An fMRI Study of Responses to Sexual Stimuli as a Function of Gender and Sensation Seeking: A Preliminary Analysis

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Abstract

Although sexual cues produce stronger neural activation in men, the mechanisms underlying this differential response are unclear. We examined the relationship of sensation seeking and the brain's response to sexual stimuli across gender in twenty-seven subjects (14 men, mean=25.2yrs, SD=3.6, 85.2% Caucasian) who underwent functional magnetic resonance imaging while viewing sexual and non-sexual images. Whole-brain corrected significant clusters of regional activation were extracted and associated with gender, sensation seeking, and sexual behaviors. Men responded more to sexual than positively valenced nonsexual images in the anterior cingulate/medial prefrontal cortex (ACC/mPFC), anterior insula/lateral orbitofrontal cortex, bilateral amygdala and occipital regions. Sensation seeking related positively to the ACC/mPFC (r=0.65, p=0.01) and left amygdala (r=0.66, p=0.01) response in men alone, with both of these correlations significantly larger in men than women (all p's<0.03). The relationship between BOLD responses and self-reported high-risk and low-risk sexual behaviors showed interesting, albeit non-significant, gender-specific trends. These findings suggest that the relationship between sexual responsivity, sensation seeking, and sexual behavior is gender-specific. This study indicates a need to identify the gender-specific mechanisms that underlie sexual responsivity and behaviors. In addition, it demonstrates that the nature of stimuli used to induce positive mood in imaging and other studies should be carefully considered.

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An fMRI study of responses to sexual stimuli as a function of gender and sensation seeking: A preliminary analysis

Sexual cues cause widespread neural activation that is generally stronger in men than women (see Georgiadis, 2015). Two recent reviews (Kuhn & Gallinat, 2011; Stoleru et al., 2012) remarked that, across studies, responses to visual erotic stimuli were present within limbic (hypothalamus, thalamus, amygdala, anterior cingulate gyrus, insula), sensorimotor (precentral gyrus), parietal, and visual (occipital cortex, fusiform gyrus) brain regions of men, with much of this activation corresponding with penile tumescence, a common physiological marker of sexual arousal. Although women tend to show similar regions of activation in response to sexual stimuli (most commonly in the insula and ventral striatum, as well as the orbitofrontal cortex, medial prefrontal, anterior cingulate, parietal, and occipototemporal cortices; Stoleru et al., 2012), men show responses to sexual stimuli that are larger in magnitude, particularly within the hypothalamus and amygdala (see Hamann et al., 2004; Karama et al., 2002). Women's responses to sexual stimuli may be more variable than men's responses (Georgiadis, 2015) and neural responses in women are often unrelated to physiological measures of arousal (as reviewed by Stoleru et al., 2012). Importantly, the amygdala appears to play a gender-specific role in sexual risk behavior – the number of sexual partners over time is related to decreased amygdala activation in men and increased amygdala activation in women (Victor et al., 2015).

While the mechanisms underlying gender differences in neural responses to sexual stimuli are not yet well understood, *sensation seeking* (defined as seeking out new and exciting experiences and sensations; Whiteside & Lynam, 2001) may represent an important factor as it tends to be higher in men than women and is related to sexual behaviors (e.g., Hendershot et al., 2007). Although many other important variables could explain gender differences in sexual behaviors, we view sensation seeking as one important factor still to be examined. The Dual Control Model of sexual response (Bancroft et al., 2009) suggests that two types of processes occur in sexual response: excitatory and inhibitory. Sensation seeking is a prime personality trait ostensibly related to the excitatory process toward sexual approach behavior, which varies across individuals, men and women, and mood experiences (Bancroft et al., 2009).

To date, it remains unclear how sensation seeking relates to underlying reward circuitry activation in response to sexual stimuli and how gender might moderate this relationship.

