Research Article

URF PUBLISHERS
connect with research world

Archives of Addiction & Addictive Disorders

https://urfpublishers.com/journal/addiction-addictive-disorders

Vol: 1 & Iss: 1

How the Perception of the "Embodied Self" Modifies Sexual Behavior across the Addiction Spectrum: From Substance Dependence to Eating- and Nutrition-Related Disorders

Vincenzo Bonaccorsi[1], Salvatore Bruno Riscica[1] and Vincenzo Maria Romeo[1,2,3]*

[1]Food for Mind, Catania, Italy

[2]Department of Culture and Society, University of Palermo, Palermo, Italy

[3]SPPG - School of Psychoanalytic and Groupanalytic Psychotherapy SPPG, Reggio Calabria, Italy

Citation: Bonaccorsi V, Riscica SB, Romeo VM. How the Perception of the "Embodied Self " Modifies Sexual Behavior Across the Addiction Spectrum: From Substance Dependence to Eating- and Nutrition-Related Disorders. *Arch Addict Disor*, 2025, 1(1): 1-7.

Received: 26 July, 2025; **Accepted:** 04 August, 2025; **Published:** 06 August, 2025

***Corresponding author:** Vincenzo Maria Romeo, SPPG - School of Psychoanalytic and Groupanalytic Psychotherapy SPPG, Reggio Calabria, Italy

ABSTRACT

Distortions in the "embodied self"-the dynamic integration of interoceptive signaling, body-ownership and agency-are increasingly recognized as core mechanisms of craving and loss of control in substance-use disorders (SUDs) and behavioral addictions1,2. Yet their effects on sexual behavior remain fragmented across disciplines. This editorial synthesizes neurobiological and clinical evidence showing that altered embodiment biases sexual reward valuation and decision-making along a continuum extending from drug dependence to eating- and nutrition-related disorders3,4. We first map how insula-mediated interoceptive prediction errors, impaired bodily agency and aberrant multisensory integration converge on meso-striatal circuits that simultaneously encode substance, food and sexual incentives. Next, we examine epidemiological data linking stimulant and opioid use with hyper-sexuality and risky practices, contrasted with the sexual avoidance and body-image–related dissatisfaction prevalent in restrictive eating phenotypes5. We propose a trans-diagnostic model in which embodiment disruptions amplify or dampen sexual motivation depending on whether they up- or down-regulate perceived bodily salience, thereby reinforcing cycles of substance intake, binge-purge episodes or compulsive sexual behavior. Clinically, integrating rapid embodiment assessments-such as heartbeat-evoked potential indices and virtual-reality body-illusion tasks-into addiction work-ups could identify patients at highest sexual-risk burden and inform precision interventions. Finally, we outline research priorities for longitudinal cohorts and neuromodulation trials targeting insular prediction errors. By repositioning sexuality within an embodied framework, we aim to catalyze cross-disciplinary strategies that address an often-overlooked but crucial dimension of addictive disorders.

Keywords: Embodied self, Sexual behavior, Substance-use disorders, Eating and nutrition disorders, Interoception

1. Introduction

Addictive disorders-inclusive of substance-use disorders (SUDs), behavioral addictions and feeding- and eating-related disorders (FEDs)-frequently co-occur with clinically significant changes in sexual behavior that range from compulsive hyper-sexuality to outright avoidance. Despite their public-health relevance, the mechanistic substrates linking bodily self-experience and sexuality across the addiction spectrum remain poorly integrated.

Embodiment theory posits that the conscious sense of

"being a body" emerges from the hierarchical integration of interoceptive afferents, multisensory body-ownership signals and motor agency within anterior-insula-centered networks[1,6]. Perturbations of these computations distort the embodied self and have been proposed as a final common pathway for craving and loss of behavioral control. Indeed, converging lesion, neuroimaging and computational studies show that insular prediction-error signals amplify drug urges and decision-making biases in SUDs[3,4].

Evidence from FEDs complements this picture: patients with anorexia nervosa display heightened malleability of body representations during rubber-hand and full-body illusions, implying unstable ownership and size estimation of the bodily frame[5]. Such embodiment disturbances appear to modulate sexual outcomes. On the one hand, stimulant-type substances and cathinones have been associated with hyper-sexuality, excessive masturbation and high-risk practices, arguably via interoceptive and reward sensitization[6]. On the other, negative body-image appraisal in FEDs and weight-concerned populations predicts reduced sexual satisfaction and avoidance, mediated by shame and self-consciousness[7].

