Published in final edited form as:

Behav Res Ther. 2011 December ; 49(12): 914–919. doi:10.1016/j.brat.2011.09.005.

An Exploration of Economic Reasoning in Hoarding Disorder Patients

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Abstract

Current models of Hoarding Disorder (HD) emphasize problems of decision-making. Evidence for neuropsychological impairment in HD, however, has been mixed. The present study examined whether HD patients show problems of economic reasoning that could be associated with decision-making problems. Forty-two HD patients, 29 obsessive-compulsive disorder (OCD) patients, and 36 healthy control participants completed the Iowa Gambling Task (IGT), a computerized card playing game that assesses participants' ability to learn and utilize a rule of sacrificing short-term gain for long-term gain, and a cognitive dissonance reduction task that measured changes in preference for items (art prints) after selecting or rejecting them. Results showed no deficits on the IGT for HD participants, and no difference in dissonance reduction results after selecting or rejecting items on the dissonance reduction task. Furthermore, performance on these two tasks was unrelated to hoarding symptom severity or self-reported indecisiveness. It is suggested that the problems of cognitive processing in HD patients may be largely related to as-yet understudied processes, including idiosyncratic categorization problems for personally-owned items as well as other aspects of economic reasoning.

Keywords

Hoarding; obsessive-compulsive disorder; decision-making; neuropsychology; cognition

Current models of Hoarding Disorder (HD) emphasize problems of decision-making, particularly when deciding about whether to keep or discard possessions (Mataix-Cols, Pertusa, & Snowden, 2011; Pertusa et al., 2010; Saxena, 2008; Steketee & Frost, 2003; Tolin, 2011). Individuals with HD report high levels of indecisiveness and other problems of decision-making (Frost & Gross, 1993; Frost & Shows, 1993; Samuels et al., 2002; Steketee, Frost, & Kyrios, 2003), and exhibit difficulty categorizing possessions (Grisham, Norberg, Williams, Certoma, & Kadib, 2010; Luchian, McNally, & Hooley, 2007; Wincze, Steketee, & Frost, 2007). These observations raise the possibility of a pattern of decision-making deficits.

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Evidence for neuropsychological impairment in HD, however, has been mixed. Research to date shows a fairly robust pattern of problems with sustained attention (Grisham, Brown, Savage, Steketee, & Barlow, 2007; Tolin, Villavicencio, Umbach, & Kurtz, in press). Less consistent results have been found for memory problems (Hartl et al., 2004; Jang et al., 2010; Tolin et al., in press) and problems of executive function (Grisham et al., 2010; Tolin et al., in press) using standardized neuropsychological tests.

One possibility is that HD patients' saving behaviors stem less from gross neurocognitive impairment than from abnormal aspects of behavioral economics such as value computation, sensitivity to future consequences, and post-decisional regret. As Bechara et al. (1994) noted, such abnormalities can dramatically impact real-life decision-making without other evidence of neuropsychological impairment. For example, while it is well known that individuals allocate risk and loss according to idiosyncratic reference points (Tversky & Kahneman, 1981), it could be argued that HD patients differ from the normal population in this respect, a hypothesis that comports with findings of abnormal activity in orbitofrontal cortex (Tolin, Kiehl, Worchunsky, Book, & Maltby, 2009). The Iowa Gambling Task (IGT; Bechara et al., 1994) has been used to examine individuals' ability to balance short-term and long-term gains and losses. In this computerized card playing game, patients select cards from one of four decks; each choice is associated with "monetary" gains and losses. Two of the decks intermittently produce large rewards but in the long term lead to significant financial losses, whereas the other two decks lead to modest but consistent gains. Impaired performance on the IGT has been documented in patients with lesions to ventromedial prefrontal cortex (Bechara, Damasio, Tranel, & Damasio, 1997), a region that has been implicated in HD (An et al., 2009). In the first application of the IGT to hoarding, Lawrence et al. (2006) administered the IGT to 39 obsessive-compulsive disorder (OCD) patients, 10 of whom received high scores on a measure of hoarding symptoms, and 40 controls. Hoarding OCD patients performed more poorly than did non-hoarding OCD patients and controls on the IGT. This finding, however, was not replicated in a study of primary HD patients (Grisham et al., 2007), although one potential limitation of that study was the absence of a clinical control group.

