REVISTA CARIBEÑA DE PSICOLOGÍA

Fundación para el Desarrollo de la Psicología en el Caribe

Artículo Original

Conditioned Fear Extinction, Neuropsychological, and Psychological Aspects of OCD in Puerto Ricans

Extinción del Miedo Condicionado y Aspectos Neuropsicológicos y Psicológicos del TOC en Puertorriqueños

Stephanie Santiago-Mejías [1]*, & Karen Martínez [2]

[1] Ponce Health Sciences University, Ponce, Puerto Rico. https://orcid.org/0000-0002-0036-7481
[2] University of Puerto Rico, Medical Sciences Campus, Puerto Rico. https://orcid.org/0000-0001-7011-2751

* Correspondencia: steph.santiago37@gmail.com

Recibido: 3 enero 2020 | **Aceptado**: 20 junio 2020 | **Publicado**: 15 julio 2020

WWW.REVISTACARIBENADEPSICOLOGIA.COM

Citar como:

Santiago-Mejías, S., & Martínez, K. (2020). Conditioned fear extinction, neuropsychological, and psychological aspects of OCD in Puerto Ricans. *Revista Caribeña de Psicología, 4*(2), 98-113. https://doi.org/10.37226/rcp.v4i2.2033

ABSTRACT

Background: Although culture can affect emotional and behavioral reactions, there is little research on the manifestations of obsessive-compulsive disorder (OCD) among Latinos. Previous studies using a fear extinction model with non-Latino populations showed that individuals with OCD have difficulty maintaining safety memories. Their neuropsychological performance has indicated inconsistent findings. We compared Puerto Ricans with OCD and healthy controls in fear of extinction retention, neuropsychological performance, and psychological symptoms to enhance understanding of OCD in Puerto Rico. ***Method:*** 17 healthy and 11 Puerto Rican adults with OCD underwent a fear conditioning and extinction paradigm using neutral visual cues that were paired or unpaired with an electric stimulus to elicit skin conductance responses. Neuropsychological tests and psychological self-reports were administered. ***Results:*** OCD subjects did not show impaired extinction recall, but showed higher reaction times towards neutral than threat-related words on the Emotional Stroop Task, compared to healthy controls. No differences in neuropsychological tests that lacked emotional content were observed. OCD subjects showed increased symptoms of anxiety, trait anxiety, depression, negative affect, and emotional dysregulation. ***Conclusions:*** Puerto Ricans with OCD may have physiological and neuropsychological characteristics that are similar to healthy subjects. Still, a different psychological profile can be used to tailor cultural adaptations of evidence-based treatments for OCD.

Keywords: fear extinction; obsessive-compulsive disorder; neuropsychology; Puerto Ricans

RESUMEN

Trasfondo: Aunque la cultura puede afectar las reacciones emocionales y conductuales, existe poca literatura sobre el trastorno obsesivo-compulsivo (TOC) en latinos. Estudios previos en poblaciones (no-latinas) con TOC, evidenciaron dificultades para mantener recuerdos de seguridad utilizando un modelo de extinción del miedo. Además, se encontraron inconsistencias en aspectos neuropsicológicos. Este estudio utilizó mediciones de retención de la

extinción del miedo, rendimiento neuropsicológico y auto-reportes psicológicos, comparando una muestra de puertorriqueños divida en individuos con TOC e individuos saludables. ***Método:*** 17 adultos saludables y 11 con TOC fueron expuestos a un paradigma de condicionamiento y extinción del miedo utilizando señales visuales neutrales, pareadas o no con un estímulo eléctrico para estimular la conductividad en la piel. Se administraron pruebas neuropsicológicas y auto-reportes. ***Resultados:*** Personas con TOC no mostraron recuerdos de extinción deteriorados. Mostraron tiempos de reacción más altos ante palabras neutrales en el EST versus el grupo control. No existieron diferencias en pruebas neuropsicológicas sin contenido emocional. Además, mostraron mayores síntomas de ansiedad, depresión, afecto negativo y desregulación emocional. ***Conclusión:*** Los puertorriqueños con TOC podrían presentar características fisiológicas y neuropsicológicas similares a personas saludables, pero diferencias psicológicas. Esto podría utilizarse para formular tratamientos basados en evidencia culturalmente adaptados.

Palabras Claves: extinción del miedo; neuropsicología; trastorno obsesivo-compulsivo; puertorriqueños

INTRODUCTION

Individuals with obsessive-compulsive disorder (OCD) consistently experience unwanted intrusions and intense fear and anxiety. OCD is characterized by recurrent and persistent thoughts and repetitive behaviors that cause significant distress (American Psychological Association, 2013; Williams & Steever, 2015). Given the difficulty of controlling anxiety, individuals with OCD find immediate relief in the repetitive performance of compulsions or rituals that end up increasing distress and reinforcing fear and avoidance (Van Noppen et al., 2006). This disorder is known to affect approximately 1-3% of the population worldwide (Abramovitch et al., 2015; American Psychological Association, 2013; Pallanti et al., 2011). The mean age of onset of OCD is 19.5 years, and it affects males and females, although males have an early start (Ruscio et al., 2010). OCD can impair academic, occupational, and social functioning, with this last domain being significantly reduced according to a study by Ruscio et al. (2010). Some of the risk factors for developing OCD include: being an older adolescent, trauma, substance abuse, depression, phobic disorders, ADHD, tic disorders, prior history of separation anxiety disorder, and family history for OCD (Fontenelle & Hasler, 2008).

Our limited understanding of the neurobiological and genetic basis of OCD remains a significant barrier that hinders elucidating the underlying mechanisms of this complex illness. OCD has been linked to hyperactivity and dysfunctional interactions, particularly in the orbitofrontal cortex (OFC), which may lead to obsessions and compulsions. However, studies have been inconsistent regarding the hyperactivity of the OFC in OCD (Wood & Ahmari, 2015). Disruption in the interactions of other brain areas, such as the ventral striatum (VS), the anterior cingulate cortex (ACC), and the ventromedial prefrontal cortex (vmPFC) has also been found to produce and maintain OCD symptoms (Haber & Heilbronner, 2013; Wood & Ahmari, 2015). Although the genetic basis for OCD is unknown and still being studied, twin studies have demonstrated that there is a heritability estimate that ranges between 27-65% (Pauls et al., 2010; van Grootheest et al., 2005). A fundamental question remains on whether genetic variations are associated with OCD, having a further impact on treatment outcome (Qin et al., 2016).

In Puerto Rico, approximately 2 in 10 adults are diagnosed with a psychiatric disorder, and the 12-month prevalence rate is 18.7% (ASSMCA, 2016). A recent study reported a 12-month prevalence rate of 22.5% of having any psychiatric disorder, including anxiety disorders, among Puerto Ricans living in Puerto Rico (Canino et al., 2019), suggesting a high incidence of psychopathology. In terms of OCD, there is a lifetime prevalence rate of 2.3% of adults with OCD in the United States (Ruscio et al., 2010) and 3.2 % in Puerto Rico (Canino, 1987). According to Weissman et al. (1994), the lifetime prevalence rates of OCD were consistent in the United States (2.3%), Edmonton (2.3%), Puerto Rico (2.5%), Munich (2.1%), Taiwan (0.7%), Korea (1.9%), and New Zealand (2.2%), with Puerto Rico's rates being higher than the other countries. Obsessions and compulsions in OCD may not be limited to a specific culture. Still, given the variability of symptoms, cultural factors may play a role in the development of OCD, since obsessions and compulsions can be expressed and perceived differ-

rently. Individuals from a particular culture can have concerns that may be reflected in their OCD symptoms (De Silva, 2006; Wheaton et al., 2013). In a comparative study of OCD subjects from Costa Rica and the United States, Chavira et al. (2008) found that the content of the obsessions and compulsions of North Americans and Costa Ricans was similar leads to the possibility that OCD may have a biological basis.

Moreover, Himle et al. (2008) found similar lifetime and 12-month rates of OCD (1.49%), OCD severity, and high standards of co-morbid psychiatric disorders between African Americans and Caribbean blacks. They also observed that mental health service use over a year for African Americans and Caribbean blacks with OCD was extremely limited in the United States (only 20% of patients with OCD received treatment). These studies highlight a pressing need to perform research and implement evidence-based treatment targeting minority populations that suffer from OCD.

Cognitive-behavioral therapy (CBT) with exposure and response prevention (ERP) have shown strong empirical support for the effective treatment of OCD (Geller et al., 2019; Leeuwerik et al., 2019). Although it is a challenging therapy, CBT is a structured and goal-oriented intervention that helps patients to re-evaluate dysfunctional intrusive thoughts that trigger intense anxiety. ERP is the main component of CBT, and it is based on the principles of fear extinction (Fullana et al., 2013). During fear extinction, an individual is exposed to repeated pairings of a neutral stimulus with an aversive stimulus. Then, it is exposed to the neutral stimulus in the absence of the aversive stimulus until the fear-conditioned response diminishes or disappears. In general terms, fear extinction generates an inhibitory memory that may suppress the manifestation of fear associations (Quirk et al., 2010). Research lacks on fear extinction in OCD, and associative learning processes seem to be significant in the maintenance of this complex illness, which warrants its importance.