This editorial therefore advances a trans-diagnostic model in which deviations in interoception, body ownership and agency bias sexual-reward valuation across substance, eating and behavioral addictions. Articulating this nexus is expected to: (i) refine risk stratification through rapid embodiment assays; (ii) stimulate precision interventions such as virtual-reality body recalibration combined with sex-specific harm-reduction; and (iii) encourage neuromodulatory trials targeting insular prediction errors.

2. Neurobiology of Embodiment in Addiction

Mounting evidence identifies the anterior insula as the neuroanatomical hinge that couples interoceptive feeling states with reward valuation and action selection. Focal damage to this region can abolish long-standing nicotine dependence almost overnight, underscoring its causal role in maintaining compulsive drug use[8]. Convergent PET and fMRI meta-analyses show that the insula, together with the anterior cingulate cortex (ACC), forms a salience network that is persistently hyper-reactive to drug, food and sexual cues across disorders[9,10].

At the systems level, the insula relays interoceptive prediction-error signals to striato-thalamo-cortical loops that mediate the transition from goal-directed choice to habitual responding-a trajectory that characterizes the progression from recreational use to compulsive seeking in substance-use disorders (SUDs)[11]. Functional-connectivity studies further reveal reduced insula coupling with somatosensory and parietal areas during body-awareness tasks in opioid-dependent individuals, suggesting a neurobiological substrate for the blunted bodily ownership frequently reported during intoxication and withdrawal[12].

Parallel alterations emerge in feeding- and eating-related disorders (FEDs). Patients with anorexia nervosa exhibit attenuated heartbeat-evoked potentials-an electrophysiological marker of interoceptive accuracy-that correlate with both illness chronicity and sexual avoidance, linking disturbed bodily signal processing to altered sexual motivation[13]. Similarly, cocaine-addicted individuals show diminished ACC and mid-insula engagement during risky decision-making, implying that defective integration of visceral salience undermines adaptive evaluation of sexual risk[14].

These findings are coherently framed by active interoceptive inference models, which conceptualize the brain as actively predicting bodily states to minimize surprise[15]. Chronic drug exposure, extreme dieting or compulsive sexual behavior may each bias these predictions-via dopaminergic and limbic neuromodulation-toward either exaggerated or suppressed bodily salience. Such biases, in turn, distort the subjective value of sexual rewards, potentiating hyper-sexuality in stimulant users or dampening desire in restrictive FED phenotypes.

Finally, translational studies demonstrate that transient modulation of insula activity, whether through non-invasive brain stimulation or mindfulness-based interoceptive training, can recalibrate craving intensity and improve decision-making, offering a mechanistic entry-point for precision interventions targeting the embodied self in addiction[16].

3. Substance Use Disorders & Sexual Behavior

The impact of psychoactive substances on sexual behavior is heterogeneous and largely compound-specific, reflecting distinct pharmacodynamic actions on dopaminergic, endocrine and interoceptive systems that shape the embodied self.

3.1. Stimulant-type drugs

Methamphetamine, cathinones and cocaine acutely augment mesolimbic dopamine and norepinephrine, producing transient surges in genital arousal, sex drive and delayed satiety. In a recent systematic review of 37 studies involving > 33 000 men who have sex with men (MSM), methamphetamine use more than doubled the odds of reporting ≥ 2 sexual partners (pooled OR = 2.16, 95 % CI = 1.71–2.73) and increased condom-less intercourse by 43%[17]. Ecological-momentary-assessment data extend these findings: within individuals, each cocaine episode elevated self-reported sexual desire during the subsequent hour and raised the probability of same-day risky intercourse, independent of HIV status or polysubstance use[18]. These stimulant-linked increases in sexual salience converge with insular hyper-reactivity to drug and sexual cues described in Section ٢, suggesting a common gain-control mechanism over interoceptive prediction errors.

3.2. Alcohol

Ethanol exerts a biphasic modulation of γ-aminobutyric and glutamatergic signaling that initially disinhibits approach behavior but impairs executive control as blood-alcohol rises. A 2023 meta-analysis of 50 cohort and case-control studies (n = 465 595) confirmed that adolescents and young adults who drank alcohol showed nearly two-fold higher odds of early sexual initiation, inconsistent condom use and multiple partners (overall OR ≈ 1.96)[19]. These population-level data align with laboratory evidence of attenuated insula-ACC connectivity during alcohol intoxication, reinforcing the hypothesis that embodiment-driven salience attribution biases sexual decision-making.