Similarly, it could be argued that HD patients' decision-making ability is hampered by post-decisional regret. Many individuals with HD describe their reaction to discarding (or failing to acquire) possessions as one of grief or sadness, rather than anxiety (Steketee & Frost, 2003). It is well known that individuals are highly motivated to avoid such regret (Loomes & Sugden, 1982); one possibility is that individuals with HD experience such regret to a greater extent than do healthy individuals. A dissonance reduction task initially designed by Gerard and White (1983), based on an earlier study by Brehm (1956), may capture this phenomenon. In this task, participants rank-order a number of art prints in terms of preference. They are then shown two pairs of prints and asked to select one pair to take home. They are then asked to re-rank all of the art prints again in terms of preference. Healthy participants show a pattern of dissonance reduction in which the previously-selected prints are ranked higher (indicating increased preference), and the previously-rejected prints are ranked lower (indicating decreased preference) (Gerard & White, 1983; Lieberman, Ochsner, Gilbert, & Schacter, 2001). To date, this task has not been used with HD or other psychiatric populations, although it might be hypothesized that HD patients' post-decisional regret would be expressed by increased preference for previously-rejected items.

The aim of the present study was to determine whether primary HD patients show impaired performance on the IGT and dissonance reduction task. HD patients (specifically recruited for the presence of significant hoarding behaviors) were compared to healthy controls and to patients with OCD, given the growing consensus that hoarding and OCD are distinct conditions (Pertusa et al., 2010; Phillips, 2009). It was predicted that HD patients, compared

to OCD patients and healthy controls, would show impaired performance on the IGT as measured by relative failure to incorporate the correct selection rule (i.e., the rule that sacrifices short-term gain for long-term gain) over time. It was also predicted that HD patients, compared to OCD patients and healthy controls, would show increased preference for previously-rejected items on the dissonance reduction task as measured by an increase in ranking position. Finally, it was predicted that the slope of the learning curve on the IGT and the change in ranking on the dissonance reduction task would correlate significantly with measures of hoarding and indecisiveness.

Method

Participants

One hundred seven adult participants met inclusion criteria of age 18–65; fluent in English; absence of lifetime bipolar, psychotic, developmental, or substance use disorders; absence of medical conditions known to impact brain function; and (for the clinical groups) symptom duration of 1 year or more and *Clinician's Global Impressions* (CGI; Guy, 1976) rating of 4 (moderately ill) or higher. Furthermore, participants were included if they could be classified into one of three diagnostic groups: *HD* (primary diagnosis of Hoarding Disorder, no diagnosis of non-hoarding OCD; $N = 42$), *OCD* (primary diagnosis of non-hoarding OCD, no diagnosis of hoarding; $N = 29$), or *Healthy Controls* (no lifetime psychiatric diagnosis or treatment; $N = 36$). Primacy of diagnoses was ascertained using clinical severity ratings (CSRs) from the *Anxiety Disorders Interview Schedule for DSM-IV* (ADIS-IV; Brown, DiNardo, & Barlow, 1994). It should be noted that patients with co-occurring HD and OCD, which comprise approximately 18% of HD patients (Frost, Steketee, & Tolin, 2011), were excluded.

Materials

Clinical Interviews—Psychiatric diagnoses were ascertained using the *ADIS-IV* (Brown et al., 1994). Reliability for the various DSM-IV categories contained in the ADIS-IV extends from good to excellent ($\alpha = .41-.86$) (Brown, Di Nardo, Lehman, & Campbell, 2001). Assessors were trained to criterion (100% agreement on diagnostic classification and within one CSR point on all diagnoses), with regular inter-rater reliability checks to prevent rater drift. Hoarding diagnoses were made using the *Hoarding Rating Scale-Interview* (HRS-I; Tolin, Frost, & Steketee, 2010), a semi-structured interview that assesses the severity of clutter, acquisition, difficulty discarding, distress, and impairment, each on a 0–8 scale. The HRS-I shows excellent internal consistency and reliably discriminates hoarding from non-hoarding participants (Tolin et al., 2010). Severity of depression was assessed using the 17-item *Hamilton Rating Scale for Depression* (HRSD-17; Hamilton, 1960), a 17-item semi-structured interview. The Structured Interview Guide for the HRSD (SIGH-D; Williams, 1988) was used; this measure shows excellent inter-rater reliability (Williams, 1988), and appears more reliable than the unstructured HRSD (Moberg et al., 2001). Overall illness severity was determined using the *CGI* (Guy, 1976). The CGI shows good test-retest reliability (Dahlke, Lohaus, & Gutzmann, 1992) and correlates strongly with clinician rated anxiety and depression symptoms (Leon et al., 1993).