Furthermore, recent neuropsychological studies of OCD have shown correlations between the activation of specific brain regions and cognitive function and behavioral changes (Nakao et al., 2014). In a systematic review, Kuelz et al. (2004) evaluated several studies and found that diverse neuropsychological deficits are present in OCD, including attention, executive functions, visuospatial abilities, and verbal and non-verbal memories, although no study has found a specific neuropsychological profile for OCD and researches on different cognitive functions, such as set-shifting, fluency, planning, and problem-solving abilities are contradictory. Moreover, a meta-analysis showed poor neuropsychological performance in individuals with OCD compared to healthy individuals (Abramovitch et al., 2013). However, Simpson et al. (2006) found that subjects with OCD performed similarly to healthy controls on most neuropsychological tasks that measured set-shifting, spatial working memory, and motor initiation and execution. Their results also showed that the severity of OCD had little impact on neuropsychological performance (Simpson et al., 2006). The results of these studies emphasize the importance of clarifying the neuropsychological effect of OCD to comprehend its pathophysiology better.

OCD in Latino/Hispanics is understudied and should be addressed given the diverse manifestations of the disorder and the psychosocial stressors (e.g., limited access to mental health services) imposed on this population. Another factor that warrants attention, especially in Puerto Rico, is the lack of knowledge of OCD by healthcare providers (Rodríguez-Acevedo et al., 2009), which may often lead to misdiagnosis and influence treatment outcomes (Cordioli & Vivan, 2012, Wetterneck et al., 2012). In this study, we aim to observe the physiological responses of a Puerto Rican sample with OCD during fear-extinct learning and their performance on neuropsychological and psychological assessments. We hypothesized that individuals with OCD would have impaired fear recall and extinction, as measured by a 2-day fear conditioning and extinction paradigm. We also hypothesized that OCD subjects would show deficits in neuropsychological functioning, such as attention, concentration, memory, and processing speed, as measured by several neuropsychological assessments. Besides, we hypothesized that OCD subjects would reveal psychological markers, such as anxiety and depression symptoms, compared to healthy individuals. The findings of this study may increase awareness and understanding of this complex disorder and its mechanisms. They can also enable the exploration and development of

culturally-adapted assessments and interventions for the Puerto Rican population.

Fear Conditioning and Extinction in Humans

OCD is commonly treated with CBT and ERP, which is based on the theory of fear extinction (McLaughlin et al., 2015) and is therefore focused on extinguishing compulsive behaviors. Fear conditioning and extinction are associative models of learning that are used to predict fear. While fear conditioning is training the organism (rodent or human) to pair an aversive stimulus (unconditioned stimulus, US) with a sensory stimulus (conditioned stimulus, CS), extinction is training the organism to learn not to fear; to split that association by creating an inhibitory memory that temporarily suppresses fear (Quirk et al., 2010). During classical conditioning, the US follows the CS during training, which results in a conditioned response (CR) that occurs after the presentation of the CS. For example, a tone (US) is paired with the presentation of food (CS), which produces salivation (CR). By associating the tone with the presentation of the food, a person can start salivating at the sound of a tone.

In an experiment conducted by Milad et al. (2013), they used a classical fear conditioning and extinction paradigm, in which participants with OCD and healthy controls paired pictures of colored lamps (red and blue; CS) with an aversive electrical stimulation (US) and measured fear expression through skin conductance responses (SCR). They found that although individuals with OCD had intact fear conditioning and extinction, they had deficits in recalling the extinction memory (Milad et al., 2013). By using functional magnetic resonance imaging (fMRI), they observed a decreased activation of the ventromedial prefrontal cortex (vmPFC) in OCD subjects during every phase of the experiment, compared to healthy controls. They found a positive correlation between OCD symptom severity, which was measured by the Yale-Brown Obsessive-Compulsive Scale (YBOCS), and extinction recall. In other words, the more severe the symptoms, the higher the ability to recall extinction memory. Milad et al. (2013) believe that this unexpected finding may be associated with the coping mechanisms being used by severely affected OCD patients to suppress fear. In another study, McLaughlin et al. (2015) showed that participants with a lifetime diagnosis of OCD had poor extinction recall, compared to healthy participants. In contrast to the study conducted by Milad et al. (2013), they did not find correlations between symptom severity and fear extinction recall. Together, these studies provide suggestive evidence in that deficits in fear extinction recall may be an OCD trait (Milad et al., 2013; McLaughlin et al., 2015), although conclusive findings are warranted in future studies.

Some research on extinction retention has included Latinos, and ethnicity may impact the physiological responses of fear (Martínez et al., 2014). For this reason, in our study, we seek to evaluate fear extinction in Puerto Ricans with OCD. Based on previous studies on their difficulty suppressing fear, we hypothesized that a sample of Puerto Ricans with OCD would show impaired extinction recall. We also assessed fear renewal, to evaluate the memory of fear conditioning.

Given that the most common and effective treatment for OCD is cognitive behavioral therapy and ERP, evaluating extinction recall and extinction through physiological responses in a group of Puerto Ricans with OCD could lead to necessary implications in their treatment outcome. If participants with OCD can respond differently to the conditioned stimuli during the extinction learning phase of the experimental task, this may be a useful treatment response. For this reason, the findings of this study can be helpful and practical in explaining OCD symptom development, maintenance, and treatment guidance.

Neuropsychology of OCD

Research suggests deficits in attention, executive functioning, and processing speed as characteristics of patients with OCD, which may play a mediating role in brain dysfunction and the prevalence, maintenance, and severity of clinical symptoms (Saremi et al., 2017). Identifying neuropsychological deficits' nature can lead to understanding OCD's psychopathology of OCD, which can be useful in the development of effective prevention and treatment programs.

Neuroimaging studies in OCD have identified abnormalities in areas, such as the OFC, anterior cingulate cortex (ACC), and caudate nucleus (Nakao et al., 2014). Impairments in neural structures and circuits can influence cognitive and behavioral changes.

Although several studies suggest underperformance of individuals with OCD in neuropsychological assessments (Abramovitch & Cooperman, 2015; Nakao et al., 2014), especially before treatment (Voderholzer et al., 2013), evidence on the neuropsychology of OCD has been divergent. Millet et al. (2013) used a neuropsychological battery to assess the executive functions of OCD outpatients with severe symptomatology. OCD outpatients showed lower verbal fluency scores, fewer correct responses on a test that measures selective attention and cognitive flexibility (e.g., Stroop). They took more time to complete a task that measures executive functions, such as planning (e.g., Tower of London) than individuals without OCD (Millet et al., 2013). In another study, Da Rocha et al. (2011) evaluated decision-making in patients with OCD by using the Iowa Gambling Task (IGT). They found that patients with OCD performed significantly worse on the IGT and showed deficits in decision-making, compared to healthy subjects (Da Rocha et al., 2011). Other studies have found deficiencies in tasks that require set-shifting (Tukel et al., 2012) and response inhibition in individuals with OCD (Pena-Garijo et al., 2010). However, Kohli et al. (2015) assessed verbal intelligence, memory, perceptual and motor functions in OCD outpatients using tests, such as the Wisconsin Card Sorting Test (WCST) and the Bhatia Battery of Performance tests of Intelligence (BSS) and participants did not show impairments in any of the cognitive functions, compared to healthy controls. The controversial findings of neuropsychological functions in individuals with OCD enhance the need to assess these functions, especially in Puerto Ricans, given the lack of research in Latinos with OCD (Williams et al., 2010). Assessing the neuropsychological functioning of Puerto Ricans with OCD can allow the identification of potential neurocognitive deficits for further rehabilitation to improve daily living and academic/occupational skills, as well as an understanding of the neurocognitive manifestations of OCD.

Psychological Assessment of OCD

OCD is strongly associated with elevated anxiety, which affected individuals to engage in maladaptive strategies to reduce it. The repetitive behaviors and rituals may have an impact on how individuals with OCD regulate their emotions. In a study, event-related brain potentials were recorded to observe how healthy controls and individuals with OCD responded to emotional stimuli by using distraction and cognitive reappraisal (Paul et al., 2016). It was found that when participants with OCD used cognitive reappraisal to reduce emotional responses elicited by OCD-related and general aversive pictures, they failed to show a reduction in the amplitude of the electrophysiological responses, as measured by late positive potentials, compared to healthy controls (Paul et al., 2016). Interestingly, at a self-report level, they reported reduced arousal. These results demonstrate that participants with OCD showed they marked ongoing processing at an electrophysiological level, which may be associated with their difficulty in disengaging their attention from emotionally relevant stimuli. In another study, using an undergraduate sample, Stern et al. (2014) found that OC symptoms were correlated with a poor understanding of emotions (positive or negative) and greater fear of experiencing them. This fear of experiencing emotions experienced by individuals with OC symptoms may be related to the fear of losing control (Stern et al., 2014). In another study, Macatee et al. (2013) evaluated distress tolerance or the capacity to experience aversive emotional states in an OCD sample. They found that although an OCD diagnosis was not a predictor of distress tolerance to obsessions, having higher obsessions, unlike other OCD symptoms, were associated with reduced distress tolerance (Macatee et al., 2013), which can contribute to a lack of emotional regulation. These studies are consistent with previous findings on emotion regulation in individuals with OCD, regarding the difficulty of maintaining control of behavior when they experience an emotion, mostly negative (Allen & Barlow, 2009; Fergus & Bardeen, 2014).

