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A randomized controlled trial of online mindfulness and cognitive-behavioral interventions for sexual interest/arousal disorder in women: *eSense*☆

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A B S T R A C T

Objective: Sexual interest/arousal disorder (SIAD) is a common and distressing sexual dysfunction in women. Although efficacious psychological treatments for SIAD exist, they are generally underutilized and inaccessible. *eSense* is a feasible and useable online intervention containing Cognitive-Behavioral Therapy (CBT) and Mindfulness-Based Therapy (MBT) programs. Our goal was to test the efficacy of the CBT and MBT arms of *eSense* relative to a waitlist control condition.
Method: Women with SIAD were randomized to *eSense*-CBT ($n = 43$), *eSense*-MBT ($n = 43$), or a waitlist ($n = 43$). Both interventions consisted of 8 modules with a recommended completion time of 8–12 weeks. Participants also met remotely with non-expert "navigators" for up to 12 weeks. Participants completed validated self-report measures of primary outcomes (sexual desire/arousal and distress) and secondary outcomes (sexual satisfaction, dissatisfaction, and overall sexual function) at baseline, mid-treatment, posttreatment, and 6-month posttreatment.
Results and conclusions: Compared to waitlist, both active treatment groups reported significant improvements in primary outcomes at post-treatment (desire/arousal $d > .90$; sexual distress $d < -0.62$) and these improvements were generally maintained at follow-up. The two active treatments did not differ in terms of primary outcomes. Effects on sexual satisfaction were also significant ($d = 0.70$–0.81) and MBT resulted in slightly greater improvements. There was no effect on sexual dissatisfaction. For overall sexual function, the effect was large ($d = 1.20$ to 1.23) with no between-arm differences. Future steps to improve engagement and increase access are discussed. *Keywords:* digital health; sexual interest/arousal disorder; mindfulness-based therapy; cognitive behavioral therapy; sexual dysfunction. *Public health significance*: This study strongly suggests that *eSense* is an efficacious digital health tool that holds much potential to improve accessibility for the treatment of SIAD.

1. Introduction

Impairments in sexual desire and arousal are some of the most common health concerns, reported by up to a third of women (Zheng et al., 2020). When these impairments are long-lasting and significantly distressing, they can constitute Female Sexual Interest/Arousal Disorder (SIAD; American Psychiatric Association [APA], 2013). Women with SIAD report lower sexual desire and satisfaction, as well as higher sexual distress, compared to women without SIAD (Rosen et al., 2019). Problems with low desire are associated with a range of negative conditions including relationship distress and low quality of life (Buczak-Stec et al., 2021; McNulty et al., 2016; Schmiedeberg & Schröder, 2016). Given the prevalence and potential impact of SIAD, efficacious interventions are needed.

SIAD is thought to result from a variety of interrelated factors. For example, the Incentive Motivation Model (Toates, 2009) suggests that, when potentially rewarding sexual stimuli (e.g., pleasurable physical sensations, attractive partner) are not prioritized due to negative cognitions or an appraisal of the sexual stimuli as unrewarding, the resulting lack of attention and/or distraction from these stimuli leads to reduced sexual response. Barlow (1986) and colleagues (Nobre and Barlow, 2023; Wiegel et al., 2007) similarly suggest that distraction from physical sensations during sex is a key contributor to low arousal, and describe other important maintaining and causal factors such as maladaptive sexual schemas, worry, and avoidance of sex.

These factors are targeted by two psychotherapies with the strongest evidence of efficacy (Brotto et al., 2024): Cognitive-Behavioral Therapy (CBT) and Mindfulness-Based Therapy (MBT). CBT includes behavioral interventions such as scheduled exchange of pleasurable touch without the goal of becoming aroused, and cognitive interventions such as

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identifying and evaluating maladaptive thoughts about sex (e.g., "my partner will leave me if I cannot become aroused; " Stinson, 2009). MBT includes regular practice of mindful meditations of varying lengths (5–45 min) during which the individual develops skills in non-judgemental awareness to all aspects of the present moment and practices compassion and acceptance (Bishop et al., 2004). Both therapies address theorized maintaining factors of SIAD by, for example, providing skills for managing distractions in sexual situations, expanding the range of stimuli that are considered rewarding, and decreasing the emotional and behavioral impact of maladaptive beliefs regarding sex (Chivers & Brotto, 2017; Stephenson, 2017).

CBT and MBT have been shown to improve symptoms of SIAD in a number of studies, including high-quality randomized trials (e.g., Brotto et al., 2021; Brotto et al., 2024; Hucker & McCabe, 2014). For example, eight weekly group sessions of MBT were found to significantly improve sexual desire ($d = 1.29$) and sexual distress ($d = -0.83$) with all gains retained a year later (Brotto et al., 2021). While there have been some instances of differential outcomes (e.g., Brotto et al., 2019), both interventions tend to cause large improvements in sexual function and distress with no clear evidence of the superiority of one approach.