The current study is a novel re-analysis of previously reported subjects who participated in a study of the brain response to alcoholic drink aromas as a function of mood induction from emotionally valenced images (Cyders et al., 2014). In this previous work (Cyders et al., 2014), we did not observe a relationship between positive image activation and impulsivity. However, re-examination of the images made it clear that the positive image stimuli included two distinct image classes: those with and those without sexual content. In this re-analysis, we examine the corticolimbic responsivity to sexual images (compared to positive images without sexual content), and how it is affected by gender and sensation seeking. Here we hypothesized that parsing positive emotional images into sexual and non-sexual subtypes would reveal associations between sensation seeking and the corticolimbic responses to the sexual cues that would, in turn, relate to sexual risk-taking behaviors. We focused solely on sensation seeking due to its role in excitatory sexual responses, as suggested by the Dual Control Model (Bancroft et al., 2009). Additionally, due to the wealth of data suggesting gender-specific brain responses to sexual cues (e.g., Hamann et al., 2004; Karama et al., 2002; Victor et al., 2015), we expected to find that the relationship between sensation seeking and limbic brain responses, primarily in the anterior cingulate/medial prefrontal cortex and the amygdala, would differ across men and women.

Methods

Participants

Thirty-eight heterosexual, right-handed, healthy social drinkers (defined as; drinking at least 3 drinks per week, one incidence of drunkenness over the previous month, absence of alcohol dependence, and absence of maternal alcoholism) between the ages of 21 and 35 were recruited. Thirty subjects completed all study procedures (completers and non-completers did not differ on any study or demographic variables). In addition, three subjects were excluded from further analyses for head motion during functional imaging that exceeded peak-to-peak translations of 2 mm and rotations of 2 deg, resulting in a final sample of n=27 (14 men, mean age=25.2, SD=3.6, 85.2% Caucasian). Participants

were in good, self-reported mental and physical health, and were not taking any medications (licit or illicit, including tobacco). Participants voluntarily signed informed consent statements approved by the Indiana University institutional review board and received $150 for completing the study.

Self-Report Measures

Sensation seeking. The sensation seeking subscale of the UPPS Impulsive Behavior Scale (UPPS-P; Lynam et al., 2006) assessed sensation seeking. This scale is comprised of 12 items, with response options ranging from 1 (agree strongly) to 4 (disagree strongly). Items are coded so that higher mean scores represent higher levels of sensation seeking. The scale had adequate reliability (α=0.89) and participants' reported levels of sensation seeking were similar to previous data (M(SD)=3.16 (0.56)).

Sexual Behaviors. The Sexual Behavior Questionnaire (Saltzman et al., 1987) is a 16-item questionnaire about different aspects of sexual behavior on a Yes/No scale. Thirteen items were parsed into two separate subscales: a high-risk scale (10 items; e.g., sex without a condom, sex after alcohol or drug use) and a low-risk scale (3 items; e.g., sexual contact in the last 12 months).

Procedure

Study sessions. During a screening session participants completed a series of self-report questionnaires, as well as drug and pregnancy urine tests to assess eligibility for imaging. Upon meeting inclusion criteria, participants completed an imaging session (average of 32 days post screening session); they reported to the Indiana University Clinical Research Center between 8 and 10 a.m. and were provided with a light, standardized breakfast. Vitals were taken and drug and pregnancy urine screens were administered. Participants were then escorted to the imaging suite, where they rated their current mood and were introduced to sample stimuli that would later be presented during functional imaging (see Cyders et al. 2013, 2014 for a full description of these stimuli and procedures), including mood images from the International Affective Picture System (IAPS; Lang et al., 1999), which were chosen and matched based on the developmental ratings of valence and arousal provided by Lang and colleagues (1999) to be similarly rated across men and women (see Cyders et al., 2014, for a full list of images used as stimuli).

Scan characteristics. Participants completed a total of six functional imaging scans (two with positive images, two with negative images, and two with neutral images, along with alcoholic drink and control odors; scan order counterbalanced across mood order); neural effects to image classes based on mood valence (Cyders et al., 2014) and odor class (Cyders et al., 2013) are reported elsewhere. Participants first saw two images, each presented for two seconds, followed by presentation of one randomly assigned odorant (alcohol, appetitive control, or sham odorless), which repeated 24 times in the scan (for a total of 26 images presented in each scan). The current study reports responses collected only during the two positive image scans.