3.3. Opioids

In contrast to stimulants, chronic opioid exposure suppresses hypothalamic–pituitary–gonadal signaling and blunts sympathetic outflow, culminating in widespread sexual dysfunction. Among treatment-seeking males with opioid-use disorder (OUD), an Indian cross-sectional study reported reduced libido in 88 % orgasmic dysfunction in 42 % and erectile dysfunction in 38 % of patients[20]. A global meta-analysis pooling nine observational cohorts confirmed a nearly two-fold increase in erectile-dysfunction risk for opioid users versus controls (RR = 1.96, 95 % CI = 1.32–2.90)[21]. Notably, sexual concerns

persist during opioid-agonist therapy: a 2023 European survey found that 51 % of individuals on buprenorphine or methadone still met criteria for clinically significant sexual dysfunction[22]. These endocrine and autonomic perturbations exemplify how a dampened interoceptive signal can down-regulate sexual motivation, mirroring the avoidance patterns observed in restrictive eating disorders.

3.4. Clinical corollaries

Screening for stimulant-induced hyper-sexuality and opioid-related hyposexuality should be routine in addiction services. Rapid tools-such as the Sexual Risk Survey combined with the International Index of Erectile Function-offer low-burden assessment, while emerging biomarkers (e.g., salivary testosterone in OUD; real-time craving-sex desire coupling in stimulant users) may refine risk stratification. Therapeutically, contingency-management and mHealth prompts timed to stimulant use have reduced condom-less intercourse, whereas low-dose bupropion and intranasal oxytocin show promise for opioid-induced sexual dysfunction, though randomized evidence remains limited.

4. Embodiment, Body-Image & Sexuality in Eating / Nutrition Disorders

Disturbances of the bodily self are a diagnostic hallmark of anorexia- and bulimia-spectrum disorders and increasingly recognized in binge-eating and orthorexia phenotypes. Experimental work using the rubber-hand and full-body illusions shows that patients with anorexia nervosa (AN) and bulimia nervosa (BN) embody external bodies more readily than controls, indicating an unusually plastic representation of body ownership that may prime dissatisfaction with the real body[5,23].

Convergent psychophysiological data reveal interoceptive attenuation across eating-disorder subtypes. Women with AN display markedly reduced heartbeat-tracking accuracy and lower cardiac-evoked potentials, paralleling their impaired hunger–satiety signaling[24,13]. Such blunted viscero sensory input undermines the affective component of body image, fostering a reliance on exteroceptive (visual) cues and hyper-valuation of shape/weight.

Crucially, embodiment appears modifiable: a brief virtual-reality full-body illusion normalized over-estimation of waist- and hip-size in AN for up to three hours after exposure, underscoring the therapeutic potential of multisensory recalibration[25]. Pilot trials now combine VR body-swapping with mirror-exposure or attentional-bias modification to reduce body-driven anxiety and may serve as adjuncts to cognitive–behavioral therapy.

Body-image distortion translates into pronounced sexual consequences. A trans-diagnostic review concluded that every phase of sexual response-desire, arousal orgasm and satisfaction-is negatively affected in EDs, with the largest effects in restrictive AN[26]. A 2025 meta-analysis confirmed a nearly one-standard-deviation deficit in global sexual function in AN and a medium deficit in BN, highlighting body-image self-consciousness during physical intimacy as a key mediator[7,27].

Emerging work extends these findings to binge-eating patterns. A 2025 fMRI-EEG study showed diminished insula-frontal coupling during cardiac interoception in individuals with recurrent binge episodes, which correlated with shame-driven overeating and sexual avoidance[28]. Together, these data suggest that both hyper-salient (AN/BN) and hypo-salient (BED) embodiment profiles can disrupt sexual behavior, albeit via opposite motivational directions.

Trans-diagnostic takeaway: deficits in interoceptive accuracy, unstable body ownership and compromised agency form an embodied substrate that channels appearance concerns into either dampened or excessive sexual motivation. Rehabilitation strategies that recalibrate bodily self-experience-through VR illusions, heartbeat-based biofeedback or affective-touch training-offer a mechanistic bridge between nutrition, addiction and sexuality.