In spite of their efficacy, these treatments are generally inaccessible to women who might benefit from them. Only around a quarter of women with sexual concerns receive treatment and it takes an average of five years or more for those who seek treatment to access it (Kingsberg et al., 2019; Lafortune et al., 2023). Barriers to access include geographical distance, cost, lack of awareness or providers, and embarrassment (Markit, 2018; Schaller et al., 2020). One method of addressing such barriers is to translate treatments to be delivered online (Mahar et al., 2022).

Online interventions have been shown to be efficacious for a range of mental health concerns (Gershkovich et al., 2017) and may increase access (Bennett et al., 2020; Hadjistavropoulos et al., 2017). Initial online treatments for sexual dysfunction included static online text and expert guidance (e.g., Hall, 2004; Jones & McCabe, 2011) and more recent interventions have incorporated interactive elements (e.g., video clips, downloadable worksheets; Zarski et al., 2022). A recent review of 15 studies concluded that a variety of therapeutic modalities are effective for improving sexual function when administered online, that attrition rates vary widely, and that individualized support may decrease attrition (Mahar et al., 2022). One newly created program with promising evidence is *eSense*.

eSense is an online intervention for SIAD created by experts in sexual dysfunction in collaboration with patient partners, web designers, and graphic artists. It includes two distinct programs or "arms": *eSense*-CBT and *eSense*-MBT. Each arm consists of eight modules that include educational content, specific instructions for therapeutic activities, fictional case examples demonstrating how activities are carried out, and troubleshooting tips. *eSense* includes text, video, images, and audio and was designed to be maximally engaging (Zippan et al., 2020).

In a series of studies, *eSense* has been shown to be useable, feasible to implement, and satisfactory (e.g., Zippan et al., 2020). Pilot trials suggested that users experienced large improvements in sexual desire, arousal, satisfaction, and distress, even when using *eSense* without personalized guidance (Brotto et al., 2022; Stephenson et al., 2021). However, these studies were limited by small sample sizes, a lack of control conditions, no post-treatment follow-up, and no direct comparison between CBT and MBT. It is also likely that addition of personalized guidance can reduce attrition (Musiat et al., 2022), even if provided by non-experts (Robinson et al., 2010).

The current study attempted to address these issues by randomizing women with SIAD to *eSense*-CBT, *eSense*-MBT, or a waitlist condition and assessing outcomes at pre-treatment, post-treatment, and 6-month follow-up using a well-powered design. We also attempted to build on research suggesting non-expert support may increase retention for online interventions (Musiat & Tarrier, 2014) by pairing participants with undergraduate student volunteers ("navigators") who were trained to provide empathic listening, encouragement, and technology support, but not formal therapy.

Our hypotheses were:

A) *eSense*-CBT and *eSense*-MBT would result in significant improvements to primary endpoints of sexual desire and distress (the core diagnostic criteria of SIAD; APA, 2013) in comparison to a waitlist.
B) *eSense*-CBT and *eSense*-MBT would result in significant improvements in secondary endpoints (sexual satisfaction, dissatisfaction, and sexual function) in comparison to a waitlist.
C) These improvements would be maintained over a 6-month follow-up period.
D) There would be little-to-no difference in efficacy between CBT and MBT.
E) Retention would be above 70 %.
F) Participants would report moderate-to-high levels of satisfaction with the treatment, and engagement with homework.

2. Method

2.1. Participants

Potential participants were recruited based on their responses to advertisements on social media, the senior author's research website, and other forms of media (e.g., podcasts, newspapers). Additionally, several potential participants were contacted through a registry of women who had provided consent to be contacted after having participated in previous (non-treatment related) research, or heard about the study through their healthcare provider.

Cisgender and transgender women 19 years of age or older from Canada or the United States were eligible for the study if they: (a) were fluent in English; (b) were in a committed stable relationship of at least six months; (c) reported sexual activity with a partner over the past four weeks and an openness to engaging in sexual activity with their partner during the study; (d) reported consistent access to the internet and basic competency using online platforms; and (e) met telephone screening DSM-5 diagnostic criteria for SIAD (APA, 2013; screener also used in Brotto et al., 2021). The research coordinator responsible for conducting the screenings received initial and ongoing one-on-one training from two clinical psychologists and a postdoctoral fellow.

Consistent with the DSM-5 exclusion factors for SIAD, women were not eligible if they reported that their sexual difficulties were fully attributable to another psychiatric diagnosis, the effect of a substance, other life stressors, a general medical condition, or significant conflict in their relationship. Additionally, women were not eligible if they experienced vulvovaginal pain that completely accounted for the low desire, or if they were currently engaging in treatment for their sexual difficulties or planned to start treatment while participating in this study. Women were not required to have a prior diagnosis from a health care provider to participate.