Furthermore, since the fear of anxiety-related sensations or anxiety sensitivity seems to be elevated in OCD, Blakey et al. (2017) investigated if this construct serves as a predictor of treatment outcome after cognitive-behavioral therapy (CBT). The results showed that anxiety sensitivity was positively correlated with baseline and posttreatment OCD severity, suggesting that anxiety sensitivity predicts treatment outcome (Blakey et al. 2017). These studies indicate that psychological constructs can provide valuable information regarding how individuals perceive their experiences with such a complex disorder, which can

thus be compared with other measures, such as physiological and neuropsychological assessments, to obtain a better understanding of the manifestations of OCD.

METHOD

Participants

A total of 17 healthy controls (mean age 35.76±13.39 years old) and 11 individuals with OCD (mean age 32±11.84 years old) from Puerto Rico, aged 21 to 60, participated in the study. The participants were recruited through local advertising (flyers, posters, conferences). Interested individuals were screened via telephone for OCD symptoms before taking part in the study and potential participants were interviewed to assess OCD diagnosis. A written informed consent was obtained from participants before the study. The inclusion criteria were: (a) age 21-60 years, (b) Puerto Rican descent, (c) Spanish speaking, (d) normal or corrected-to-normal color vision, and (e) a diagnosis of OCD confirmed by SCID-IV interview for the experimental sample. Exclusion criteria included (1) medical conditions that could be affected by the fear conditioning paradigm (e.g., arrhythmias, heart failure), (2) history or active drug, alcohol or substance dependence, and (3) history of any neurological disorder or head trauma, as they could interfere with neuropsychological test performance. The study was performed at the Center for the Study and Treatment of Fear and Anxiety (CETMA for its Spanish acronym) with Institutional Review Board (IRB) approval (A5280109) from the University of Puerto Rico, Medical Sciences Campus.

Measures and Procedure

The study had an observational and cross-sectional design, which allowed the comparison of two groups at a single time. It was divided into two days due to the extended duration of the assessments. During Day 1, after participants were recruited and provided informed consent, demographic information was obtained, the clinical interview using the SCID-IV was completed, and the psychological questionnaires were administered. During Day 2, the neuropsychological assessment was performed. Fear conditioning and extinction were performed on Day 1, and extinction retention was tested on Day 2.

Physiological Assessment

We measured fear responses through skin conductance responses (SCR). These responses were recorded using a Coulbourn Isolated Skin Conductance Coupler (S71-23) (Coulbourn Inst., Allentown, PA). A current of 0.5 V was passed through 8mm diameter Ag/AgCl radio translucent electrodes (BioPac Systems Inc., Goleta, CA) filled with isotonic paste. The electrodes were placed on the palm of the participant's non-dominant hand, and each was separated from another by 14mm. A Coulbourn Lablinc Analog-to-digital converter (V19-16) digitalized the analog signal stored in the computer. Changes in skin conductance levels were calculated for each conditioned stimulus (CS) trial by subtracting the mean skin conductance level during 2 seconds immediately before CS onset from the highest skin conductance level recorded during the 6 second CS duration. This procedure has been validated (Milad et al., 2005), and it facilitates the detection of the maximal increases in skin conductance levels during the 6-second presentation. This procedure has also been carried out effectively in the past with Puerto Rican healthy and OCD samples (Martinez et al., 2014). The average of SCR was quantified to determine the conditioned fear responses. The outcome measures that were calculated were: peak SCR during conditioning, average SCR during the first two trials of extinction, and percent fear during recall and renewal phases (average SCR during the first two trials of the period divided by the peak SCR during conditioning).

Neuropsychological Assessment

Wisconsin Card Sorting Test (WCST). The WCST is a neuropsychological test created by Grant and Berg (1948). It is used to measured cognitive functions, such as set-shifting and impulsive responses. In the WCST, participants sort cards according to characteristics: color (red, green, blue, or yellow), form (circles, stars, squares, or crosses), and number (1, 2, 3, or 4). They will try out ways to find the correct method for sorting the cards and are told if they correctly or incorrectly guess the rule. The computer calculates the scores of the participant, which are the number of runs of 10 correct scores and the perseverative errors or the number of errors where the participant chose the same rule as the previous one. Total errors (all incorrect responses), perseverative respon-

ses (number of wrong answers that would have been correct for the preceding category), perseverative errors (number of errors in which a participant continuously responds incorrectly using the same pattern), non-perseverative errors (all the remaining incorrect responses), and conceptual level responses (all consecutive correct reactions that occur in runs of three or more) are scored.

Multi-Source Interference Task (MSIT). The MSIT was created by Bush et al. (2003). It measures attention and cognitive processing. In the MSIT, participants are presented with sets of three numbers (0, 1, 2, or 3), in which one number will always be different from the other two numbers. Participants identify the number that is different from the other two by pressing a button. During control trials (congruent), the different numbers will always match its position on the button press (e.g., 100, 020, 003). During interference trials (incongruent), the different number never matches its position on the button press. Participants are required to quickly and accurately select a different number, regardless of their location. The computer calculates the reaction times, and the averages of reaction times during control and interference trials are computed.

Emotional Stroop Task (EST). The EST is used to assess selective attention and processing speed under emotional content exposure. It is similar to the standard Stroop task, but it includes negative emotional words (e.g., threat-related) and neutral words. In the EST, participants are asked to identify the color of neutral (e.g., chair, table, etc.) or threat-related (e.g., death, kill, etc.) words. The words are presented in a computer monitor for 1.5 seconds with a 0.5-second interval between words. Participants have 45 seconds to identify the color of the word that is presented by pressing a button. The average reaction times to neutral and threat-related words is computed.

Psychological Assessment

Structured Clinical Interview for DSM-IV Disorders (SCID-IV). The SCID-IV was designed by the American Psychiatric Association (APA), and the Spanish version was used for this study. The SCID-IV is divided into Axis I and Axis II disorders. We used the Axis I assessment to evaluate symptoms of anxiety disorders, medications, and history of substance use.

Beck Anxiety Inventory – Spanish Version (BAI). The BAI was created by Beck et al. (1988) and is commonly used to measure the severity of anxiety. It includes 21 items, rated from 0 (not at all) to 3 (severely, bothered me a lot), with scores indicating very low, mild, moderate, and severe anxiety symptoms. The English version has an internal consistency of α = .92 (Beck et al., 1988). A study that included a Spanish-speaking sample obtained an alpha coefficient of .93 (Magán et al., 2008).

Beck Depression Inventory-II – Spanish Version (BDI-II). The BDI-II was created by Beck (1996) to evaluate the severity of depression symptoms. The BDI-II has 21 items, ranging from 0 to 3, indicating very low to severe symptoms. It has an alpha coefficient of α = .91 for psychiatric outpatients (Beck et al., 1996). An adapted version of the BDI (BDI-S) obtained high internal consistency α = .88 in a study that included Puerto Rican undergraduate students (Bonilla et al., 2004).

State and Trait Anxiety Inventory – Spanish Version (STAI). The STAI was created by Spielberger et al. (1983) to assess state and trait anxiety. The STAI includes 20 items to measure state anxiety and 20 items to measure trait anxiety. Scores range from 1 (very slightly) to 4 (extremely). The internal consistency of the STAI ranges from .86 to .95 (Spielberger et al., 1983). The Spanish version of the STAI has been used in several studies (González-Barrios et al., 2016) and a study that included the assessment of Puerto Ricans yielded a high internal consistency in State α = .83 to .92 and Trait α = .86 to .92 (Spielberger & Díaz-Guerrero, 1975).

Positive and Negative Affect Schedule (PANAS). The PANAS was created by Watson and Clark (1988), and it evaluates mood state, positive and negative affect. It includes 10 items that describe negative emotional states and 10 items that describe positive emotional states. Scores are rated on a 5-point Likert scale, ranging from 1 (very little or have not felt it) to 5 (extremely). It has an alpha coefficient that ranges from .86 to .90 for the Positive Affect scale and .84 to .87 for the Negative Affect scale (Watson et al., 1988). A study that used a Spanish adaptation of the PANAS showed alpha coefficients of .89 (Positive Affective State) and .91 (Negative Affective State) for males and alpha coefficients of .87 (Positive Affective

State) and .89 (Negative Affective State) for females (Sandín et al., 1999). This scale has not been validated in Puerto Rico (González-Barrios et al., 2016).

Emotional Dysregulation Scale (EDS). The Emotional Dysregulation Scale is composed of 40 items, and it evaluates emotional changes and perceptions of an individual's capacity to manage emotions. Although it has been previously used, no studies have assessed the psychometric properties, and this scale has not been validated for the Puerto Rican population (González-Barrios et al., 2016).