Image acquisition. Imaging was performed on a 3T Magnetom Trio-Tim scanner (Siemens, Erlangen, Germany) equipped with a 12-channel head coil array. A whole-brain high-resolution anatomic image volume (1.0×1.0×1.2 mm^3 voxels, 3D magnetization prepared rapid gradient echo; MPRAGE) was utilized to position functional images (189 blood oxygenation level dependent (BOLD) contrast sensitive volumes, echo-planar imaging pulse sequence, gradient echo; 2250/29 ms repetition/echo time, 78° flip angle, 88×88 matrix, 39 slices, 2.5×2.5×3.0 mm^3 voxels, GRAPPA acceleration factor 2) that incorporated a 3D prospective acquisition correction to minimize effects of the head motion (Thesen et al., 2000).

Data analysis. Data were analyzed using SPM8 (Wellcome Department of Neuroscience Imaging, University College, London) and PASW Statistics v. 18.0 (SPSS, Inc.). Functional volumes were corrected for differences in slice acquisition timing and rigid-body realigned to the reference volume (the initial volume of the first functional imaging scan) to account for residual movement after prospective motion correction. Each subject's high-resolution anatomic image was co-registered to the reference functional volume and segmented into tissue classes. Nonlinear spatial transformation parameters from this segmentation were utilized to convert BOLD volumes to the Montreal Neurological Institute (MNI) space, with the resulting BOLD volumes re-sampled to isotropic (2 mm per side) voxels and smoothed by a 6mm full-width at half-maximum (FWHM) isotropic Gaussian kernel. Image presentation onsets and 2-second durations were modeled in a within-subjects general linear model, using

SPM's canonical hemodynamic response function (HRF). Odorant trials were modeled as effects of no interest. Movement parameters from realignment were included as regressors, while a high-pass filter with a cutoff of 1/128 Hz was applied to each voxel's time series to remove low frequency noise.

Analyses here compared sexual images ([SI], n=17) to a subset of non-sexual images ([NSI], n=17) that appeared across the two positive image scans (Table 1). Images were matched for valence, arousal, and image content, i.e., all images contained people; with mean valence and arousal ratings (range of 1-9) of sexual images, 6.74 and 6.34, p's>0.10 respectively, vs. mean valence and arousal ratings of non-sexual images, 7.00 and 5.99, p's>0.10 respectively. All sexual images except two involved a man and a woman. The [SI>NSI] contrast of interest compared these image classes in the overall sample, and in each gender. Statistical inferences were made using whole-brain family wise error (FWE) corrected cluster-level significance ($p(FWE)$<0.05) with the cluster-forming height threshold p<0.00001 (uncorrected). Brain areas activated in the overall sample were extracted using MarsBar (Brett, Anton, Valabregue, & Poline, 2002) and mean regional effects tested for relationships with gender, impulsivity, and self-reported sexual behaviors. We hypothesized widespread activation in the "psychosexual arousal network" (see Georgiadis, 2015; Poepel et al., 2014), including the occipitotemporal cortex, anterior cingulate cortex, amygdala, and the anterior insula. We also hypothesized that such activation would be stronger in men than in women (see Georgiadis, 2015) and that the [SI>NSI] activation would differentially correlate with sensation seeking and self-reported sexual behavior across men and women.

Results

Sensation seeking and Sexual Behaviors

There were no significant differences between men and women in sexual behaviors (t=-0.87, df=22, p=0.39), but men reported marginally higher levels of sensation seeking (t=2.00, df=25, p=0.06). Sensation seeking was unrelated to high-risk (r=0.09, p=0.66) or low-risk (r=-0.08, p=0.72) sexual behaviors in the overall sample.