Self-Report Measures—Severity of the core features of hoarding (clutter, difficulty discarding, acquiring) was assessed using the *Saving Inventory-Revised* (SI-R; Frost, Steketee, & Grisham, 2004), a 23-item questionnaire of compulsive hoarding severity. Internal consistency is excellent for the total score and for the 3 subscales. The SI-R readily discriminates hoarders from OCD patients and community controls, and correlates significantly with ratings of clutter and impairment (Frost et al., 2004). Specific OCD symptom dimensions were measured using the *Obsessive-Compulsive Inventory-Revised*

(OCI-R; Foa et al., 2002), an 18-item questionnaire that assesses OCD symptoms across six factors, with possible scores ranging from 0–12: 1) Washing, 2) Checking/Doubting, 3) Obsessing, 4) Mental Neutralizing, 5) Ordering, and 6) Hoarding. The OCI-R possesses excellent test-retest reliability in OCD patients (Foa et al., 2002) and reliably discriminates among OCD subtypes (Huppert et al., 2007). Self-reported indecisiveness was assessed using the *Frost Indecisiveness Scale* (FIS; Frost & Shows, 1993), a 15-item scale that comprises two subscales: Fears about Decision-Making and Positive Attitudes towards Decision-Making. The FIS demonstrated adequate reliability and validity in undergraduate samples (Frost & Shows, 1993) and is associated with hoarding behaviors (Frost, Tolin, Steketee, & Oh, in press).

Iowa Gambling Task—The IGT (Bechara et al., 1997) is a computerized card playing game in which the participant is instructed to try and win as much “money” as possible over 100 selections from one of four decks shown on the screen. Participants select a card from a deck, one at a time, by pointing and clicking on the deck with the computer mouse. After each choice, the participant is informed how much money he/she has gained, and how much was lost. Every choice is associated with an amount won and lost. The rules are not disclosed, and the participant should gradually learn that two of the decks are “high risk” (i.e., intermittently produce large rewards but in the long term lead to significant financial losses), whereas two decks lead to modest but consistent gains. The dependent variable in this task is the ratio of “good” cards to “bad” cards selected after an initial learning period (the first 50 cards). Healthy individuals quickly learn to avoid the risky decks (i.e., after the initial learning period, their ratio of good to bad cards is high), whereas patients with lesions to the ventromedial prefrontal cortex do not (i.e., their ratio of good to bad cards remains low) (Bechara et al., 1997). Deficits on the IGT appear independent from working memory (Bechara, Damasio, Tranel, & Anderson, 1998).

Dissonance Reduction Task—The dissonance reduction task was originally used as a measure of post-decisional cognitive dissonance reduction (Gerard & White, 1983) and was included in the present study as an index of post-decisional regret. The task, which followed the protocol outlined by Lieberman et al. (2001), is administered in 3 contiguous phases. In Phase 1, subjects are asked to rank two stacks of 15 3×5" color art prints in order of preference. While subjects perform a filler task, the experimenter removes two pairs of prints from the second set, each consisting of a relatively liked and relatively disliked print. In Phase 2, subjects are asked to indicate which of two pairs of art prints they would prefer to hang in their home if they could have full-size reproductions of that pair to take with them (although they are not actually given the prints). Participants make six such choices, five involving novel pairs of prints and one involving the relatively liked and disliked prints from Phase 1. After another filler task, phase 3 begins in which subjects are asked to rank each set of prints again, in order of their preference. The scores of interest are the attitude change scores (changes in rank) for selected and rejected prints. Of particular interest for the present study is the degree to which participants' rankings of previously rejected prints increase, which would indicate post-decisional regret. This task, like the IGT, appears to be relatively insensitive to working memory deficits or degree of cognitive load (Lieberman et al., 2001), reducing the risk of between-group confounds.