Of the 162 people who completed a telephone screen, 129 eligible women (mean age 43.1 yrs, range 21–74) were randomized to one of three treatment arms ($n = 43$ per arm; see CONSORT diagram in Fig. 1; Schulz et al., 2010). The sample was primarily White (87.6 %) and heterosexual (82.2 %; see Table 1). All participants were cisgender women, and as such, we refer to the participants as women throughout, consistent with their preferred pronouns. Participants were well educated, with the majority (56.6 %) completing some form of post-graduate degree. Participants' average relationship duration was 15 years (range = 8 months–49 years). Women reported that they had experienced sexual difficulties for an average of 95.9 months ($SD = 102.7$; median = 60.0), and only 13.2 % reported having received prior professional treatment for their sexual difficulties. There were no baseline demographic differences among treatment arms ($ps > .05$).

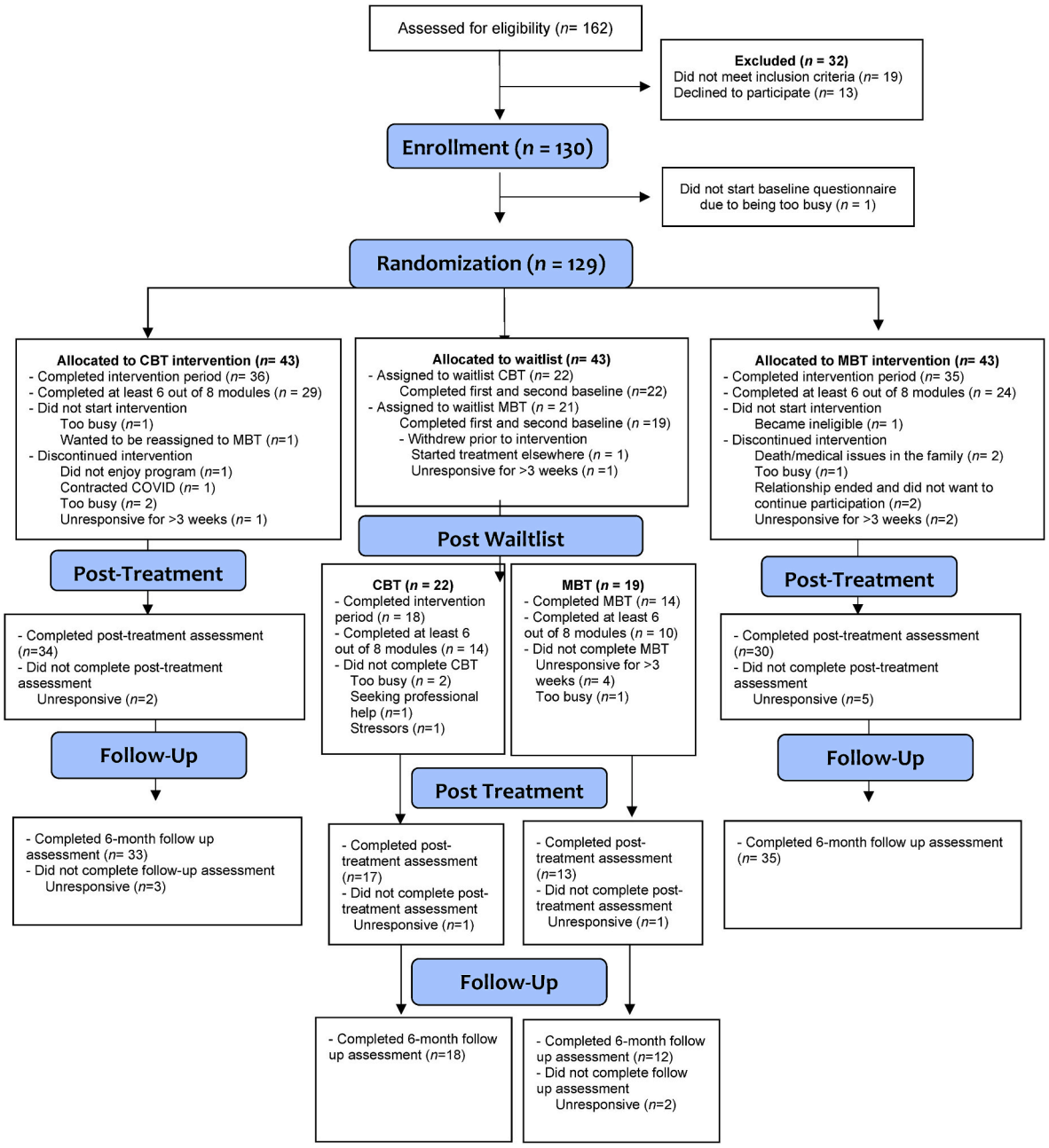


Fig. 1. CONSORT diagram for study participants.

2.2. Procedure

Recruitment occurred from November 2021 to November 2022. Potential participants scheduled a telephone screen with the study coordinator to assess eligibility. If eligible, the study coordinator sent a consent form via email. After consenting, participants filled out pretreatment questionnaires online using Qualtrics, and were then randomized to CBT, MBT, or a wait-list control group. Participants initially randomized to the waitlist completed a second pretreatment questionnaire after a 10-week waiting period. After this period, they were then randomized to either CBT or MBT. All randomizations were carried out using the Blockrand package in R (Snow, 2020) with random block sizes.