Statistical Analyses

Descriptive statistics were used to analyze demographic data. Kruskal-Wallis tests were used to compare physiological data between OCD and healthy groups during fear conditioning and extinction. Non-parametric Friedman tests were performed to analyze the SCR of all participants between trials during phases of the fear conditioning and extinction paradigm. Post-hoc Wilcoxon signed-rank tests were used to assess differences in SCR across trials of each phase by group. Mann-Whitney U tests were used for group comparison in neuropsychological and psychological measures. Statistical significance was set at $p < 0.05$. All statistical analyses were performed using the SPSS software package, version 22.

RESULTS

Healthy controls and participants with OCD did not differ in age, sex, and years of education (Table 1). We found no differences in the SCR to the conditioned stimulus during the presence of the shock (CS+) between the OCD and healthy groups (Figure 1). During CS+, no significant differences between the OCD and healthy groups were observed on trials of the Habituation, Conditioning, Early Extinction, Late Extinction, Recall, and Renewal phases ($p > 0.05$). Likewise, we found no differences in the SCR to the conditioned stimulus during the absence of the shock (CS-) between OCD and healthy groups on trials of the Habituation, Conditioning, Early Extinction, Late Extinction, Recall, and Renewal, as shown by the Kruskal-Wallis test ($p > 0.05$).

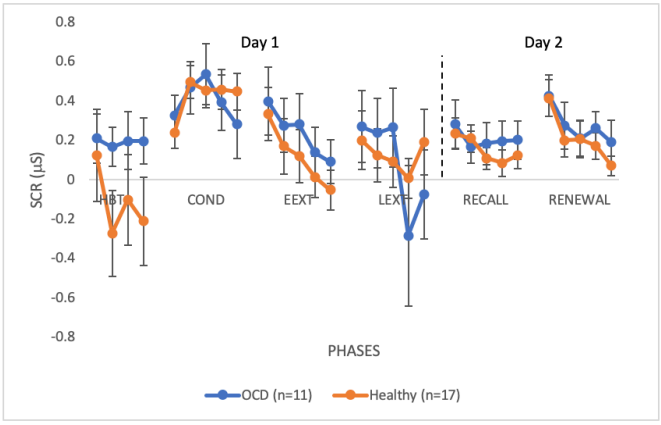
Table 1

Demographic characteristics of groups, OCD and healthy controls

Characteristic	OCD (N =11) (mean, SD, %)	HC (N=17) (mean, SD, %)
Sex		
Male	27%	24%
Female	73%	76%
Age	32±11.84	35.76±13.39
Education (yrs)	45% Part/Completed Graduate School	47% Part/Completed Graduate School

Note. OCD = Obsessive-Compulsive Disorder; HC = healthy controls

Figure 1. *Skin conductance responses to the CS+ across all experimental phases in OCD and HC*



Note. Mean skin conductance responses (SCR) to the CS+ across all experimental phases in OCD and HC. SCR to CS+ in OCD and healthy subjects. No differences were observed across all experimental phases between groups. OCD=Obsessive-Compulsive Disorder; HC = healthy controls, HBT = Habituation, COND = Conditioning, EEXT = Early Extinction, LEXT=Late Extinction, µS = microsiemens.

Non-parametric Friedman tests were conducted to evaluate differences in medians among the SCR during the trials of each phase. The Friedman test showed significant differences in SCR between trials in the Conditioning phase during CS+ ($\chi^2(4) = 11.23$, $p = 0.024$) and during CS- ($\chi^2(4) = 16.75$, $p = 0.002$) when both groups were assessed. Post-hoc using a Wilcoxon signed-rank test showed that SCR of healthy subjects in the Conditioning phase during CS+ was significantly different ($z = -2.58$, $p = 0.010$) across the early and late trials, but this difference was not observed in the OCD group ($z = -0.53$, $p = 0.594$). However, SCR in the Conditioning phase during CS- were significantly different in the healthy group ($z = -2.44$, $p = 0.015$) and OCD group ($z = -2.22$, $p = 0.026$) during the first and last trials. In other words, both OCD and healthy groups learned to fear the shock during the Conditioning phase, as fear increased from early to late trials, although the increase in fear throughout the trials was significant only in the healthy group. SCR in both groups decreased significantly during the course of the trials of the Conditioning phase during CS-.

The Friedman test also showed significant differences in SCR between trials in the Recall phase during CS- ($\chi^2(4) = 18.85$, $p = 0.001$) when both groups were assessed. Follow-up Wilcoxon signed-rank test revealed a significant difference in SCR during CS- early and late trials of the Recall phase in the healthy group ($z = -2.20$, $p = 0.028$), but not in the OCD group ($z = -1.16$, $p = 0.248$). This suggests that both OCD and healthy groups, learned to extinguish fear during CS- in the Recall phase, when the memory for fear extinction is assessed, but SCR only decreased significantly across early and late trials in the healthy group.

Furthermore, significant differences in the SCR of both groups were observed during CS+ ($\chi^2(4)19.66$, $p = 0.001$) and during CS- ($\chi^2(4)12.74$, $p = 0.013$) in the Renewal phase, when the memory for fear conditioning is assessed. Follow-up Wilcoxon signed-rank test revealed significant differences in SCR across early and late trials during CS+ in the Renewal phase in the OCD group ($z = -2.22$, $p = 0.026$) and healthy group ($z = -2.86$, $p = 0.004$). Follow-up tests also revealed significant differences in SCR across early and late trials during CS- in the Renewal phase in the OCD group ($z = -2.22$, $p = 0.026$) and healthy group ($z = -2.39$, $p = 0.017$). These results suggest that both groups experienced a renewal of the fear response when re-exposed to the shock in a novel context. No other significant differences in SCR in OCD and healthy groups were observed throughout trials of other phases ($p>0.05$).

Mann-Whitney U tests showed no significant differences in percent fear extinction recall between groups when the conditioning stimulus was paired with a shock (CS+), $z = -.21$, $p = 0.83$, and when it was not paired with a shock (CS-), $z = -0.26$, $p = 0.80$. Likewise, there were no significant differences between groups in percent fear renewal between groups during CS+, $z = -0.40$, $p = 0.69$ and during CS-, $z = -0.97$, $p = 0.34$.

However, subjects with OCD showed increased symptoms of general anxiety, compared to healthy controls, as measured by the administered psychological assessments measuring general anxiety, $z = -3.57$, $p = 0.00$ (BAI), trait anxiety, $z = -3.63$, $p = 0.00$ (STAI), depression, $z = -2.92$, $p = 0.00$ (BDI), negative affect, $z = -3.30$, $p = 0.00$ (PANAS), and emotional dysregulation, $z = -2.80$, $p = 0.01$ (EDS) (Table 2). However, no significant differences were observed between healthy and OCD groups in state anxiety, $z = -1.79$, $p = 0.73$ (STAI) and positive affect, $z = -0.90$, $p = 0.37$ (PANAS).

Mann-Whitney U tests were conducted to evaluate the hypothesis that subjects with OCD will have lower performance on neuropsychological tests compared to healthy controls (Table 3). The results on the WCST, which measures executive functions and set-shifting, were not significant, $p>0.05$, as shown in the assessment of total errors ($z = -0.33$, $p = 0.74$), perseverative responses ($z = -0.15$, $p = 0.90$), perseverative

Table 2

Psychological self-report scores by group, OCD and healthy controls

Self-report	OCD (N =11) (mean, SD)	HC (N=17) (mean, SD)
Beck Anxiety Inventory (BAI)	**20.18 (4.62)**	**2 (0.43)**
Beck Depression Inventory (BDI)	**10.45 (2.47)**	**2.47 (0.70)**
Emotional Dysregulation Scale (EDS)	**125.3 (19.20)**	**56 (3.47)**
State-Trait Anxiety Inventory (STAI)		
State Anxiety	37.64 (3.28)	30.47 (1.94)
Trait Anxiety	**48.36 (4.62)**	**31.47 (1.67)**
Positive and Negative Affect Schedule (PANAS)		
Positive	34.55 (1.97)	35.53 (2.77)
Negative	**27.09 (2.54)**	**15 (1.32)**

Note: Mean and standard deviation scores of psychological self-reports by group. Scores in **bold** represent significant differences, $p < 0.05$. *Note*. OCD=Obsessive-Compulsive Disorder; HC=healthy controls.