Sex Images Compared to Non-Sex Images ([SI>NSI]) across Gender

As expected, sexual images (compared to matched non-sexual images) activated the occipitotemporal regions, insula, amygdala, and the anterior cingulate/medial prefrontal cortex (Figure 1, Table 2). In addition to the hypothesized network, sexual images activated the left nucleus accumbens, and orbitofrontal and dorsolateral cortical areas. As found in previous studies, these effects were driven by men, with no significant activations in women (Table 3).

Sex Images Compared to Non-Sex Images ([SI>NSI]) as Related to Sensation Seeking and Sexual Behaviors

Although sensation seeking was unrelated to [SI>NSI] BOLD response in the overall sample, this relationship varied significantly by gender: in men, sensation seeking was positively related to BOLD response in the anterior cingulate/medial prefrontal cortex (ACC/mPFC) (r=0.65, p=0.01) and the left amygdala (r=0.66, p=0.01); however, in women there were no significant relationships (Figure 2). Although not statistically significant, the same pattern occurred for the right amygdala. In all three regions, the correlation of sensation seeking and BOLD response to sexual images compared to non-sexual images was significantly different between genders ($ps \leq 0.03$).

BOLD responses in the three reported regions were not related to self-reported high-risk or low-risk sexual behaviors in the overall sample. Although not significantly different, there were similar trends for differences between genders with high-risk sexual behaviors: **1)** the relationship with BOLD responses in the ACC/mPFC was positive in men (r=0.19) but slightly negative in women (r=-0.05) and **2)** the relationship with BOLD responses in the right amygdala was slightly positive in men (r=0.09) but negative in women (r=-0.36). Interestingly, the relationship between low-risk sexual behaviors also varied, but in the opposite direction: **1)** the relationship with BOLD responses in the right amygdala was negative in men (r=-0.60), but slightly positive in women (r=0.06) and **2)** the relationship with BOLD responses in the left amygdala was negative in men (r=-0.44) but positive in women (r=0.27).

Discussion

This study examined gender-specificity of the relationship between corticolimbic responses to sexual cues and **1)** sensation seeking and **2)** high- and low-risk sexual behavior engagement. Although

previous analyses did not yield a relationship between impulsivity and BOLD responses to positive emotional stimuli, the current study found that sensation seeking and self-reported engagement in high-risk and low-risk sexual behaviors were related to increased BOLD activation to sexual stimuli (as compared to non-sexual stimuli) differently by gender. BOLD responses to sexual stimuli in the anterior cingulate/medial prefrontal cortex and left amygdala were positively related to sensation seeking in men only, suggesting that men have increased responses to sexual cues in the environment, as compared to women, that are even more marked as sensation seeking increases. These differences in responding, then, may drive sexual approach and excitatory behaviors and subsequent risky sexual behaviors.

Additionally, self-reported engagement in high-risk sexual behaviors similarly corresponded with BOLD responses to sexual stimuli in the anterior cingulate/medial prefrontal cortex in men alone. Interestingly, though, BOLD responses in the amygdala negatively corresponded with low-risk sexual behaviors in men alone, which corresponds with recently reported data showing a similar pattern of decreased amygdalar activation in men as corresponding with increased ventral striatum responses and an increased number of sexual partners (Victor et al., 2015). These regions are well implicated in reward responses, suggesting an important neural mechanism by which sensation seeking might affect sexual excitation. It's not just that sensation seeking predicts higher seeking out of exciting experiences, but it also might make a man more likely to be aroused by and respond to sexual cues in the environment, leading to increased excitatory sexual approach behaviors and a decreased likelihood to avoid such cues and behavioral responses (e.g., Victor et al., 2015). Men, on average, report higher sensation seeking (Cyders, 2013) and also respond more strongly to sexual cues, thus suggesting that gender differences in excitatory sexual responses might be driven in part by gender differences in sensation seeking tendencies and a higher coupling between the personality trait of sensation seeking and reward circuitry, at least in response to sexual stimuli.