After completing their online pretreatment survey (or after completing their second pretreatment survey if randomized to the control group; t1), participants attended an initial meeting with their navigator via video teleconferencing software (secure university Zoom account). Navigators were psychology undergraduate volunteers who provided encouragement to engage with *eSense*, accountability for completing homework activities, and answers to practical questions. After this initial navigator meeting, participants started the *eSense* program to which they were assigned. Throughout the treatment period, they met weekly via Zoom with their navigator. Before their first participant meeting, navigators read relevant background literature and standardized protocol and adherence documents, completed training sessions on the technical aspects of the role (e.g., scheduling meetings) and on the study protocol, and participated in an active listening skills workshop led by a clinical psychologist. Additionally, navigators attended weekly group meetings and biweekly one-on-one meetings with the study coordinator, who provided personalized feedback.

A midtreatment questionnaire evaluating all outcomes and mediators was given after completing module 4 (data presented in a separate manuscript). Participants were sent posttreatment questionnaires (t2) a

Table 1
Baseline characteristics of participants.

Measure	CBT	MBT	Wait-list	Total
Age (years), mean (*SD*) [range]	46.00 (11.99) [22–68]	40.37 (12.96) [23–70]	43.05 (13.06) [21–74]	43.14 (12.79) [21–74]
Length of current relationship (years), mean (*SD*) [range]	18.54 (11.64) [1-45]	12.93 (11.64) [1-49]	14.38 (11.88) [0.7–41]	15.28 (11.87) [0.7–49]
Has children	24 (55.8)	22 (51.2)	27 (62.8)	73 (56.6)
Ethnicity[1]				
Arab/West Asian	1 (2.3)	0	1 (2.3)	2 (1.6)
Black	2 (4.7)	0	0	2 (1.6)
Chinese	0	2 (4.7)	0	2 (1.6)
Filipino	1 (2.3)	1 (2.3)	1 (2.3)	3 (2.3)
Hispanic or Latin American	0	6 (14.0)	0	6 (4.7)
Indigenous	0	1 (2.3)	1 (2.3)	2 (1.6)
Korean	1 (2.3)	0	1 (2.3)	2 (1.6)
South Asian	1 (2.3)	2 (4.7)	1 (2.3)	4 (3.1)
White (European)	39 (90.7)	34 (79.1)	40 (93.0)	113 (87.6)
Prefer to self-describe	0	2 (4.7)	1 (2.3)	3 (2.3)
Sexual Orientation				
Bisexual	3 (7.0)	7 (16.3)	5 (11.6)	15 (11.6)
Heterosexual	38 (88.4)	33 (76.7)	35 (81.4)	106 (82.2)
Gay/Lesbian	0	0	1 (2.3)	1 (0.8)
Pansexual	1 (2.3)	1 (2.3)	0	2 (1.6)
Prefer to self-describe	1 (2.3)	2 (4.7)	2 (4.7)	5 (3.9)
Years of formal education, mean (*SD*) [range]	18.74 (2.95) [13–27]	18.28 (3.50) [9-31]	18.33 (2.48) [14–28]	18.45 (2.99) [9-31]
Education				
Some high school	0	1 (2.3)	0	1 (0.8)
High school or GED	0	0	1 (2.3)	1 (0.8)
Attended some college/ university	4 (9.3)	2 (4.7)	1 (2.3)	7 (5.4)
Graduated 2-y college/ university	1 (2.3)	1 (2.3)	1 (2.3)	3 (2.3)
Graduated 4-y college/ university	12 (27.9)	15 (34.9)	17 (39.5)	44 (34.1)
Postgraduate degree	26 (60.5)	24 (55.8)	23 (53.5)	73 (56.6)
Employment Status[1]				
Employed full-time	18 (41.9)	20 (46.5)	26 (60.5)	64 (49.6)
Employed part-time	6 (14.0)	9 (20.9)	7 (16.3)	22 (17.1)
On disability	2 (4.7)	1 (2.3)	2 (4.7)	5 (3.9)
Retired	5 (11.6)	3 (7.0)	4 (9.3)	12 (9.3)
Self-employed	8 (18.6)	4 (9.3)	2 (4.7)	14 (10.9)
Student	4 (9.3)	6 (14.0)	7 (16.3)	17 (13.2)
Unemployed	2 (4.7)	2 (4.7)	2 (4.7)	6 (4.7)
Other	2 (4.7)	6 (14.0)	1 (2.3)	9 (7.0)
Report of history of sexual assault				
As a child	10 (23.3)	7 (16.3)	6 (14.0)	23 (17.8)
As an adult	7 (16.3)	9 (20.9)	8 (18.6)	24 (18.6)
As both a child and an adult	3 (7.0)	6 (14.0)	6 (14.0)	15 (11.6)
Received past treatment for sexual dysfunction	3 (7.0)	4 (9.3)	10 (23.3)	17 (13.2)
Currently receiving menopausal hormone therapy	8 (18.6)	7 (16.3)	7 (16.3)	22 (17.1)

Note. Data are presented as No. (%) unless otherwise noted. CBT = cognitive behavioral therapy. MBT = mindfulness-based therapy. [1]Participants could select more than one option.

week after their treatment end date (i.e., 12 weeks after they first logged into *eSense*) or a week after their last meeting with their navigator if they finished *eSense* before the treatment end date. Participants were sent a follow-up questionnaire 6-months after their treatment end date (t3) (or 6-months after their last navigator meeting).