Table 3

Neuropsychological test scores by groups, OCD and healthy controls

Test	OCD (N =10) (mean, SD)	HC (N=17) (mean, SD)	P
Wisconsin-Card Sorting Test (WCST)			
Perseverative Responses	47.7 (4.28)	46.18 (1.62)	0.88
Perseverative Errors	47.7 (4.24)	45.24 (1.64)	0.90
Non-Perseverative Errors	48.8 (2.37)	44.82 (2.61)	0.67
Conceptual Level Responses	47.3 (2.76)	45.35 (2.53)	0.94
Total Errors	48.5 (3.19)	46.35 (2.48)	0.74
Multi-Source Interference Task (MSIT)			
Congruent Average RT	0.63 (0.03)	0.60 (0.03)	0.29
Non-Congruent Average RT	0.90 (0.07)	0.93 (0.03)	0.78
Congruent Correct RT	0.63 (0.03)	0.60 (0.03)	0.36
Non-Congruent Correct RT	0.99 (0.03)	0.91 (0.07)	0.47
Congruent ACC	0.99 (0.01)	0.99 (0.00)	0.43
Non-Congruent ACC	0.83 (0.09)	0.81 (0.07)	0.46
Total Accuracy	0.94 (0.04)	0.90 (0.04)	0.29
Performance (RT/ACC)	0.40 (0.05)	0.39 (0.02)	0.49
Emotional Stroop Task (EST)			
Neutral Words RT	724.02 (35.28)	710.37 (21.92)	1.00
Threat Words RT	685.63 (28.19)	705.43 (24.55)	0.55
Differential RT (RT Threat – RT Neutral)	**-38.39 (9.56)**	**-4.94 (9.12)**	**0.03**
Neutral Words ACC	0.96 (0.02)	0.98 (0.00)	0.47
Threat Words ACC	0.96 (0.02)	0.98 (0.01)	0.19
Total Accuracy	0.96 (0.02)	0.98 (0.01)	0.31
Total Performance (RT/ACC)	**-48.03 (11.55)**	**-8.35 (10.24)**	**0.04**

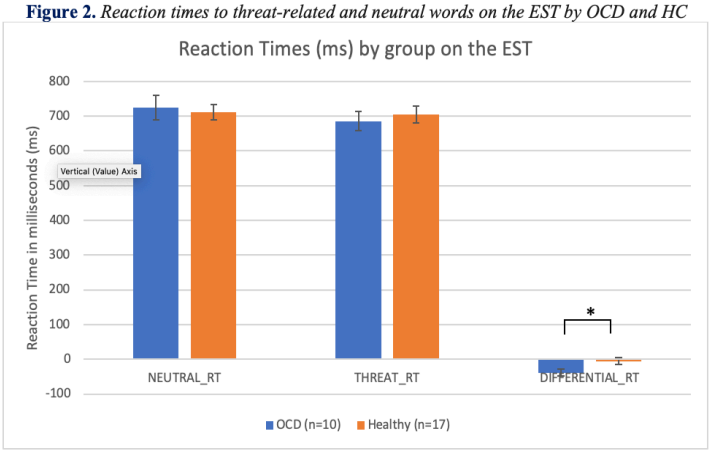
Note: Mean and standard deviation scores (reaction times and accuracy) of cognitive tests scores by group. Scores in **bold** represent significant differences, $p < 0.05$. Cognitive tests data was missing of one subject with OCD. The significance level is 0.05. OCD = Obsessive-Compulsive Disorder; HC = healthy controls, RT = Reaction Time, ACC = Accuracy.

errors (z = - 0.13, p = 0.90), non-perseverative responses (z = - .43, p = 0.67), and conceptual level responses (z = - 0.08, p = 0.94). Furthermore, results on accuracy on congruent (z = -0.80, p = 0.42) and incongruent trials (z = -0.73, p = 0.46) and reaction times of congruent (z = -1.06, p = 0.29) and incongruent trials (z = -0.31, p = 0.76) on the MSIT, which evaluates attention and cognitive processing, showed no significant differences between groups, p>0.05. Additionally, differences were not significant between groups inaccuracy to neutral (z = -0.72, p = 0.47) and threat-related words (z = -1.32, p = 0.18) nor in reaction time to neutral (z = 0.00, p = 1.00) and threat-related words (z = - 0.60, p = 0.54), as assessed by the performance on the EST; a test that evaluated the effect of emotional content on participants, as shown by Mann-Whitney U tests. Nevertheless, significant differences were observed between groups in differential reaction time (the difference between the reaction time to threat-related and neutral words; reaction time to threat-related words minus reaction time to neutral words). In other words, there was a significant difference in the effects of emotional interference between groups, z = - 2.16, p = 0.031 (Figure 2 and Figure 3). The effect size was moderate 0.41 (Cohen, 1988), suggesting that the OCD group showed higher reaction times to neutral words than to threat-related words, compared to healthy subjects who had similar reaction times to both threat-related and neutral words.

DISCUSSION

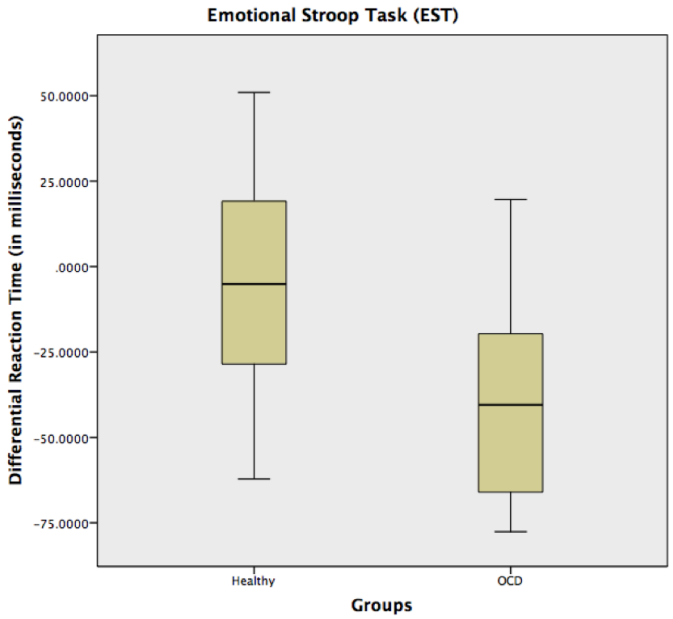
In the present study, we evaluated the manifestations of OCD in physiological, neuropsychological, and psychological measures using a Puerto Rican sample, compared to healthy controls. Interestingly, in our study, participants with OCD did not show impaired extinction recall, contrary to what we hypothesized and reported with a non-Latino White sample. In other words, there were no differences between OCD and healthy groups when the memory of fear extinction is tested. However, differences in SCR across trials during Conditioning and Renewal were observed in both groups, suggesting adequate acquisition and extinction of fear. The lack of differentiation in fear conditioning and extinction between OCD subjects and healthy controls is inconsistent with the results of a previous study by Milad et al. (2013), in which the same fear conditioning and extinction paradigm were used, and they found deficits on the

Figure 2. *Reaction times to threat-related and neutral words on the EST by OCD and HC*



Note. Differential reaction time (difference between the reaction time to threat-related and neutral words) between groups was significant, $p < 0.05$. EST data was missing for one subject from the OCD group. Asterisks (*) represent significant differences, $p < 0.05$. *Note.* EST=Emotional Stroop Task.

Figure 3. *Distributions of the differential reaction times on the EST*



Note. Distributions of the differential (threat words RT – neutral words RT) reaction times on the EST by group. RT=Reaction Time.

recall of extinction in an OCD Caucasian sample. This result points to the possibility that Puerto Ricans with OCD can learn how to fear a specific stimulus and may be able to extinguish this fear as well as healthy individuals.

Nevertheless, this outcome would likely be different if the fear conditioning and extinction paradigm consisted of common themes relevant to OCD. For example, Armstrong and Olatunji (2017) used an associative learning task that showed a neutral face that

was followed by a disgusting image (unconditioned stimulus) and a neutral face that was not paired with a disgusting image (CS-) and found that individuals with high and low contamination concerns did not differ in discriminant responding. However, those with high contamination concerns, who exhibited symptoms consistent with individuals with OCD, reported more considerable disgust to the CS+, and their unconditioned stimulus expectancy during the CS+ was resistant to extinction. It is also possible that OCD subjects in our study were receiving treatment, which was not evaluated, and were consequently efficient in acquiring and extinguishing fear memories. Additionally, it may be possible that the two samples differed in other characteristics not assessed, such as the severity of OCD symptoms or years living with the condition.

Although no differences were observed in physiological responses, we found marked differences in trait anxiety, depressive symptoms, negative affect, and emotional dysregulation in OCD participants, compared to the healthy group. These findings confirm that in addition to the SCID confirmed the presence of OCD, and the clinical sample showed marked pathological symptoms as compared to the healthy controls. These results are consistent with previous studies that highlight the difficulty of individuals with OCD in regulating their emotions, which may be related to their fear of expressing feelings, such as anxiety, and losing control (Allen & Barlow, 2009; Macatee et al., 2013). Significant differences were found on the EST in terms of the effects of emotional interference (differential reaction time) in the OCD group, compared to the healthy group. OCD subjects showed quicker responses towards threat-related words than the whole group, which had similar reaction times towards both threat-related and neutral words. This finding suggests that OCD subjects may perform better under exposure to threatening content, specifically to written information.