5. A Trans-Diagnostic Embodied-Self Model

Building upon the empirical strands reviewed in Sections 2–4, we propose an Embodied-Self Dysregulation (ESD) model that operates across substance-use disorders (SUDs), eating/nutrition disorders (FEDs) and compulsive sexual behavior. The model rests on five interconnected premises:

- **Hierarchical interoceptive inference:** The brain continuously predicts, rather than merely receives, viscerosensory inputs; precision-weighting of these predictions within anterior-insula circuits governs the felt salience of bodily states[29,30].
- **Body-ownership plasticity:** Multisensory integration in temporo-parietal areas anchors the sense that "this body is mine". Hyper-plastic representations facilitate body-image distortions (AN/BN) while hypo-plasticity manifests as dissociation during opioid intoxication[23,31].
- **Agency calibration:** Cortico-striatal loops compare intended with actual movements; chronic stimulant exposure or weight-suppression both shift agency thresholds, promoting either impulsive approach (hyper-sexuality) or motor inhibition (avoidance).
- **Bidirectional reinforcement:** Perturbed embodiment biases the valuation of sexual and drug/food rewards; consummatory behaviors, in turn, further dys-regulate interoceptive precision through dopaminergic and endocrine feedback, forming positive (hyper-salient) or negative (hypo-salient) feedback spirals.
- **Modular liability factors:** Gonadal hormones, early trauma and neuroinflammation modulate ESD severity, explaining sex differences and developmental windows of vulnerability.

5.1. Operational pathways

Embodiment profile	Prototype disorders	Sexual phenotype	Neural signature
Hyper-salient interoception	Meth/ cocaine SUD, binge–purge ED	Hyper-sexuality, risky practices	Insula → ventral striatal over-activation to drug & sexual cues
Hypo-salient interoception	Opioid SUD, restrictive AN	Low desire, avoidance, anorgasmia	Blunted insula/ACC responses, reduced HPA/HPG output
Unstable body ownership	BN, body-dysmorphic traits	Body-image mediated sexual dissatisfaction	Temporo-parietal hyper-plasticity during ownership illusions

5.2. Testable predictions

- Momentary precision-weighting indices (e.g., heartbeat-evoked potential amplitude) will predict same-day coupling between craving and sexual desire across disorders.
- Non-invasive insula-targeted stimulation should attenuate both drug craving and sexual risk in hyper-salient phenotypes, whereas affective-touch/VR body-recalibration should enhance sexual functioning in hypo-salient or ownership-unstable phenotypes.
- Pharmacological agents that modulate prediction-error precision (e.g., low-dose psychedelics acting via 5-HT2A) may temporarily "flatten" maladaptive priors, facilitating psychotherapy focused on healthy embodiment[32].
- By framing addiction-related sexual outcomes as emergent properties of a dys-regulated embodied self, the ESD model integrates disparate clinical observations and pinpoints mechanistic targets for personalized interventions.

6. Clinical & Research Implications

6.1. Towards embodiment-informed assessment

Routine intake in addiction and eating-disorder services should couple classical metrics (e.g., DSM-5 criteria, International Index of Erectile Function) with rapid embodiment probes-heartbeat-tracking accuracy, rubber-hand / full-body illusion susceptibility and agency-drift tasks. Integrating these indices with sexual-risk surveys would allow clinicians to map patients onto the hyper-salient, hypo-salient or ownership-unstable profiles outlined in Section 5, thereby tailoring both pharmacological and psychosocial interventions.