These findings suggest a stronger correspondence between sensation seeking and neural responsivity to sexual cues for men, which extends previous work that has shown less correspondence between self-report and physiological measures of sexual arousal for women as compared to men (as

reviewed by Stoleru et al., 2012). Reasons for this lowered correspondence in women could include a lower likelihood of self-reporting arousal and sexual risk-taking, decreased sensitivity of physiological measures of arousal, or differences in the types of sexual stimuli that cause sexual arousal in women as compared to men. Although we do not have data in the current study showing similar levels of arousal in response to the sexual stimuli across men and women, developmental ratings of the IAPS images do not suggest a large divergence in valence and arousal of these images. Even allowing for differences in arousal, knowing why and how women respond to such sexual stimuli is important. For instance, understanding that neural responses to sexual images are reduced in women can help dispel the myth that gender differences in sexual responding are driven solely by women's under-reporting of sexual arousal and stimulation.

Finally, our results suggest that sensation seeking is more highly linked to sexual responding in men due to gender differences in excitatory and approach motivations for sexual responses, as suggested by the Dual Control Model (e.g., Bancroft et al., 2009). Perhaps, as sensation seeking increases, there is increased likelihood for men to approach sexual experiences and to potentially engage in more risky sexual behaviors. However, sensation seeking does not seem to be related to increased excitatory or approach processes in women and likely manifests in other behaviors or outcomes. This suggests that men and women might require different intervention strategies to prevent engagement in risky sexual behavior. As sensation seeking is not as strongly related to sexual responsivity and behaviors in women, targeting sensation seeking in the prevention of sexual risk-taking would be less effective for women than for men. This study supports the viability of future work in better identifying gender specific mechanisms underlying sexual responsivity and behaviors that can lead to the informed development of more effective, gender-targeted interventions.

Finally, the current study suggests that the type of positively valenced stimuli is an important methodological factor in the study of impulsivity. Although impulsivity was not related to responses to generally positively valenced stimuli (Cyders et al., 2014), activation to the more biologically 'hard-wired' content of sexual images is related to sensation seeking, albeit differently across men and women.

Additionally, choosing sexual images for use in inducing a positive mood state will likely lead to group differences in BOLD responding across men and women that could bias study findings.

There are limitations that make this study preliminary in nature. The causal relationship between BOLD responses to sexual images and sexual risk-taking cannot be determined as it is unclear if the BOLD responses observed reflect an underlying brain difference between genders or if the pattern of activation is as a result of personality and expectancy factors that have developed over time. We did not collect data on perceived valence and arousal of sexual images in the current study, so it is possible that observed differences are in part due to gender differences in the ratings of sexual stimuli. However, even if this is the case, our study ssuggest that sexual cue reactivity might underlie these gender-specific patterns of brain responses as reported in numerous previous studies. Additionally, others suggest that these differential relationships might be due to increased variability in women's responses to sexual stimuli (Georgiadis, 2015), which suggests that interventions targeting these factors are likely to be more reliably predictive of change in men than in women. Also, the current findings are not accompanied by physiological or self-reported measures of sexual arousal and therefore cannot address whether or how genital arousal was related to BOLD responses; see Poeppl et al., 2014). Furthermore, the sample is relatively small and homogenous, limiting power to find significant effects, which might explain why some relationships did not reach statistical significance. Additionally, the design is cross-sectional, limiting causal conclusions and generalizability of findings. In addition, only static visual sexual stimuli were used, which produce different patterns of BOLD responses than genital/erotic touch, subliminal sexual stimulation, and erotic video clips (see Georgiadis, 2015). Lastly, some study findings show only trend-level significance; however, the data contained herein support the feasibility of further examination in a larger study properly powered for these effects.