Previous research on attentional bias in OCD has generated conflicting findings. Foa and McNally (1986) conducted one of the first studies to assess attentional bias in OCD by using a dichotic listening task before and after exposure and response prevention treatment. Participants were presented with different fear-relevant and neutral prose passages to each ear. They were asked to shadow the passage given in the dominant ear as they were spoken on the tape while pressing a button when they heard the designated target word or phrase that was shown on a printed card, placed in front of the subject. Foa and McNally (1986) found that fear-relevant words were detected more than neutral words before but not after treatment, according to behavioral (button press) and physiological (skin conductance responses) measures, thus skin conductance responses to fear-relevant words were more significant than to neutral words before treatment. After exposure and response prevention treatment, OCD subjects did not detect fear-relevant and neutral words differentially.

Similarly, in our study, the EST included a verbal paradigm with threat-related words that were not associated with OCD-related concerns (e.g., washing, checking), and OCD subjects responded quicker to threat-related than neutral words. This leads to questioning if the attentional bias found in OCD subjects on previous research may be towards personally relevant threatening content (Amir et al., 2010). In a study by Rao et al. (2010), clinically symptomatic and remitted OCD patients were examined using the EST, including OCD relevant words, positively valenced (e.g., neat) and negatively valenced (e.g., dirty). They found that symptomatic OCD patients had significantly higher emotional interference compared to healthy subjects; thus, OCD subjects selectively attended to threatening stimuli that were associated with their OC concerns (i.e., took longer to process negatively valenced OCD relevant words). Their results also showed that the emotional interference was only present in symptomatic, but not in remitted OCD subjects, which suggests it may be a state rather than a trait marker. However, another study showed different results (Moritz et al., 2008). Moritz et al. (2008) used the EST with words associated with washing and checking OCD subtypes to assess if OCD patients share an attentional bias towards stimuli related to their disorder. Results in their study showed that OCD participants had no interference nor bias towards OCD subtype-congruent words. It may be possible that the worries of individuals with OCD may be mostly triggered by visual cues or images (e.g., dirt on the table). Thus Moritz et al. (2008) suggest that using a visual paradigm can be more suitable in assessing attentional bias in OCD.

The fact that there were no significant differences between groups on other neuropsychological tests suggests that the neuropsychological functioning of OCD subjects can be altered upon the presence of emotional stimuli. These results add relevant information to the controversial findings on the neuropsychological performance of individuals with OCD (Abramovitch & Cooperman, 2015; Kohli et al., 2015). Lack of differences between groups in fear recall and fear renewal suggests that OCD in Puerto Ricans may not be characterized by difficulty in maintaining fear acquisition and extinction memories. Significant differences in trait anxiety, negative affect, and emotional dysregulation between groups suggest that Puerto Ricans with OCD may have neuropsychological and physiological characteristics that are similar to healthy subjects but have a distinct psychological profile, which can be used to tailor cultural adaptations of evidence-based treatments for OCD. Considering cultural adaptations or changes in the process and content of psychotherapy according to cultural differences is essential to protect the scientific integrity of evidence-based research, promote valid studies, and reduce health disparities (Bernal & Domenech-Rodríguez, 2012) and not considering them may limit enhanced treatment response in minority populations, including Puerto Rico.

For this reason, according to the results of this study, treatment interventions in Puerto Ricans with OCD should be focused on the regulation of emotions, given the intense anxiety they experience. Although OCD is experienced globally, significant differences in the expression and severity of symptoms, primarily associated with psychological stressors, may exist and should be deliberated for effective treatment outcomes. This view is consistent with findings in a study by Chavira et al. (2008), showing similarities in the phenotypic expression of OCD of Costa Ricans and North Americans, such as the content of obsessions and compulsions, and symptom frequency and common subtypes, which may have a biological component. However, differences were observed in severity, suggesting the influence of culture. Furthermore, Chavira et al. (2008) found differences in trait anxiety between Costa Ricans and North Americans; North Americans had higher levels of trait anxiety than Costa Ricans. These results highlight possible disparities in the psychological functioning of different ethnic groups. According to Hwang (2006) (as cited in Zane et al., 2016), adapted interventions should focus on several areas that are relevant to culture, such as contemplating variation of the expression and management of emotional distress according to culture and addressing cultural issues and stressors that may be specific to ethnic minorities.

The most common and effective evidence-based treatment for OCD includes selective serotonin reuptake inhibitors (SSRIs) and cognitive behavioral therapy with exposure and response prevention (Abramowitz & Arch, 2014; Franz et al., 2013; Pauls et al., 2014). Limitations in the development and promotion of treatment for the minority population and the lack of professional cultural competence emphasizes the need for research that includes ethnic considerations (Williams et al., 2010; Zane et al., 2016). Our study's findings draw attention to the possibility that Puerto Ricans with OCD differ from healthy subjects, predominantly on subjective psychological measures. Although this study did not evaluate neurobiological structure or functioning in individuals with OCD, this should be considered in future studies regarding the manifestations of OCD in Puerto Ricans.

Limitations and Directions for Future Research

This study has several limitations. A small sample size may have limited the detection of OCD and healthy group differences in physiological responses and neuropsychological functioning and, thus, the generalization of results. However, differences were observed in psychological reports and emotionally-linked neuropsychological measures, despite a small sample size. Additionally, illness duration and if treatment was received was not assessed for participants with OCD. Changes in the severity of symptoms and illness duration complicate the adequate evaluation of neuropsychological performance. Also, if participants received or were currently receiving treatment could have an impact on the process of fear acquisition and extinction in OCD subjects. Future studies should consider these limitations to reach accurate conclusions. Future studies can include a larger sample and consider illness duration and if participants have received treatment in the past, as well as consider OCD subtypes and symptom

severity, which may influence neuropsychological and psychological functioning.

CONCLUSION

In conclusion, Puerto Ricans with OCD reacts similarly to healthy individuals during the process of maintaining fear acquisition and extinction memories. Thus, they may be efficient in learning how to fear and extinguishing the fear memory when concerns are not OCD-related. Furthermore, emotional stimuli may be influencing the psychological functioning of Puerto Ricans with OCD and their neuropsychological performance when tests involve emotional content. These findings can provide a further understanding of OCD in Latinos and emphasize the importance of considering cultural differences, such as the impact of emotional content, in the treatment and assessment of this population to obtain effective outcomes.

Funding: The project described was supported by Award Number S21MD001830 (K. Martínez) from the National Center on Minority Health and Health Disparities. The content is solely the authors' responsibility and does not necessarily represent the official views of the funding institutions.

Acknowledgments: We would also like to thank Dr. Carlos Morales for helpful assistance with the statistical analyses.

Conflict of Interest: None of the authors has any financial conflicts of interest to disclose.

REFERENCIAS

Abramovitch, A., & Cooperman, A. (2015). The cognitive neuropsychology of obsessive-compulsive disorder: A critical review. *Journal of Obsessive-Compulsive and Related Disorders, 5*, 24-36. https://doi.org/10.1016/j.jocrd.2015.01.002

Abramovitch, A., Abramowitz, J.S., & Mittelman, A. (2013). The neuropsychology of adult obsessive-compulsive disorder: A meta-analysis. *Clinical Psychology Review, 33*(8), 1163-1171. http://doi.org/10.1016/j.cpr.2013.09.004

Abramovitch, A., Mittelman, A., Tankersley, A. P., Abramowitz, J. S., & Schweiger, A. (2015). Neuropsychological investigations in obsessive–compulsive disorder: A systematic review of methodological challenges. *Psychiatry Research, 228*(1), 112-120. https://doi.org/10.1016/j.psychres.2015.04.025

Abramowitz, J. S., & Arch, J. J. (2014). Strategies for improving long-term outcomes in Cognitive Behavioral Therapy for Obsessive-Compulsive Disorder: Insights from learning theory. *Cognitive and Behavioral Practice, 21*(1), 20-31. https://doi.org/10.1016/j.cbpra.2013.06.004

Allen, L. B., & Barlow, D. H. (2009). Relationship of Exposure to Clinically Irrelevant Emotion Cues and Obsessive-Compulsive Symptoms. *Behavior Modification, 33*(6), 743-762. https://doi.org/10.1177/0145445509344180

American Psychiatric Association, DSM-5 Task Force. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5™* (5th ed.). American Psychiatric Publishing, Inc. https://doi.org/10.1176/appi.books.9780890425596

Amir, N., Najmi, S., & Morrison, A.S. (2010). Attenuation of attention bias in obsessive-compulsive disorder. *Behaviour Research and Therapy, 47*(2), 153-157. https://doi.org/10.1016/j.brat.2008.10.020

Armstrong, T. & Olatunji, B.O. (2017). Pavlovian disgust conditioning as a model for contamination-based OCD: Evidence from an analogue study. *Behaviour Research and Therapy, 93*, 78-87. https://doi.org/10.1016/j.brat.2017.03.009

ASSMCA. (December, 2016). *Need Assessment Study of Mental Health and Substance Use Disorders and Service Utilization among Adult Population of Puerto Rico*. Behavioral Sciences Research Institute University of Puerto Rico Medical Sciences Campus. http://www.assmca.pr.gov/BibliotecaVirtual/Estudios/Need%20Assessment%20Study%20of%20Mental%20Health%20and%20Substance%20of%20Puerto%20Rico%202016.pdf

Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology, 56*(6), 893-897. https://doi.org/10.1037/0022-006X.56.6.893

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Manual for the Beck Depression Inventory-II*. Psychological Corporation.