The study was administered entirely online. The study coordinator reached out up to three times to unresponsive participants with reminder emails and/or telephone calls. Participants were compensated $30 CAD for completing the pretreatment questionnaire, $40 for the posttreatment questionnaire, and $40 for the 6-month follow-up questionnaire. The study was approved by the Clinical Research Ethics Board at the University of British Columbia (H20-03914) as well as the Vancouver Coastal Health Hospital Research Ethics Board. Hypotheses and study procedures were preregistered at Clinicaltrials.gov (NCT05168371) and Open Science Framework (https://osf.io/szbnc/?view_only=283ef17d8ad74dce8bb21ffa983b474d).

2.3. Intervention content

A summary of *eSense* content is presented in Table 2.[1] The content of the MBT program was well-established via focus groups with patients, pilot studies, and a randomized controlled trial (Brotto, 2021; Paterson et al., 2017). The overall program structure was aligned with mindfulness-based cognitive therapy for depression in terms of teaching non-judgmental, present-moment awareness to body sensations, the breath, sounds, thoughts, and movement (Segal et al., 2012) and adapted with a focus on sexual sensations. The CBT program structure was aligned with best practices in CBT as described by widely-recognized experts (e.g., Beck, 2021; Greenberger & Padesky,

Table 2
Intervention Content in the CBT and MBT Arms of eSense
Note: CBT = cognitive behavioral therapy. MBT = mindfulness-based therapy.

Module	CBT Arm	MBT Arm
1	Psychoeducation, introduction to CBT	Psychoeducation, introduction to mindfulness
2	The cognitive model and thought records	Increasing awareness of physical sensations
3	Unhelpful thinking patterns	Exploring your body and judgments about it
4	Cognitive restructuring	Awareness of sexual thoughts and beliefs
5	Behavioral experiments	Working with aversion and self-touch
6	Self-touch and sensate focus	Creating awareness of sexual sensations
7	Couple sensate focus	Sensate focus with your partner
8	Maintaining and extending your gains	Maintaining and extending your gains

[1] In the future, we hope to commercialize the intervention to maximize access for women with SIAD. As such, the specific content of the intervention is not publicly available. Description of the content is available from the corresponding author upon reasonable request by a researcher.

2016; Tolin, 2024), which include various methods of cognitive restructuring (e.g., identification of cognitive distortions and weighing of evidence) and behavior change (e.g., behavioral activation, exposure, etc.). This content was augmented by updated guidelines for sensate focus (e.g., Weiner & Avery-Clark, 2017) and adapted with a focus on sexual desire/arousal. The initial program was revised based on feedback from patient partners with sexual desire difficulties (Stephenson et al., 2021; Zippan et al., 2020). All modules in both arms contain text (high school reading level), pictures, diagrams, videos, audio clips, and homework activities.

2.4. Measures

2.4.1. Demographic characteristics

In the pretreatment questionnaire, participants responded to demographic questions (e.g., age, ethnicity, education, sexual orientation, relationship duration).

2.4.2. Sexual desire and arousal

The co-primary outcome of sexual desire/arousal was measured using the Sexual Interest and Desire Inventory-Female (SIDI). The SIDI-F includes questions on desire, arousability, sexual initiation, receptivity, and sexual thoughts. Possible total scores on this 13-item scale range from 0 to 51, with higher scores indicating higher levels of sexual desire and arousal. For the initial randomization (R1), Cronbach's alpha was .81 at t1 and .87 at t2. For the second randomization (R2), Cronbach's alpha at t1, 2, and 3 was .81, .84, and .90, respectively. The clinical cutoff for this measure is $\leq$ 33 (Clayton et al., 2010).

2.4.3. Sexual distress

The Female Sexual Distress Scale–Revised (FSDS; DeRogatis et al., 2008) was used to measure the second co-primary outcome of sexual distress. Scores on this 13-item scale can range from 0 to 52, where higher scores represent higher levels of distress. An example item is, "How often do you feel distressed about your sex life?" Items were measured using a response scale from 0 (*Never*) to 4 (*Always*). Cronbach's alphas for t1, 2, and 3 were .90 and .95 (R1) and .90, .93, and .95 (R2).

2.4.4. Sexual satisfaction and dissatisfaction

We measured these secondary outcomes using the Quality of Sexual Inventory (QSI; Shaw and Rogge, 2016). The QSI has two 12-item subscales: satisfaction (e.g., "My sex life is fulfilling") and dissatisfaction (e.g., "I am very disappointed with my sex life with my partner"), with response options from 0 (*Not at all true*) to 5 (*Completely true*). Scores for each subscale can range from 0 to 60, with higher scores reflecting higher levels of their respective construct. Cronbach's alphas follow for t1, 2, and 3, respectively: sexual satisfaction subscale (R1: .93, .97; R2: .93, .97, .98) and sexual dissatisfaction subscale (R1: .94, .95; R2: .93, .95, .96).