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Table 1. IAPS images used in the current study

Sexual Images		NonSexual Images	
IAPS #	Descriptor	IAPS #	Descriptor
4677	EroticCouple	2347	Children
4311	EroticFemale	8178	CliffDiver
4599	Romance	7499	Concert
4698	EroticCouple	8090	Gymnast
4611	EroticCouple	8206	Surfers
4653	EroticCouple	2216	Children
4660	EroticCouple	8179	Bungee
4683	EroticCouple	8158	Hiker
4643	Erotic Couple	8380	Athletes
4664.1	Erotic Couple	8185	Skydivers
4623	Romance	8350	TennisPlayer
4676	EroticCouple	7660	Crowd
4645	EroticCouple	8492	Rollercoaster
4652	EroticCouple	8540	Athletes
4681	EroticCouple	8116	Football
4090	Bikini	8251	Motorcycle
4689	EroticCouple	8001	Basketball

Region	Cluster		Peak Voxel	Peak Voxel MNI Coordinate (mm)		
	p_{FWE}	*k*	*Z*	*x*	*y*	*z*
All subjects (n=27)						
L Inferior Occipital Gyrus/BA19	< 0.001	1731	6.38	-40	-88	-10
L Lingual Gyrus/BA17	< 0.001	649	6.38	-12	-84	4
R Middle Occipital Gyrus/BA19	< 0.001	1469	6.29	44	-82	8
R Superior Parietal Lobule/BA7	< 0.001	84	5.59	28	-58	58
R Superior Parietal Lobule/BA7	< 0.001	44	5.39	28	-68	34
L Insula †	< 0.001	97	5.39	-36	0	-16
R Insula/Inferior Frontal Gyrus †	< 0.001	151	5.34	30	20	-18
R Orbitofrontal Cortex/BA47 †	< 0.001		5.04	26	32	-14
Anterior Cingulate Cortex/BA32 †	< 0.001	143	5.32	-4	36	-4
Medial Prefrontal Cortex/BA10 †	< 0.001		4.64	0	56	6
L Nucleus Accumbens †	< 0.001	55	5.31	-4	10	-4
Medial Prefrontal Cortex/BA10	< 0.001	32	5.06	-6	52	14
L Amygdala †	< 0.001	39	5.04	-22	8	-24
R Amygdala †	0.002	24	5.02	18	-6	-12
Dorsal Anterior Cingulate Cortex/BA24 †	0.002	23	4.96	0	28	24
R Nucleus Accumbens †	0.001	25	4.96	4	8	-4
Ventromedial Frontal Cortex/BA10	0.003	21	4.84	-2	58	-8
Right Precentral Gyrus/BA6	< 0.001	32	4.73	44	6	30
Left Orbitofrontal Cortex/BA11 †	0.002	24	4.59	-26	32	-18

MNI = Montreal Neurological Institute coordinates in mm. BA = Broadmann Area. FWE = Family Wise Error. Height threshold $p \leq 0.00001$; Extent threshold $k = 8$. † Regions used to define functional clusters.

Region	Cluster		Peak Voxel	Peak Voxel MNI Coordinate (mm)		
	p_{FWE}	*k*	*Z*	*x*	*y*	*z*
Men (n=14)						
L Calcarine Gyrus/BA17	< 0.001	396	6.7	-12	-84	4
R Middle Occipital Gyrus/BA19	< 0.001	397	6.24	44	-82	8
L Middle Occipital Gyrus/BA18	< 0.001	828	6.09	-32	-90	2
R Middle Occipital Gyrus/BA18	< 0.001	161	5.92	24	-90	16
L Calcarine Gyrus/BA17	< 0.001	62	5.88	-20	-64	6
L Inferior Occipital Gyrus/BA18	< 0.001	41	5.58	-38	-88	-10
L Superior Parietal Lobule/BA7	0.006	17	5.42	-20	-60	58
R Fusiform Gyrus/BA37	< 0.001	52	5.33	44	-58	-14
R Amygdala	0.001	26	5.28	18	-4	-12
R Insula/Inferior Frontal Gyrus	< 0.001	59	5.24	30	22	-18
R Orbitofrontal Cortex/BA47	< 0.001	76	5.2	38	32	-16
L Insula	< 0.001	133	5.19	-28	8	-16
R Superior Parietal Lobule/BA7	0.002	23	5.19	28	-58	58
Anterior Cingulate Cortex/BA32	< 0.001	71	5.03	-4	36	-4
Dorsal Anterior Cingulate Cortex/BA24	0.002	24	5.01	0	28	24
L Fusiform Gyrus/BA37	0.012	14	4.99	-26	-62	-12
R Calcarine Gyrus/BA17	< 0.001	50	4.9	22	-68	4
L Fusiform Gyrus/BA37	0.002	23	4.85	-44	-48	-20
Medial Prefrontal Cortex/BA10	0.036	9	4.8	6	56	18
Posterior Cingulate Cortex/BA23	0.015	13	4.74	4	-36	22
R Precentral Gyrus/BA6	0.012	14	4.73	40	4	30
Women (n=13)						
L Inferior Occipital Gyrus/BA19	< 0.001	35	5.40	-42	-86	-10
R Inferior Occipital Gyrus/BA19	< 0.001	32	5.33	40	-84	-8
R Middle Temporal Gyrus/BA19	0.015	13	4.94	48	-76	12
R Middle Occipital Gyrus/BA19	0.018	12	4.88	42	-74	4
R Inferior Temporal Gyrus/BA37	0.01	15	4.63	48	-68	-8

