resulting in the down-regulation of their activity ([Neubauer & Fink, 2009](#)).

Moreover, there is evidence supporting the association between OCD symptoms and feelings of guilt. It was demonstrated that washing behavior in OCD patients is associated with the sense of not only physical but also mental cleansing. Reuven *et al.* (2014) carried out a study in which healthy individuals and OC patients were asked to write about an immoral act they have had before. Then, some of them were asked to wipe their hands. Surprisingly, it was observed that subjects, especially OC patients, were less likely to help others in return of nothing when they had wiped their hands. Likewise, subjects who had not washed their hands showed more tendency to help. Reuven *et al.* also showed that hand wiping, especially in OC patients, is associated with subsiding unpleasant moral emotions (e.g., guilt, disgust, regret). This indicates that hand washing relieves the feeling of guilt. Taken together,

they concluded that OC patients assign the physical cleansing to spiritual and mental cleansing and it relieves their feeling of guilt. This effect, however, was not limited to washing obsession patients ([D'Olimpio & Mancini, 2014](#); [Reuven et al., 2014](#)). Besides, the induction of deontological guilt is accompanied by increased washing and checking behaviors, which are known as typical OCD symptoms, significantly more than altruistic guilt induction. These results provide further evidence for the correlation between OCD symptomatology and the feeling of deontological guilt ([D'Olimpio & Mancini, 2014](#); [Trafford et al., 2018](#)).

5.3 Feeling of disgust

Disgust is defined as the intense feeling of revulsion or aversion for unpleasant stimuli. The correlation between OCD and disgust is investigated and endorsed by several studies ([Bhikram et al., 2017](#); [Inchausti et al., 2015](#)). It is proposed that symptoms of OCD are highly driven by the feeling of disgust to stimuli, suggesting a causal role for disgust in OCD symptomatology. The feeling of disgust may be attributed to contaminations (which account for washing rituals) or moral violations (which account for moral rigidity) ([Bhikram et al., 2017](#); [Olatunji et al., 2011](#)). However, symmetry and checking obsessions are also thought to be correlated with disgust ([Bhikram et al., 2017](#); [Melli et al., 2015](#)). In the case of morality, one's unwanted intrusive thoughts, especially about sexual or religious transgressions, provoke morality related feelings of disgust ([Olatunji et al., 2005](#); [Vicario, 2013](#)). Feeling of guilt is also correlated with the level of disgust ([D'Olimpio et al., 2013](#)). A recent study by Robinson *et al.* (2019) found that disgust sensitivity was associated with an increased propensity for deontological judgments, which is mediated by the preference for respecting orders (e.g., societal orders) ([Robinson et al., 2019](#)). Taken together, an inflated feeling of disgust is another mediator of sensitive moral judgment in OC patients. Again, neuroimaging evidence supports the role of the dysregulation of insula activity in OCD symptomatology, this time focusing on disgust sensitivity ([Viol et al., 2019](#)). On the other hand, Viol *et al.* (2019) stated that disgust sensitivity is related to the activation of DLPFC, caudate nucleus and visual association cortex (VAC) ([Rickelt et al., 2019](#)). More studies are required to resolve or explain the inconsistency.

5.4 Fear of responsibility

Some obsessive behaviors in OCD are induced by an inflated sense of responsibility and fear of being criticized and despised by others due to not acting perfectly in a situation ([Mancini & Gangemi, 2011](#);

[Salkovskis et al., 2000](#)). It has been shown that when the responsibility of action was attributed to OC patients, they exhibited more obsessive behaviors, but when the responsibility was averted to someone else, OC patients exhibited decreased concerns and desires for their rituals ([D'Olimpio & Mancini, 2014](#); [Franklin et al., 2009](#); [Lopatka & Rachman, 1995](#)). In other words, OC patients, especially those with checking rituals, worried the most about their responsibility and performance, rather than being altruistic and worried about others' wellbeing. Likewise, when the responsibility of action was assigned to healthy subjects, they will show OCD resembling behaviors, compared to control subjects ([Arntz et al., 2007](#); [Mancini & Gangemi, 2011](#)). Arntz *et al.* also