Procedure

Participants were recruited via newspaper advertisements and flyers, as well as from the patient flow at a specialty anxiety clinic. Of note, the HD participants were recruited specifically for hoarding or clutter problems, not for OCD, which may result in a more representative sample given the rather low rate of true OCD among hoarders (Frost et al., 2011). After providing written informed consent, participants completed all self-report

measures and met with a trained graduate-level interviewer who administered the ADIS-IV, HRS-I, HRSD-17, and CGI. Once these measures were completed, participants completed the IGT and dissonance reduction task, administered by a trained graduate-level assessor, in a separate, single session.

Results

Sample Description

Table 1 shows that the OCD group was younger on average than were the hoarding and healthy control groups. Subsequent analyses therefore corrected for age. As expected, the hoarding group exhibited higher SI-R scores than did the other two groups (the OCD group also showed some elevation, but were well within the nonclinical range on the SI-R). The OCD and healthy control groups' SI-R scores were somewhat lower than those found in previous research (Frost et al., 2004). The two clinical groups scored higher than did the healthy group on the HRSD-17 but did not differ from each other; however, hoarding participants were more likely than were OCD participants to be diagnosed with a depressive disorder. Examination of specific OCD symptom dimensions on the OCI-R confirmed the expected differences among the groups. HD participants scored higher on the Hoarding subscale than did the OCD and healthy control groups, although some elevation was seen in the OCD group. The OCD group scored higher than did the other two groups on all other OCI-R subscales except Ordering, on which they did not differ from the HD group. Among OCD participants, the highest scores were obtained for Obsessing, Checking, and Washing. Compared to the other two groups, the hoarding participants reported higher fear of decision-making and lower positive feelings about decision-making.

Iowa Gambling Task

A 3 (group: HD, OCD, HC) $\times$ 5 (block) mixed-factor GLM with block as the repeated measure, controlling for age, was conducted, with the number of "good" cards per block selected as the dependent variable. This analysis revealed a main effect of block ($F_{4,408} = 2.45, p = .046$), showing that more "good" cards were selected over time. There was no significant main effect of group ($F_{2,102} = 0.29, p = .749$) or group $\times$ block interaction ($F_{8,408} = 0.58, p = .791$). (See Figure 1). Sixty-seven percent of HD patients, 62% of OCD patients, and 61% of healthy controls were able to identify the correct strategy verbally at the end of the trial; these proportions did not differ significantly ($\chi^2 = 0.30, p = .862$).

For each participant, the slope of the line representing the number of "good" cards selected across the 5 blocks was calculated. Slopes ranged from -6.00 , representing a worsening of performance, to 4.10 , representing a performance improvement ($M = 1.25$). Slopes did not correlate significantly with SI-R total score ($r = -0.43, p = .665$), fear of decision-making ($r = 0.11, p = .319$), or HRSD total score ($r = 0.09, p = .399$). On the OCI-R subscales, slopes did not correlate with the Hoarding ($r = -.04, p = .660$), Checking ($r = .03, p = .733$), Neutralizing ($r = -.05, p = .627$), Obsessing ($r = .12, p = .228$), Ordering ($r = -.01, p = .916$), or Washing ($r = .16, p = .111$) scales.

Dissonance Reduction Task

For each participant, two change scores were calculated, reflecting the mean percent change in ranking for the two selected prints, and the mean percent change in rank position for the two rejected prints. Mean change of rank position for selected prints ranged from -0.83 , representing an 83% worsening of rank position (decreased preference), to 0.83 , representing an 83% improvement in rank position (increased preference) ($M = 0.02$). Mean change of rank position for rejected prints ranged from -0.85 , representing an 85%

worsening of rank position (decreased preference), to 0.46, representing a 46% improvement in rank position (increased preference) ($M = -0.11$).

A 3 (group: HD, OCD, HC) $\times$ 2 (decision: select, reject) mixed-factor GLM with decision as the repeated measure, controlling for age, was conducted, with percent change in ranking position as the dependent variable. This analysis revealed no main effect of decision ($F_{1,103} = 1.20, p = .275$), no significant main effect of group ($F_{2,103} = 2.20, p = .116$), and no significant group $\times$ decision interaction ($F_{2,103} = 0.95, p = .387$). (See Figure 2).