Bernal, G., & Domenech-Rodríguez, M. M. (Eds.). (2012). *Cultural adaptations: Tools for evidence-based practice with diverse populations*. American Psychological Association. https://doi.org/10.1037/13752-000

Blakey, S. M., Abramowitz, J. S., Reuman, L., Leonard, R. C., & Riemann, B. C. (2017). Anxiety sensitivity as a predictor of outcome in the treatment of obsessive-compulsive disorder. *Journal of Behavior Therapy and Experimental Psychiatry, 57*, 113-117. https://doi.org/10.1016/j.jbtep.2017.05.003

Bonilla, J., Bernal, G., Santos, A., & Santos, D. (2004). A revised Spanish version of the Beck Depression Inventory: Psychometric properties with a Puerto Rican sample of college students. *Journal of Clinical Psychology, 60*(1), 119-30. https://doi.org/10.1002/jclp.10195

Brand, J., Reid, J. M., & McKay, D. (2013). Neuropsychological assessment of Obsessive–Compulsive Disorder. Handbook of assessing variants and complications in anxiety disorders, 43-61. https://doi.org/10.1007/978-1-4614-6452-5_4

Bush, G., Shin, L. M., Holmes, J., Rosen, B. R., & Vogt, B. A. (2003). The Multi-Source Interference Task: validation study with fMRI in individual subjects. *Molecular Psychiatry, 8*(1), 60-70. https://doi.org/10.1038/sj.mp.4001217

Canino, G. J. (1987). The Prevalence of specific psychiatric disorders in Puerto Rico. *Archives of General Psychiatry, 44*(8), 727. https://doi.org/10.1001/archpsyc.1987.01800200053008

Canino, G., Shrout, P. E., NeMoyer, A., Vila, D., Santiago, K.M., Garcia, A., Cruz, V., & Alegria, M. (2019). A comparison of the prevalence of psychiatric disorders in Puerto Rico with the United States and the Puerto Rican population of the United States. *Social Psychiatry and Psychiatric Epidemiology, 54*, 369–378. https://doi.org/10.1007/s00127-019-01653-6

Chavira, D. A., Garrido, H., Bagnarello, M., Azzam, A., Reus, V. I., & Mathews, C. A. (2008). A comparative study of obsessive-compulsive disorder in Costa Rica and the United States. *Depression and Anxiety, 25*(7), 609-619. https://doi.org/10.1002/da.20357

Da Rocha, F. F., Alvarenga, N. B., Malloy-Diniz, L., & Corrêa, H. (2011). Decision-making impairment in obsessive-compulsive disorder as measured by the Iowa Gambling Task. *Arquivos de Neuro-Psiquiatria, 69*(4), 642-647. https://doi.org/10.1590/s0004-282x2011000500013

De Silva, P. (2006). Culture and obsessive–compulsive disorder. *Psychiatry, 5*(11), 402-404.

Fergus, T. A., & Bardeen, J. R. (2014). Emotion regulation and obsessive–compulsive symptoms: A further examination of associations. *Journal of Obsessive-Compulsive and Related Disorders, 3*(3), 243-248. https://doi.org/10.1016/j.jocrd.2014.06.001

Foa, E.B. & McNally, R.J. (1986). Sensitivity to feared stimuli in obsessive-compulsives: A dichotic listening analysis. *Cognitive Therapy and Research, 10*(4), 477-485. https://doi.org/10.1007/BF01173299

Fontenelle, L. F., & Hasler, G. (2008). The analytical epidemiology of obsessive–compulsive disorder: Risk factors and correlates. *Progress in Neuro-Psychopharmacology and Biological Psychiatry, 32*(1), 1-15. https://doi.org/10.1016/j.pnpbp.2007.06.024

Fontenelle, L. F., Mendlowicz, M. V., Marques, C., & Versiani, M. (2004). Trans-cultural aspects of obsessive–compulsive disorder: a description of a Brazilian sample and a systematic review of international clinical studies. *Journal of Psychiatric Research, 38*(4), 403-411. https://doi.org/10.1016/j.jpsychires.2003.12.004

Franz, A. P., Paim, M., Araújo, R. M., Rosa, V. D., Barbosa, Í. M., Blaya, C., & Ferrão, Y. A. (2013). Treating refractory obsessive-compulsive disorder: what to do when conventional treatment fails? *Trends in Psychiatry and Psychotherapy, 35*(1), 24-35. https://doi.org/10.1590/s2237-60892013000100004

Fullana, M.A., Cardoner, N., Alonso, P., Subira, M., Lopez-Sola, C., Pujol, J., Segalas, C., Real, E., Bossa, M., Zacur, E., Martinez-Zalacain, I., Bulbena, A., Mechon, J.M., Olmos, S., Soriano-Mas, C. (2013). *Psychological Medicine,* 1-12. https://doi.org/10.1017/S0033291713001128

Geller, D.A., McGuire, J.F., Orr, S.P., Small, B.J., Murphy, T.K., Trainor, K., Porth, R., Wilhem, S., & Storch, E.A. (2019). Fear extinction learning as a predictor of response to cognitive behavioral therapy for pediatric obsessive-compulsive disorder. *Journal of Anxiety Disorders, 64*, 1-8. https://doi.org/10.1016/j.janxdis.2019.02.005

González-Barrios, P., Morales-Rodríguez, C. M., Merced-Morales, K., Lampón, A., González, R., & Martínez, K. (2016). Dimensional assessment of anxiety in Puerto Rican patients: evaluating applicability of psychological questionnaires. *Puerto Rico Health Sciences Journal, 35*(3), 134-41.

Grant, D. A., & Berg, E. (1948). A behavioral analysis of degree of reinforcement and ease of shifting to new responses in a Weigl-type card-sorting problem. *Journal of Experimental Psychology, 38*(4), 404-411. https://doi.org/10.1037/h0059831

Haber, S. N., & Heilbronner, S. R. (2013). Translational Research in OCD: Circuitry and Mechanisms. *Neuropsychopharmacology, 38*(1), 252-253. https://doi.org/10.1038/npp.2012.182

Himle, J. A., Muroff, J. R., Taylor, R. J., Baser, R. E., Abelson, J. M., Hanna, G. L., Abelson, J.L., & Jackson, J.S. (2008). Obsessive-compulsive disorder among African Americans and blacks of Caribbean descent: results from the national survey of American life. *Depression and Anxiety, 25*(12), 993-1005. https://doi.org/10.1002/da.20434

Kohli, A., Kumar Rana, D., Gupta, N., & Kulhara, P. (2015). Neuropsychological Assessment in Obsessive- Compulsive Disorder. *Indian Journal of Psychological Medicine, 37*(2), 205-211. https://doi.org/10.4103/0253-7176.155624

Kuelz, A.K., Hohagen, F., & Voderholzer, U. (2004). Neuropsychological performance in obsessive-compulsive disorder: A critical review. *Biological Psychology, 65*, 185-236. https://doi.org/10.1016/j.biopsycho.2003.07.007

Leeuwerik, T., Cavanagh, K., & Strauss, C. (2019). Patient adherence to cognitive behavioural therapy for obsessive-compulsive disorder: A systematic review and meta-analysis. *Journal of Anxiety Disorders, 68*, 1-30. https://doi.org/10.1016/j.janxdis.2019.102135

Macatee, R. J., Capron, D. W., Schmidt, N. B., & Cougle, J. R. (2013). An examination of low distress tolerance and life stressors as factors underlying obsessions. *Journal of Psychiatric Research, 47*(10), 1462-1468. https://doi.org/10.1016/j.jpsychires.2013.06.019

Magán, I. Sanz, J. & García-Vera, M.P. (2008). Psychometric properties of a Spanish version of the Beck Anxiety Inventory (BAI) in general population. *Spanish Journal of Psychology, 11*(2), 626-640. https://doi.org/10.1017/S1138741600004637

Martin, P. (2003). The epidemiology of anxiety disorders: a review. *Dialogues of Clinical Neuroscience, 5*(3), 281-298.