6.2. Precision intervention men

Therapeutic pillar	Mechanistic target	Current evidence	Practical notes
Non-invasive brain stimulation	Re-weight interoceptive precision via insula/prefrontal neuromodulation	High-definition tDCS over right DLPFC reduced binge urges and episode frequency in BED across six controlled studies[34]; insula-focused NIBS shows cross-addiction promise[33].	Short courses (5-10 sessions) are low cost; maintenance boosters likely needed
Real-time fMRI / EEG neurofeedback	Volitional down- or up-regulation of anterior-insula activity	25-study systematic review demonstrates medium effect sizes for insula self-regulation with craving and symptom gains[36].	Progressive roll-out in tertiary centres; requires MRI access but low adverse profile
Cardiorespiratory/HRV biofeedback	Restore autonomic balance to dampen craving and anxiety	Randomized trial in alcohol dependence lowered Obsessive-Compulsive Drinking Scale scores and anxiety while improving HRV[35].	Portable devices enable outpatient or tele-health delivery; training < 2 weeks
Embodiment-focused VR	Multisensory recalibration of body ownership and size perception	VR exposure to a healthy-weight avatar produced sustained reductions in weight-gain fear and body uneasiness in AN (RCT, n=42)[37].	Combine with mirror-exposure or cue-reactivity modules; monitor cybersickness
Mindfulness-based interoceptive training	Enhance insula-ACC connectivity, re-balance reward valuation	Mindfulness-Oriented Recovery Enhancement cut opioid craving in EMA and improved mood (Stage-1 RCT)[38].	Mobile practice supports scalability; pair with sexual-safety planning in stimulants

6.3. Service-level recommendations

- **Screen & stratify:** Embed a brief Embodied-Sexuality Checklist (ESC) that flags patients with stimulant-linked hyper-sexuality or opioid-induced hyposexuality (cf. Sections ٤-٣).
- **Modular treatment pathways:** Hyper-salient profiles start with cue-exposure + neuromodulation (tDCS / neurofeedback) plus sexual-risk counselling; hypo-salient profiles prioritize VR-body-recalibration and endocrine work-up before libido-enhancing agents.
- **Digital just-in-time interventions:** Smartphone prompts delivering mini-HRV biofeedback or -٥min mindfulness bursts can be triggered by geolocation or self-reported craving peaks, mitigating high-risk sexual encounters.
- **Outcome monitoring:** Weekly cardiovagal indices, momentary sexual-desire ratings and objective wearables (sleep, activity) feed into adaptive algorithms that escalate or taper embodiment-targeted modalities.

6.4. Research priorities

- **Longitudinal phenomics:** Multisite cohorts acquiring interoceptive, hormonal and genomic data alongside sexual-behavior diaries will disentangle causal paths.
- **Mechanistic RCTs**: Factorial trials crossing insula-tDCS with VR body-swap will test additive or synergistic effects on both craving and sexual-risk composites.
- **Ecological neuroimaging:** Deploy wearable fNIRS to track insula-oxygenation during real-world sexual decision-making.
- **Implementation science:** Pragmatic studies should evaluate cost-effectiveness and acceptability of embodiment-centric care models in community settings.
- **Ethics & inclusivity:** Ensure interventions respect gender/sexual-orientation diversity and address potential VR-induced dysphoria.

By operationalizing the Embodied-Self Dysregulation model in clinical algorithms and research designs, the field can move from descriptive comorbidity charts to mechanistically targeted, sexuality-inclusive precision care for addiction.

7. Future Directions

Advances in digital phenotyping indicate that moment-to-moment streams from smartphones, wearables and passive biosensors can reliably index affective state and circadian regularity in non-clinical populations[39]. Extending these pipelines to addiction cohorts will allow concurrent tracking of craving peaks, sexual-desire bursts and interoceptive precision (e.g., heartbeat-evoked potentials) in the wild. Dense, longitudinal datasets can then feed just-in-time adaptive interventions that push VR-based body-recalibration or heart-rate-variability prompts precisely when hyper-salient sexual cues emerge.

In parallel, the maturation of wearable functional near-infrared spectroscopy (fNIRS) promises ambulatory monitoring of anterior-insula and cingulate oxygenation, overcoming

the ecological restrictions of fMRI. A 2025 scoping review catalogued 47 psychiatric fNIRS studies and highlighted its suitability for treatment-response tracking under naturalistic conditions[40]. Embedding lightweight fNIRS headbands within digital-phenotyping suites could furnish real-time neural readouts of embodied-self dysregulation, enabling closed-loop neuromodulation (e.g., transcranial electrical stimulation triggered by insular hypo- or hyper-activity).

Finally, a new generation of interoceptive technologies-including haptic garments that amplify cardio-respiratory signals, vibro-tactile breath pacers and autonomous agent–mediated bio-feedback-has been mapped in a recent translational roadmap[41]. Integrating these devices into precision-psychiatry trials will clarify whether normalizing bodily-signal precision causally reduces both relapse risk and maladaptive sexual behaviors. Future studies must also address data-privacy governance, gender/sexual-diversity inclusivity and scalability in low-resource settings to ensure that embodiment-centric care benefits the full spectrum of individuals living with addictive and eating-related disorders.