Percent change in ranking position for previously-selected items did not correlate significantly with SI-R total score ($r = -0.02, p = .850$), fear of decision-making ($r = 0.13, p = .222$), or HRDS total score ($r = -0.08, p = .400$). On the OCI-R subscales, percent change in ranking position did not correlate with the Hoarding ($r = -.06, p = .535$), Checking ($r = -.03, p = .718$), Neutralizing ($r = .01, p = .897$), Obsessing ($r = -.04, p = .644$), Ordering ($r = -.15, p = .115$), or Washing ($r = -.02, p = .862$) scales.

Percent change in ranking position for previously-rejected items did not correlate significantly with SI-R total score ($r = -0.13, p = .155$), fear of decision-making ($r = 0.08, p = .474$), or HRDS total score ($r = -0.18, p = .069$). On the OCI-R subscales, percent change in ranking position did not correlate with the Hoarding ($r = -.15, p = .118$), Checking ($r = .08, p = .422$), Neutralizing ($r = -.03, p = .743$), Obsessing ($r = .04, p = .689$), Ordering ($r = -.01, p = .893$), or Washing ($r = .03, p = .763$) scales.

Discussion

The HD patients in the present study reported higher fear of decision-making and lower positive feelings about decision-making than did OCD patients or healthy controls, replicating and extending the findings of previous research (Frost & Gross, 1993; Frost & Shows, 1993; Samuels et al., 2002; Steketee et al., 2003). However, they did not exhibit abnormalities of economic reasoning on the behavioral tasks used. HD patients performed adequately on the IGT, a finding that contrasts with previous results using OCD patients with hoarding symptoms (Lawrence et al., 2006), although it is noted that another study failed to replicate that result using primary HD patients (Grisham et al., 2007).

We also did not find evidence of marked post-decisional regret in HD patients. After "rejecting" (choosing not to acquire) a pair of art prints, HD patients exhibited the same pattern of dissonance reduction seen in the other groups, as well as in previous research (Lieberman et al., 2001), with the rejected items decreasing in ranked preference and the selected items increasing in ranked preference after the decision. Regrettably, re-ranking was not timed in this task and it is possible that HD patients would have taken longer to adjust their preferences. Furthermore, it is possible that greater post-decisional regret would have been evident had participants actually been given the art prints.

Current models of HD emphasize problems of decision-making as a critical mechanism of the saving and acquiring behavior that lead to severe clutter. Indeed, in clinical practice, HD patients are routinely described as exhibiting substantial problems of information processing (Christensen & Greist, 2001; Tolin, Frost, & Steketee, 2011). Neuroimaging studies of patients with hoarding symptoms implicate abnormal activity in anterior cingulate cortex (Saxena et al., 2004), orbitofrontal cortex (Mataix-Cols et al., 2004; Tolin et al., 2009), and ventromedial prefrontal cortex (An et al., 2009), regions highly involved with decision-making (Bechara et al., 1994; Devinsky, Morrell, & Vogt, 1995; Rolls, 2004). How these neural abnormalities translate into saving and acquiring behaviors, however, is not entirely clear. As noted previously, with the exception of problems sustaining attention, evidence for

true neuropsychological impairment has been mixed (Grisham et al., 2007; Grisham et al., 2010; Hartl et al., 2004; Jang et al., 2010; Tolin et al., in press).

One possible explanation for this pattern of results is that HD patients are not characterized by objective problems of decision-making. This explanation seems rather unlikely, given the observed fears of decision-making as well as clinicians' reports of impaired cognitive processes and the high rates of hoarding behavior in individuals with dementia (Hwang, Tsai, Yang, Liu, & Lirng, 1998; Nakaaki et al., 2007) and lesions to the frontal cortex (Anderson, Damasio, & Damasio, 2005).

Another possibility, therefore, is that the decision-making deficits in HD patients are not well captured by existing standardized tests. Novel behavioral tasks have been developed that might assess hoarding-related deficits more effectively. One such task is the possession categorization task developed by Wincze et al. (2007), in which participants sorted owned and non-owned possessions into piles. Compared to the non-owned possessions, HD patients, but not OCD patients or healthy controls, created more piles and took more time on this task when making decisions about their own possessions. These results have been partially replicated in other studies (Grisham et al., 2010; Luchian et al., 2007).