Martínez, K. G., Franco-Chaves, J. A., Milad, M. R., & Quirk, G. J. (2014). Ethnic Differences in Physiological Responses to Fear Conditioned Stimuli. *PLoS ONE, 9*(12), e114977. https://doi.org/10.1371/journal.pone.0114977

McLaughlin, N., Strong, D., Abrantes, A., Garnaat, S., Cerny, A., O'Connell, C., … Greenberg, B. (2015). Extinction retention and fear renewal in a lifetime obsessive–compulsive disorder sample. *Behavioural Brain Research, 280*, 72-77. https://doi.org/10.1016/j.bbr.2014.11.011

Milad, M. R., Furtak, S. C., Greenberg, J. L., Keshaviah, A., Im, J. J., Falkenstein, M. J., … Wilhelm, S. (2013). Deficits in Conditioned Fear Extinction in Obsessive-Compulsive Disorder and

Neurobiological Changes in the Fear Circuit. *JAMA Psychiatry, 70*(6), 608. https://doi.org/10.1001/jamapsychiatry.2013.914

Millet, B., Dondaine, T., Reymann, J., Bourguignon, A., Naudet, F., Jaafari, N., … Le Jeune, F. (2013). Obsessive Compulsive Disorder networks: Positron emission tomography and neuropsychology provide new insights. *PLoS ONE, 8*(1), e53241. https://doi.org/10.1371/journal.pone.0053241

Moritz, S., Fischer, B.K., Hottenrott, B., Kellner, M., Fricke, S., Randjbar, S., & Jelinek, L. (2008). Words may not be enough! No increased Stroop effect in obsessive-compulsive disorder. *Behaviour Research and Therapy, 46*, 1101-1104. https://doi.org/10.1016/j.brat.2008.05.005

Nakao, T., Okada, K., & Kanba, S. (2014). Neurobiological model of obsessive-compulsive disorder: Evidence from recent neuropsychological and neuroimaging findings. *Psychiatry and Clinical Neurosciences, 68*(8), 587-605. https://doi.org/10.1111/pcn.12195

Pallanti, S., Grassi, G., Sarrecchia, E. D., Cantisani, A., & Pellegrini, M. (2011). Obsessive–Compulsive Disorder Comorbidity: Clinical Assessment and Therapeutic Implications. *Frontiers in Psychiatry*, 2. https://doi.org/10.3389/fpsyt.2011.00070

Pauls, D. L. (2010). The genetics of obsessive-compulsive disorder: a review. *Dialogues Clinical Neuroscience, 12*(2), 149-63.

Pauls, D. L., Abramovitch, A., Rauch, S. L., & Geller, D. A. (2014). Obsessive–compulsive disorder: an integrative genetic and neurobiological perspective. *Nature Reviews Neuroscience, 15*(6), 410-424. https://doi.org/10.1038/nrn3746

Pena-Garijo, J., Ruipérez-Rodríguez, M. A., & Barros-Loscertales, A. (2010). Neurobiología del trastorno obsesivo-compulsivo: aportaciones desde la resonancia magnética funcional (I). *Revista Neurología, 50*(8), 477-485. https://doi.org/10.33588/rn.5008.2009385

Qin, H., Samuels, J. F., Wang, Y., Zhu, Y., Grados, M. A., Riddle, M. A., … Greenberg, B. D. (2016). Whole genome association analysis of treatment response in obsessive-compulsive disorder. *Molecular Psychiatry, 21*(2), 270–276. https://doi.org/10.1038/mp.2015.32

Quirk, G. J., Pare, D., Richardson, R., Herry, C., Monfils, M. H., Schiller, D., & Vicentic, A. (2010). Erasing Fear Memories with Extinction Training. *Journal of Neuroscience, 30*(45), 14993-14997. https://doi.org/10.1523/jneurosci.4268-10.2010

Rao, N.P., Arasappa, R., Reddy, N.N., Venkatasubramanian, G., & Reddy, Y.C.J. (2010). Emotional interference in obsessive-compulsive disorder: A neuropsychological study using optimized emotional Stroop test. *Psychiatry Research, 180*, 99-104. https://doi.org/10.1016/j.psychres.2009.10.017

Rocha, F. F., Alvarenga, N. B., Malloy-Diniz, L., & Corrêa, H. (2011). Decision-making impairment in obsessive-compulsive disorder as measured by the Iowa Gambling Task. *Arquivos de Neuro-Psiquiatria, 69*(4), 642-647. https://doi.org/10.1590/s0004-282x2011000500013

Rodríguez-Acevedo, A., Toro-Alfonso, J., & Martínez-Taboas, A. (2009). El trastorno obsesivo compulsivo: Escuchando las voces ocultas. *Revista Puertorriqueña de Psicología, 20*(1), 7-32.

Ruscio, A. M., Stein, D. J., Chiu, W. T., & Kessler, R. C. (2010). The epidemiology of obsessive-compulsive disorder in the National Comorbidity Survey Replication. *Molecular Psychiatry, 15*(1), 53-63. https://doi.org/10.1038/mp.2008.94

Sandín, B., Chorot, P., Lostao, L., Joiner, T.E., M.A., Santed, & Valiente, R.M. (1999). Escalas PANAS de afecto positivo y negativo: Validación factorial y convergencia transcultural. *Psicotherma, 11*(1), 37-51.

Saremi, A. A., Shariat, S. V., Nazari, M. A., & Dolatshahi, B. (2017). Neuropsychological functioning in Obsessive-Compulsive Washers: Drug-Naive without depressive symptoms. *Basic and clinical neuroscience, 8*(3), 233–248. https://doi.org/10.18869/nirp.bcn.8.3.233

Simpson, H.B., Rosen, W., Huppert, J.D., Lin, S.H., Foa, E.B., Liebowitz, M.R. (2006). Are there reliable neuropsychological deficits in obsessive-compulsive disorder? *Journal of Psychiatric Research, 40*(3), 247-257. https://doi.org/10.1016/j.jpsychires.2005.04.004

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1983). *STAI manual for the state-trait anxiety inventory: (Self-evaluation questionnaire)*. Consulting Psychologists Press.

Spielberger, C.D. & Díaz-Guerrero, R. (1975*). IDARE Inventario de Ansiedad: Rasgo Estado*. Editorial El Manual Moderno, SA.

Stern, M. R., Nota, J. A., Heimberg, R. G., Holaway, R. M., & Coles, M. E. (2014). An initial examination of emotion regulation and obsessive compulsive symptoms. *Journal of Obsessive-Compulsive and Related Disorders, 3*(2), 109-114. https://doi.org/10.1016/j.jocrd.2014.02.005

Tukel, R., Gurvit, H., Ertekin, B.A., Oflaz, S., Ertekin, E., Baran, B., Kalem, S.A., Kandemir, P.E., Ozdemirogiu, F.A., & Atalay, F. (2012). Neuropsychological function in obsessive-compulsive disorder. *Comprehensive Psychiatry, 53*, 167-175. https://doi.org/10.1016/j.comppsych.2011.03.007

Van Grootheest, D. S., Cath, D. C., Beekman, A. T., & Boomsma, D. I. (2005). Twin Studies on Obsessive–Compulsive Disorder: A Review. *Twin Research and Human Genetics, 8*(5), 450-458. https://doi.org/10.1375/183242705774310060

Van Noppen, B. L., Boudouvas, C., Pato, M. T., & Rasmussen, S. (2006). *Learning to Live with OCD* (6th ed.). Obsessive Compulsive Foundation, Inc.

Voderholzer, U., Schwartz, C., Freyer, T., Zurowski, B., Thiel, N., Herbst, N., Wahl, K., Kordon, A., Hohagen, F., & Kulz, A. K. (2013). Cognitive functioning in medication-free obsessive-compulsive patients treated with cognitive-behavioural therapy. *Journal of Obsessive-Compulsive and Related Disorders, 2*(3), 241-248. https://doi.org/10.1016/j.jocrd.2013.03.003

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063-1070. https://doi.org/10.1037//0022-3514.54.6.1063

Weissman, M. M., Bland, R. C., Canino, G. J., Greenwald, S., Hwu, H. G., … Newman, S. C. (1994). Cross-National Epidemiology of Obsessive-Compulsive Disorder: The Cross-National Collaborative Group. *The Journal of Clinical Psychiatry, 55*(3), 5-10.

Wetterneck, C.T., Little, T.E., Rinehart, K.L., Cervantes, M.E., Hyde, E., & Williams, M. (2012). Latinos with obsessive-compulsive disorder: Mental healthcare utilization and inclusion in clinical trials. *Journal of Obsessive-Compulsive Related Disorders, 1*(2), 85-97. https://doi.org/10.1016/j.jocrd.2011.12.001

Wheaton, M.G., Berman, N.C., Fabricant, L.E., & Abramowitz, J.S. (2013). Differences in obsessive-compulsive symptoms and obsessive beliefs: A comparison between African Americans, Asian Americans, Latino Americans, and European Americans. *Cognitive Behaviour Therapy, 42*(1), 9-20. https://doi.org/10.1080/16506073.2012.701663

Williams, M. T. & Steever, A. (2015). Cultural manifestations of obsessive-compulsive disorder. In Lack, C.W. (Ed.), *Obsessive-Compulsive Disorder: Etiology, Phenomenology, and Treatment.* (pp. 63-84). Onus Books.

Williams, M., Powers, M., Yun, Y., & Foa, E. (2010). Minority Participation in Randomized Controlled Trials for Obsessive-Compulsive Disorder. *Journal of Anxiety Disorders, 24*(2), 171-177. https://doi.org/10.1016/j.janxdis.2009.11.004

Wood, J. & Ahmari, S. E. (2015). A Framework for Understanding the Emerging Role of Corticolimbic-Ventral Striatal Networks in OCD-Associated Repetitive Behaviors. *Frontiers in Systems Neuroscience, 9*. http://doi.org/10.3389/fnsys.2015.00171

Zane, N. W., In Bernal, G., & Leong, F. T. (2016). *Evidence-based psychological practice with ethnic minorities: Culturally informed research and clinical strategies*. American Psychological Association.