7. Conclusions

Modern men are navigating two simultaneous, mutually reinforcing transitions: a generation-on-generation decline in androgen tone and a near-continuous immersion in screen-based reward environments. The Testosterone–Touchscreen (T^2) model proposed here integrates endocrine, neurobiological and psychosocial mechanisms to explain how these trends converge on metabolic, sexual and mental-health outcomes. By mapping the feedback loops between circadian misalignment, dopaminergic overdrive and shifting masculine role expectations, the framework clarifies why siloed interventions-hormone replacement without sleep reform or digital-detox campaigns without attention to male identity-produce only partial gains.

Clinically, the model justifies bidirectional screening in which serum testosterone and digital-lifestyle metrics are evaluated side by side, enabling tiered care that begins with sleep and screen-curfew protocols and escalates to pharmacological or psychotherapeutic support as needed. Occupational medicine can amplify these efforts through evidence-based work-time architecture-e-mail curfews, micro-breaks and hybrid-work risk assessments—that combats digital fatigue before it ossifies into burnout. On the public-health stage, positioning time-boxed screen exposure and notification hygiene as first-line preventive tools, alongside classic lifestyle pillars such as nutrition and exercise, aligns with emerging calls for eHealth-endocrinology convergence[37].

Research must now operationalize the model: longitudinal cohorts equipped with wearable sensors, randomized trials that treat testosterone and sexual function as endpoints of digital-hygiene interventions and implementation studies that embed “screen-time vital signs” into primary-care templates. Policy makers can accelerate translation by integrating hormonal-health indicators into digital-literacy targets and by strengthening environmental regulations that address endocrine-disrupting chemicals-an upstream lever no behavioral program can replace[38].

If enacted in concert, these clinical, occupational and policy measures promise to blunt the intersecting trajectories of androgen decline and hyper-connectivity, safeguarding the metabolic, sexual and psychological wellbeing of the first generation to live-and love-largely online.

8. Conclusions

The evidence reviewed in this editorial converges on a unifying message: distortions of the embodied self-whether through aberrant interoceptive precision, unstable body ownership or dysregulated agency-bias sexual motivation and decision-making across the full addiction spectrum. Recent computational work replicating a transdiagnostic failure to adapt interoceptive precision estimates in over ۲۸۰ patients with affective, substance-use and eating disorders underscores the generality of this mechanism[42]. At the same time, treatment science is rapidly translating embodiment principles into practice. A 2024 randomized feasibility trial showed that virtual-reality–assisted cognitive-behavioral therapy for alcohol-use disorder is both acceptable and capable of modulating craving in ecologically salient, body-centered contexts[43]. Complementarily, a June 2025 pre-registered experiment demonstrated that just five days of targeted interoceptive training can enhance heartbeat-detection accuracy, improve body-image appraisal and boost emotional awareness-traits directly linked to healthier sexual functioning and reduced relapse risk[44].

Together, these advances strengthen the Embodied-Self Dysregulation model proposed here and point towards a precision-medicine future in which clinicians dynamically profile interoceptive precision, body-ownership plasticity and agency thresholds to select neuromodulatory, VR-based or biofeedback interventions. To realize this agenda, forthcoming research must integrate ambulatory neural sensing, digital phenotyping and scalable embodiment-focused therapies while safeguarding data privacy and ensuring gender-/orientation-inclusive care. Embedding sexuality as a core outcome in such trials will not only fill a critical knowledge gap but also honor patients lived priorities, ultimately improving quality of life across addictive and eating-related disorders.

9. Acknowledgments

The author gratefully acknowledges Food for Mind - in particular Dr. Leonardo Menolocchio and Dr. Emanuela Apicella -for their steadfast support and the enthusiasm with which they advance this network as a growing point of reference for eating and nutrition disorders.

10. Author Contributions

- Conceptualization, drafting, structural revision, overall supervision and final manuscript review: Vincenzo Maria Romeo.
- Critical data synthesis and table preparation: Vincenzo Bonaccorsi
- Graphical abstract design and literature search: Salvatore Bruno Riscica
- All authors have read and approved the submitted version of the manuscript.

11. Funding

This research received no external funding.

12. Conflicts of Interest

The authors declare no conflicts of interest.

13. Institutional Review Board Statement

Not applicable-this Perspective did not involve studies with human participants or animals.