MNI = Montreal Neurological Institute coordinates in mm. BA = Broadmann Area. Height threshold $p \leq 0.00001$, Extent threshold $k = 8$

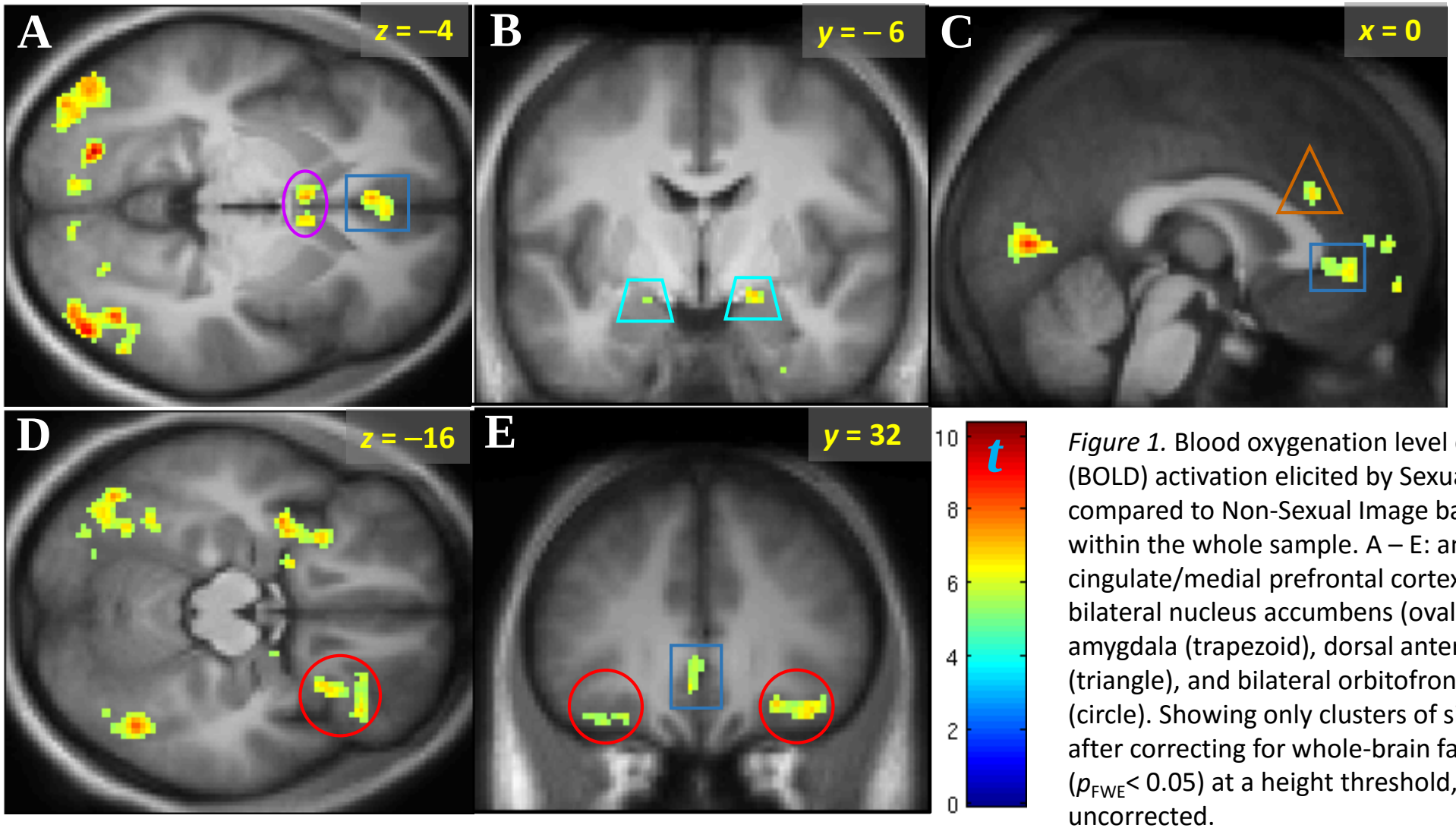

Figure 1. Blood oxygenation level dependent (BOLD) activation elicited by Sexual Images as compared to Non-Sexual Image baseline [SI>NSI] within the whole sample. A – E: anterior cingulate/medial prefrontal cortex (box), bilateral nucleus accumbens (oval), bilateral amygdala (trapezoid), dorsal anterior cingulate (triangle), and bilateral orbitofrontal cortex (circle). Showing only clusters of significance after correcting for whole-brain family wise error ($p_{FWE} < 0.05$) at a height threshold, $p < 0.00001$ uncorrected.