2.4.5. Sexual function

The secondary outcome of overall sexual function was measured using the Female Sexual Function Index total score (FSFI; Rosen et al., 2000). The FSFI measures multiple aspects of sexual function (i.e., desire, arousal, lubrication, orgasm, pain, and satisfaction). Possible scores range from 7.2 to 36 where higher scores indicate greater sexual function, and a score of 26.55 is used as a cut-off for possible sexual dysfunction (Wiegel et al., 2005). If a participant reported no sexual activity during the past 4 weeks, their total score was coded as missing data. Items with responses of "No sexual activity" or "Did not attempt penetration" were also coded as missing data (Meyer-Bahlburg & Dolezal, 2007). Data that were missing for these reasons were not imputed. Cronbach's alphas for t1, 2, and 3 were .85 and .92 (R1), and .86, .90, and .92 (R2).

2.4.6. Treatment satisfaction

To measure treatment satisfaction at posttreatment (t2), participants completed the Adapted Erectile Dysfunction Inventory of Treatment Satisfaction (EDITS; Althof et al., 1999; items 1–10). Items were adapted to ask about their treatment satisfaction since beginning *eSense* (e.g., "Since beginning *eSense*, to what degree has the treatment met your expectations?"), with items asked on a 0 (e.g., *Very dissatisfied/Not at all/Very difficult*) to 4 (e.g., *Very satisfied/Completely/Very easy*) scale. Scores can range from 0 to 100, with higher scores reflecting higher treatment satisfaction. Cronbach's alpha was .91.

Participants also completed two face-valid single-item measures after completing each module. These questions asked them to rate the helpfulness of the content covered each week and the ease of reading the content on 0 (*Extremely unhelpful/Extremely difficult or impossible*) to 10 (*Extremely helpful/Extremely easy*) scales. We used a cut-off of 6.5/10 on these measures to indicate acceptable utility and clarity of content.

2.4.7. Homework engagement

Participants completed the Homework Rating Scale-II (HRS-II; Kazantzis et al., 2005) after each module. The 12-item HRS-II assesses homework engagement, homework beliefs (e.g., comprehension, rationale), and consequences of doing homework (e.g., mastery). Because *eSense* refers to homework activities as "between-module activities," we adapted the wording of the scale accordingly. An example item is "I was able to do the between-module activities," with response options ranging from 0 (*Not at all*) to 4 (e.g., *Completely/Extremely*). Scores can range from 0 to 4, with higher scores reflecting high levels of homework engagement.

2.4.8. Additional measures

Participants completed additional measures that will be reported on in separate manuscripts.

2.5. Data analysis

2.5.1. Power analysis

Based on previous research (Brotto et al., 2022; Stephenson et al., 2021), we expected large effect sizes for the outcomes of sexual distress (d = 1.05) and sexual function (d = 0.80). According to our a priori power analysis based on these two measures and two treatment groups, we would need 75 participants to give us 90 % power to discover a large effect size of our treatment at an alpha level of .05 (PASS, 2019). To account for ~30 % attrition (Melville et al., 2010), we recruited 129 individuals (n = 43 per arm; wait-list control later randomized to treatment).

2.5.2. Analysis plan

We conducted three sets of analyses. The primary goal of the first set (referred to as R1) was to test whether CBT and MBT groups improved compared to the wait-list control group from t1 to t2. For these analyses, we used data exclusively from the first randomization, and the second pretreatment questionnaire was treated as t2 for the wait-list control group. The goal of the second set of analyses (referred to as R2) was to test whether changes over time differed between CBT and MBT groups and to examine the sustainability of treatment effects by the addition of t3 to the model. After the wait-list control group's post-waiting period randomization into CBT or MBT, their data were combined with the rest of the participants (i.e., those who were initially randomized into CBT or MBT). Thus, for R2, the wait-list control group's second pretreatment questionnaire was treated as their t1. When there were less than 20 % of items missing on an individual's measure (or 33 % in the case of measures with 3 items), we used mean replacement to calculate their total score on that measure.

The goal of the third set of analyses was to test the proportion of participants who exhibited "reliable change" in primary outcomes (sexual desire and distress) during their active treatment phase (i.e., t1

to t2). Reliable change was calculated to determine whether individual changes were larger or smaller than would be expected due to measurement error alone (Jacobson & Truax, 1991).