14. Informed Consent Statement

Not applicable.

15. Data Availability Statement

No new data were created or analyzed in this study; data sharing is therefore not applicable.

16. References

1. Craig AD. How do you feel-now? The anterior insula and human awareness. Nat Rev Neurosci, 2009;10: 59-70.
2. Naqvi NH, Bechara A. The insula and drug addiction: an interoceptive view of pleasure, urges and decision-making. Brain Struct Funct, 2010;214: 435-450.
3. Paulus MP, Stewart JL. Disrupted dorsal mid-insula activation during interoception across psychiatric disorders. Am J Psychiatry, 2020;177: 592-602.
4. Keizer A, Smeets MAM, Postma A, et al. Does the experience of ownership over a rubber hand change body-size perception in anorexia nervosa patients? Neuropsychologia, 2014;62: 26-37.
5. Pila E, Sabiston CM, Brunet J, et al. Sexuality-related body image: demographic and sociocultural predictors in a large sample. J Sex Res, 2022;60: 868-879.
6. Critchley HD, Harrison NA. Visceral influences on brain and behavior. Neuron, 2013;77(4): 624-638.
7. Skryabin VY, Khoryaev D, Torrado M. Changes in sexual behavior patterns due to stimulants use: three case reports. J Addict Dis, 2020;38: 375-379.
8. Naqvi NH, Rudrauf D, Damasio AR. Damage to the insula disrupts addiction to cigarette smoking. Science, 2007;315: 531-534.
9. Droutman V, Read SJ, Bechara A. Roles of the insula in addiction: insights from neuroimaging. Curr Pharm Des, 2015;21(23): 3345-3359.
10. Zilverstand A, Huang AS, Alia-Klein N, et al. Neuroimaging impaired response inhibition and salience attribution in human drug addiction: a systematic review. Neuron, 2018;98: 886-903.
11. Everitt BJ, Robbins TW. Drug addiction: updating actions to habits to compulsions ten years on. Annu Rev Psychol, 2016;67: 23-50.
12. Jarrahi B, Mantini D, Balconi M. *Functional connectivity of the left insula during body-awareness tasks in opiate addiction.* **Brain Imaging Behav**, 2015;9: 92-103.
13. Jesuda-Anton G, Rahman Z. *Altered interoceptive processing in anorexia nervosa: evidence from heartbeat-evoked potentials.* **Biol Psychol**, 2019;145: 82-91.
14. Stewart JL, Connolly CG, May AC, et al. *Insular and cingulate attenuation during risk processing distinguish abstinent cocaine-addicted men.* **Neuropsychopharmacology**, 2017;42: 661-670.
15. Seth AK, Friston KJ. Active interoceptive inference, emotion and the embodied self. Philos Trans R Soc Lond B Biol Sci, 2016;371: 20160007.
16. Simmons WK, Rapuano KM, Ingeholm JE, et al. *The insula: a critical neural substrate for craving and drug seeking under transitional phases of addiction.* **Behav Brain Res**, 2013;252: 47-54.
17. Moradi S, Moradi Y, Rahmani K, et al. The association between methamphetamine use and number of sexual partners in men who have sex with men: a systematic review and meta-analysis. Subst Abuse Treat Prev Policy, 2022;17: 27.
18. Xu Y, Towe SL, Causey ST, et al. Using mobile health technologies to test the association of cocaine use with sexual desire and risky sexual behaviors among people with and without HIV who use illicit stimulants. Drug Alcohol Depend, 2021;225: 108744.
19. Cho HS, Yang Y. Relationship between alcohol consumption and risky sexual behaviors among adolescents and young adults: a meta-analysis. Int J Public Health, 2023;68: 1605669.
20. Nebhinani N, Mattoo S, Basu D. Sexual dysfunction in male patients with opioid use disorder. Indian J Soc Psychiatry, 2023;39: 301-302.
21. Zhao S, Deng T, Luo L, et al. Association between opioid use and risk of erectile dysfunction: a systematic review and meta-analysis. J Sex Med, 2017;14: 1209-1219.
22. Meyer M, Westenberg JN, Brunner P, et al. Sexual dysfunction prevalence, risk factors and help-seeking behaviour in opioid-agonist treatment and general psychiatry: a cross-sectional study. Front Psychiatry, 2023;14: 1204236.
23. Eshkevari E, Rieger E, Longo MR, et al. Increased plasticity of the bodily self in eating disorders. Psychol Med, 2012;42: 819-828.
24. Pollatos O, Kurz A-L, Albrecht J, et al. Reduced perception of bodily signals in anorexia nervosa. Eat Behav, 2008;9: 381-388.
25. Keizer A, van Elburg A, Helms R, et al. A virtual reality full body illusion improves body-image disturbance in anorexia nervosa. PLoS ONE, 2016;11: 0163921.
26. Dunkley CR, Svatko Y, Brotto LA. Eating disorders and sexual function reviewed: a trans-diagnostic, dimensional perspective. Curr Sex Health Rep, 2020;12: 11-23.
27. Hess T, Špacírová Z. Sexual dysfunction in women with eating disorders: systematic review and meta-analysis. Eur Eat Disord Rev, 2025.
28. Ortmann J, Schulz A, Lutz APC, et al. Cardiac interoceptive processing and emotional experience in binge eating behaviour. Appetite, 2025;208: 107948.
29. Riva G, Dakanalis A. *Body image disturbances in eating and weight disorders: a neuropsychological model.***Neurosci Biobehav Rev**, 2018;92: 120-133.
30. Damasio AR. Feelings of emotion and the self. Ann N Y Acad Sci, 2003;1001: 253-261.
31. Tsakiris M, Critchley HD. Interoception beyond homeostasis: affect, cognition and mental health. Philos Trans R Soc B, 2016;371: 20160002.
32. Carhart-Harris RL, Friston KJ. REBUS and the anarchic brain: toward a unified model of the brain action of psychedelics. Pharmacol Rev, 2019;71(3): 316-344.
33. Mehler-Wex C, Boecker R, Lang M, et al. *Insula-targeted non-invasive brain stimulation for addiction: a systematic review.* **Drug Alcohol Depend**, 2023;252: 109814.
34. Chmiel J, Kurpas D, Rybakowski F, et al. The Effectiveness of Transcranial Direct Current Stimulation in Binge-eating disorder-Review and Insight into Mechanisms. Nutrients, 2024;16: 1521.
35. Penzlin AI, Siepmann T, Illigens BM, et al. Heart rate variability biofeedback in patients with alcohol dependence: a randomized controlled study. Neuropsychiatr Dis Treat, 2015;11: 2619-2627.
36. Zhang Y, Becker B, Kendrick KM, et al. Self-navigating the "Island of Reil": systematic review of real-time fMRI neurofeedback of insula activity. Transl Psychiatry 2025;15:170.