Correlations with Sensation Seeking

Data Extracted from Functional Clusters in Fig 1, $p \leq 0.00001$, $k = 8$

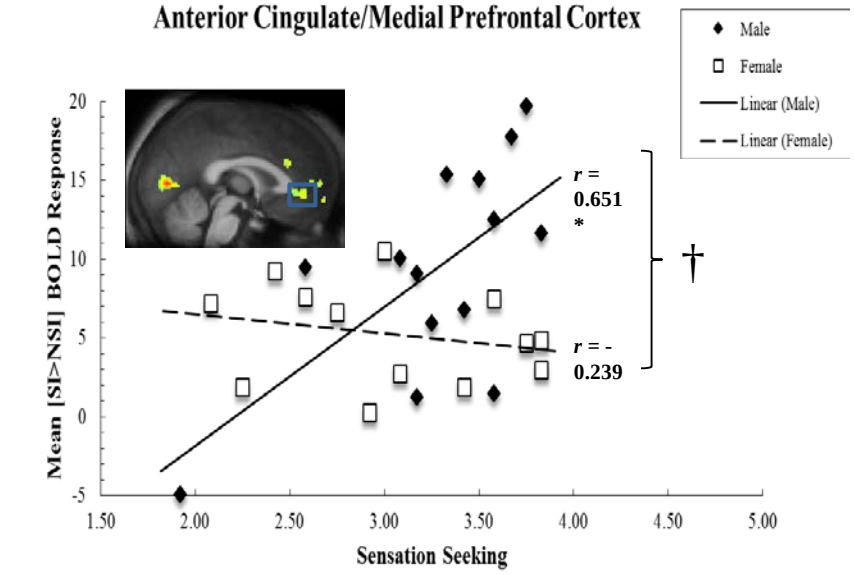

Figure 2. Relationship between the sexual images > non-sexual images [SI>NSI] BOLD response and sensation seeking, for men and women within responding clusters in the anterior cingulate/medial prefrontal cortex (top panel) and bilaterally within the amygdala (bottom panels). * $p < 0.05$. Solid diamonds and full lines for men. Unfilled squares and dashed lines for women. Correlations within each region of interest are significantly different (†, $p < 0.05$) between men and women.