2.5.3. Analysis of primary and secondary outcomes

The effects of treatment were analyzed using IBM SPSS Statistics (Version 29). We used multilevel mixed-effect model analyses with one within-subject factor of time (treated as a categorical variable) based on two or three measurement points (pretreatment [t1] and posttreatment [t2] in R1; plus 6-month follow-up [t3] for R2) and one between-subject factor (MBT and CBT vs. wait-list control in R1; MBT vs. CBT for R2) as well as their interaction. Interactions tested differences in the amount of change due to treatment among arms. All models had random intercepts. Analyses followed an intention-to-treat (ITT) approach, with all participants who completed t1 included. Mixed-effects models estimated model parameters using full information maximum likelihood estimation. For primary and secondary outcome total score outcomes, multiple imputation (10 imputations) was used to manage missing data and pooled results are reported for both sets of analyses.

3. Results

3.1. Treatment adherence

Of the 129 randomized women, 77 (60 %) had completed at least 6 of the 8 modules at t2. In total, 26 participants (20 %) withdrew from the study (wait-list control: $n = 11$; CBT: $n = 7$; MBT: $n = 8$). Participants who withdrew from the study did not significantly differ from participants who remained on any baseline demographic variables ($ps > .05$). Participants' reasons for withdrawing are detailed in Fig. 1.

3.2. Effects of treatment on primary outcomes of sexual desire and arousal, and distress

Tables 3 and 4 report the raw (non-imputed) means and standard deviations for primary and secondary outcomes by treatment arm and time of assessment; reliable change descriptives are also noted in Table 4. For R2, 96.1 % of the participants with a non-missing total SIDI-F score met the clinical cutoff for sexual distress at t1, 66.7 % at t2, and 68.5 % at t3. Tables 5 and 6 contain the reports of the random coefficient analyses, including confidence intervals and Cohen's *d*s. For all analyses on both primary and secondary outcomes, the main effects of time were statistically significant ($ps < .05$).

Table 3
Primary and secondary outcome measures by group and time for R1.

Measure	Pretreatment	Posttreatment
Sexual desire and arousal (SIDI-F)		
CBT	17.52 (8.07)	31.04 (8.74)
MBT	18.70 (8.87)	28.96 (9.10)
WL	17.29 (7.45)	19.24 (7.60)
Sexual distress (FSDS-R)		
CBT	26.88 (8.87)	20.09 (10.93)
MBT	29.68 (8.79)	18.87 (9.27)
WL	32.64 (8.13)	31.70 (8.51)
Sexual satisfaction (QSI-S)		
CBT	17.95 (12.49)	27.69 (15.43)
MBT	18.21 (11.38)	29.33 (16.20)
WL	13.14 (9.50)	13.70 (9.94)
Sexual dissatisfaction (QSI-D)		
CBT	14.52 (14.09)	8.72 (12.20)
MBT	12.88 (10.89)	8.55 (10.21)
WL	19.89 (14.29)	18.44 (13.49)
Sexual function (FSFI)		
CBT	17.93 (5.02)	24.34 (6.36)
MBT	18.87 (4.93)	25.39 (4.86)
WL	18.93 (4.01)	19.12 (4.59)

Note. R1 corresponds with the first analysis that compares CBT and MBT to the wait-list (WL) condition. SIDI-F = Sexual interest/desire inventory-Female; FSDS-R = Female sexual distress scale-revised; QSI-S = Quality of Sex Inventory, satisfaction subscale; QSI-D = Quality of Sex Inventory, dissatisfaction subscale; FSFI = Female Sexual Function Index. Data are presented as raw mean (*SD*).

Table 4
Primary and secondary outcome measures by group and time for R2.

Measure	Pretreatment	Posttreatment	6-month follow-up	Reliable Change
Sexual desire and arousal (SIDI-F)				
CBT	18.23 (7.85)	30.16 (8.54)	26.86 (11.62)	Improvement: 29 (45 %); No change = 16 (25 %); Deterioration: 1 (2 %)
MBT	18.73 (8.55)	29.00 (9.42)	28.58 (10.14)	Improvement: 27 (44 %); No change = 13 (21 %); Deterioration: 1 (2 %)
Sexual distress (FSDS-R)				
CBT	28.50 (8.67)	21.00 (9.58)	17.59 (11.30)	Improvement: 29 (45 %); No change = 18 (28 %); Deterioration: 4 (6 %)
MBT	30.31 (9.07)	19.35 (9.17)	18.32 (11.96)	Improvement: 28 (45 %); No change = 14 (23 %); Deterioration: 1 (2 %)
Sexual satisfaction (QSI-S)				
CBT	17.17 (12.08)	26.39 (14.84)	22.94 (15.42)	
MBT	16.18 (10.79)	26.05 (15.39)	29.29 (15.73)	
Sexual dissatisfaction (QSI-D)				
CBT	15.97 (14.80)	9.73 (13.20)	9.91 (13.77)	
MBT	14.34 (10.82)	8.80 (9.40)	8.76 (9.51)	
Sexual function (FSFI)				
CBT	18.62 (4.93)	24.54 (5.64)	24.10 (6.43)	
MBT	18.62 (4.79)	24.66 (5.21)	26.44 (4.73)	
Treatment satisfaction (EDITS)				
CBT		71.83 (20.47)		
MBT		70.26 (18.74)		