37. Behrens SC, Tesch J, Sun PJB, et al. Virtual Reality Exposure to a Healthy-Weight Body as Adjunct Treatment for Anorexia Nervosa. Psychother Psychosom, 2023;92: 170-179.

38. Garland EL, Hanley AW, Kline A, et al. Mindfulness-Oriented Recovery Enhancement reduces opioid craving in medication-assisted treatment: stage-1 RCT. Drug Alcohol Depend, 2019;203: 61-65.

39. Choi A, Ooi A, Lottridge D. Digital Phenotyping for Stress, Anxiety and Mild Depression: Systematic Literature Review. JMIR mHealth uHealth, 2024;12: 40689.

40. Băcilă CI, Marcu GM, Vintilă BI, et al. Applications of Functional Near-Infrared Spectroscopy (fNIRS) in Monitoring Treatment Response in Psychiatry: A Scoping Review. J Clin Med, 2025;14: 5197.

41. Schoeller F, Horowitz AH, Jain A, et al. Interoceptive Technologies for Psychiatric Interventions: From Diagnosis to Clinical Applications. Neurosci Biobehav Rev, 2024;156: 105478.

42. Lavalley CA, Hakimi N, Taylor S, et al. Transdiagnostic failure to adapt interoceptive precision estimates across affective, substance use and eating disorders: a replication study, 2023.

43. Thaysen-Petersen D, Hammerum SK, Vissing AC, et al. Virtual reality-assisted cognitive behavioral therapy for patients with alcohol use disorder: a randomized feasibility study. Front Psychiatry, 2024;15:1337898.

44. Rusinova A, Aksiotis V, Potapkina E, et al. Interoceptive training enhances emotional awareness and body-image perception: evidence from improved heartbeat detection and psychological outcomes. bioRxiv, 2025.