showed a correlation between checking behaviors and responsibility levels. Interestingly, they also suggested a causal role for the responsibility beliefs in both the development and maintenance of checking behaviors in OCD. However, this also applies to washing behaviors, aimed to prevent guilt and responsibility due to contamination and resulted in illnesses ([D'Olimpio & Mancini, 2014](#)). Therefore, an inflated sense of responsibility can be considered as a target for cognitive and behavioral therapy of OCD ([Cosentino et al., 2012](#); [Vos et al., 2012](#)). However, D'Olimpio and Mancini claimed that the feeling of responsibility could not explain the obsessive-compulsive rituals and behaviors alone ([D'Olimpio & Mancini, 2014](#)). There is not

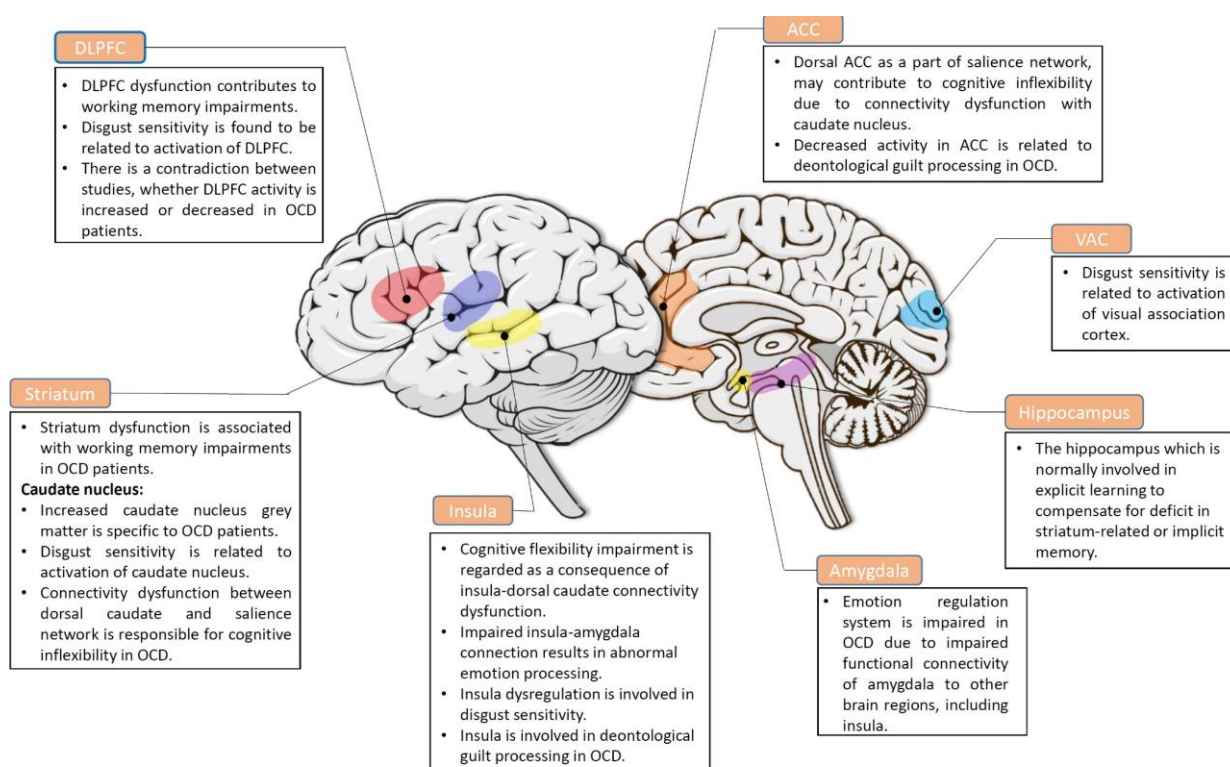


Figure 2. This figure shows a graphical abstract of the important brain regions that are affected in pathophysiology and symptomatology of OCD. The association between these abnormalities and OCD has to be studied more. However, the precise neural basis of abnormal fear of responsibility should be further investigated.

sufficient neuroimaging evidence of the association between fear of responsibility and OCD incidence or symptomatology. Therefore, more investigations are needed on this matter to gain more insight into the pathophysiological and neural basis of abnormal fear of responsibility in OCD patients, in order to develop new potential treatments for the disease. Figure 2 represents a graphical summary of the most striking

neuroimaging findings regarding the brain regions involved in the components discussed earlier.