It is also possible that cognitive processing deficits in HD are present mainly under conditions of emotional load, and are therefore not captured in the emotionally neutral setting of a typical neuropsychological study. In healthy individuals, mood induction does not cause substantial declines in neurocognitive performance (Chepenik, Cornew, & Farah, 2007), although there may be some subtle impact on frontal lobe function (Bartolic, Basso, Schefft, Glauser, & Titanic-Schefft, 1999). Additional research that tests HD patients' cognitive function under negative mood conditions is needed.

The field of behavioral economics has identified other aspects of decision-making that might be impaired in HD patients. For example, the endowment effect (Thaler, 1980), in which ownership of an item can increase its perceived worth, may be informative for the study of hoarding. The endowment effect has been demonstrated to be associated with distorted estimates of the desirability vs. uselessness of objects (Nayakankuppam & Mishra, 2005; Sen & Block, 2009), is increased under conditions of negative mood and low coping resources (Zhang & Fishbach, 2005), and is sensitive to feelings of involvement or attachment to the item (Saqib, Frohlich, & Bruning, 2010). These phenomena all resonate with observations of HD patients, and additional analysis of HD from the perspective of behavioral economics might be informative.

Highlights

- Explored economic reasoning in hoarding patients, OCD patients, and healthy controls.
- Iowa Gambling Task and a dissonance reduction task were used.
- No evidence was found for problems of economic reasoning in hoarding patients.

Acknowledgments

This study was funded by NIMH grant #R01MH074934 to Dr. Tolin.

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Figure 1. Number of "good" cards selected on the Iowa Gambling Task across 5 blocks for hoarding patients, OCD patients, and healthy controls

Figure 2.
Mean percent change in ranking of previously-selected and previously-rejected art prints for hoarding patients, OCD patients, and healthy controls

Table 1

Sample Characteristics

	Hoarding (N=42)	OCD (N=29)	Healthy Control (N = 36)	F	χ^2
Age	51.14 (8.33) ^a	31.21 (11.80) ^b	47.00 (12.29) ^a	31.12 ^{**}	
Female [N (%)]	31 (73.8%) ^a	8 (27.6%) ^b	29 (80.6%) ^a		22.60 ^{**}
White [N (%)]	38 (90.5%)	26 (89.7%)	33(91.7%)		0.08
SI-R Total	64.07(11.48) ^a	13.32 (12.06) ^b	5.53 (5.71) ^c	383.94 ^{**}	
HRSD-17 Total	6.93 (4.24) ^a	5.29(5.19) ^a	0.97(1.61) ^b	23.48 ^{**}	
OCI Hoarding	9.86 (2.35) ^a	1.59 (1.99) ^b	0.89 (1.19) ^b	257.50 ^{**}	
OCI Checking	1.88(1.94) ^a	3.55 (3.86) ^b	0.19(0.40) ^c	16.39 ^{**}	
OCI Neutralizing	1.24(1.81) ^a	2.86 (3.11) ^b	0.11 (0.40) ^c	15.42 ^{**}	
OCI Obsessions	1.57(1.96) ^a	7.14 (3.71) ^b	0.11 (0.46) ^c	81.55 ^{**}	
OCI Ordering	4.05 (2.95) ^a	2.79 (2.78) ^a	1.00 (1.15) ^b	15.17 ^{**}	
OCI Washing	1.33(1.90) ^a	3.69 (3.78) ^b	0.06 (0.23) ^c	20.36 ^{**}	
FIS Fear of Decision Making	29.41 (7.37) ^a	23.50 (9.29) ^b	13.81 (5.50) ^c	30.08 ^{**}	
FIS Positive Feelings about Decision Making	15.83 (3.80) ^a	16.29 (6.33) ^a	21.85 (4.86) ^b	11.74 ^{**}	
Comorbid Anxiety Disorder [N(%)]	20 (47.6%)	9(31.0%)	--		1.95
Comorbid Depressive Disorder [N (%)]	20 (47.6%) ^a	7(24.1%) ^b	--		4.01 [*]
Medicated	23 (54.8%) ^a	22(81.5%) ^b	--		5.17 [*]

Scores are shown as *M (SD)* unless noted otherwise.

*
 $p < .05$.

**
 $p < .01$.

Within each row, groups with different superscript letters are significantly different ($p < .05$).