6.0 CONCLUSION

Numerous studies have demonstrated that deontology is the most preferred type of moral thinking in individuals affected by OCD. In this review study, we aimed to investigate some of the possible components

of moral judgment and decision making in light of available theories, especially the dual-process theory, in OCD as one of the most common and debilitating mental disorders. Moral thinking is an essential aspect of social living, as the social structure is maintained based on rules and norms and a complex network for practicing and reinforcing these norms.

Executive dysfunctions, including impaired cognitive control, cognitive inflexibility, and working memory dysfunction, are known to be among the important problems in OC patients. It was discussed that OCD encompasses deficits in inhibitory cognitive control. As a result of this deficit, patients cannot maintain control over their emotional responses, especially in extreme scenarios, involving the death of individuals. Such uncontrolled and inflated emotional responses drive more rigid and deontological judgments in moral scenarios. Almost in every decision-making process, deliberate reasoning is preceded by intuitive thinking, as intuition needs less cognitive effort. Thus, cognitive flexibility is required to divert the focus of attention from the most emotional aspect of moral scenarios (the needed action) to the consequences of actions that requires more cognitive effort. OCD encompasses a deficit in cognitive flexibility, which can explain deontological preference. Another executive function that is impaired in OCD is working memory, which is argued to be abnormally overloaded by intrusive obsessive thoughts. It is shown that overloaded working memory will result in more impulsive decision making. Also, children with working memory problems have difficulty in learning and practicing moral norms by participating in social activities; thus working memory is regarded as one of the most important aspects of moral development.

The affective component of dual-process theory in moral decision making is discussed here by investigating the abnormalities in the feeling of guilt, feeling of disgust, and fear of responsibility in OCD. There is evidence showing that OC patients are more susceptible to the guilt of deontology than non-OC individuals, so they prefer decisions that get them rid of this guilty feeling, for example, by choosing inaction over morally challenging actions. Moreover, there is supporting evidence demonstrating the association between feeling of guilt and induction of compulsive behaviors, suggesting a causal role for abnormal guilt processing in OCD symptomatology. This indicates the sensitivity to

deontological guilt feelings in these patients. Also, the inflated feeling of disgust, which is aversion for unpleasant stimuli such as immorality, will induce more severe moral rigidity in these individuals. Feeling of guilt is also known to be correlated with the feeling of disgust in these patients. Moreover, fear of responsibility is also a crucial component in moral thinking and behaving, which is argued to be inflated and significantly associated with OCD symptoms.

Morality is a very crucial aspect in our daily lives and social activities; thus abnormality in moral thinking will lead to issues in OCD patients' lives, and having a clearer understanding of what exactly happens in their moral thinking will help in enhancing their quality of life and social functioning. Also, understanding the affected components in moral judgments and developing richer cognitive models of the disease will lead to finding better and more effective targets in cognitive therapy of OCD.

Our investigated components, including executive and affective functions, lead to evidence of abnormalities in the way of explaining the deontological preference in OC individuals, but further investigations on finding a clearer picture of these components are needed to provide more abundant evidence on their neuroscientific basis (e.g., fear of responsibility), and the precise role of the neurotransmitters (e.g., glutamate) in pathophysiology of the disorder, and effect of cultural and religious differences (as most of the studies reviewed in this paper were from the United States). Also, we believe that there would be far more components worth further investigation and consideration, such as the role of stereotypes, feeling of shame, development of a theory of mind, perfectionism, self-referential thinking effect, culture, religion, and point of view on moral judgment.

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