Note. R2 corresponds with the second analysis that compares CBT and MBT to one another, with those originally randomized to wait-list then included into their second randomized arm. SIDI-F = Sexual interest/desire inventory-Female; FSDS-R = Female sexual distress scale-revised; QSI-S = Quality of Sex Inventory, satisfaction subscale; QSI-D = Quality of Sex Inventory, dissatisfaction subscale; FSFI = Female Sexual Function Index; EDITS = Erectile Dysfunction Inventory of Treatment Satisfaction Scale. Data are presented as raw mean (*SD*). For reliable change in primary outcomes, *n*s for each of the three categories (i.e., reliable improvement, no reliable change, reliable deterioration) are listed for all participants who completed pretreatment and posttreatment measures for that outcome. Reliable change data are presented as *n* (% of total in that arm).

The significant group-by-time interactions for R1 indicate that both CBT ($p < .001$) and MBT ($p = .001$) showed significant improvements in sexual desire and arousal (SIDI-F) from t1 to t2 compared to the wait-list control group, with large interaction effect sizes ($d = 1.13$ and 0.90, respectively; see Fig. 2). Group-by-time interactions for R2 were non-significant, indicating that the improvements in sexual desire/arousal did not differ between treatment arms.

Similarly, sexual distress (FSDS-R) was significantly more reduced from t1 to t2 for both CBT ($p = .011$) and MBT ($p < .001$) compared to the wait-list control group (Fig. 3). Interaction effects were medium/large ($d = -0.62$ and -1.00, respectively) and reduction in sexual distress did not differ between treatment arms.

3.3. Effects of treatment on secondary outcomes of sexual satisfaction, sexual dissatisfaction, and sexual function

For R1 for sexual satisfaction (QSI-S), there were significant group-

Table 5
Time and group comparisons and interaction effects from random coefficient analysis models for outcome measures for R1.

Variable	*b*	SE	*p* value	*d*	95 % CI for *b*
Model for SIDI-F					
Constant	14.494	1.183	<.001		[12.175, 16.813]
Time (t2-t1)	7.686	0.932	<.001	0.95	[5.853, 9.519]
Group					
CBT	4.852	1.598	.002	0.60	[1.718, 7.986]
MBT	5.127	1.613	.002	0.63	[1.961, 8.292]
Time × Group					
t2-t1 × CBT	9.153	2.072	<.001	1.13	[5.078, 13.227]
t2-t1 × MBT	7.334	2.242	.001	0.90	[2.893, 11.775]
Model for FSDS-R					
Constant	35.026	1.271	<.001		[32.535, 37.518]
Time (t2-t1)	−5.805	0.945	<.001	−0.66	[-7.660, −3.950]
Group					
CBT	−8.485	1.685	<.001	−0.96	[-11.789, −5.182]
MBT	−7.404	1.703	<.001	−0.84	[-10.742, −4.065]
Time × Group					
t2-t1 × CBT	−5.461	2.140	.011	−0.62	[-9.662, −1.260]
t2-t1 × MBT	−8.903	2.161	<.001	−1.00	[-13.147, −4.658]
Model for QSI-S					
Constant	10.297	1.755	<.001		[6.856, 13.738]
Time (t2-t1)	6.295	1.216	<.001	0.55	[3.908, 8.681]
Group					
CBT	8.776	2.351	<.001	0.77	[4.165, 13.386]
MBT	9.638	2.419	<.001	0.85	[4.889, 14.387]
Time × Group					
t2-t1 × CBT	7.928	2.897	.006	0.70	[2.234, 13.622]
t2-t1 × MBT	9.142	3.005	.003	0.81	[3.220, 15.064]
Model for QSI-D					
Constant	20.599	1.808	<.001		[17.055, 24.142]
Time (t2-t1)	−2.400	1.101	.031	−0.18	[-4.573, −0.226]
Group					
CBT	−6.508	2.480	.009	−0.49	[-11.370, −1.646]
MBT	−7.853	2.482	.002	−0.59	[-12.718, −2.987]
Time × Group					
t2-t1 × CBT	−1.979	2.542	.437	−0.15	[-6.977, 3.019]
t2-t1 × MBT	−1.390	2.673	.604	−0.10	[-6.666, 3.886]
Model for FSFI					
Constant	16.941	0.757	<.001		[15.456, 18.426]
Time (t2-t1)	4.301	0.592	<.001	0.92	[3.133, 5.469]
Group					
CBT	1.858	1.004	.064	0.40	[-0.111, 3.827]
MBT	2.921	1.032	.005	0.63	[0.894, 4.947]
Time × Group					
t2-t1 × CBT	5.620	1.220	<.001	1.20	[3.223, 8.016]
t2-t1 × MBT	5.761	1.426	<.001	1.23	[2.914, 8.608]

Note. R1 corresponds with the first analysis that compares CBT and MBT to the wait-list (WL) condition. SIDI-F = Sexual interest/desire inventory-Female; FSDS-R = Female sexual distress scale-revised; QSI-S = Quality of Sex Inventory, satisfaction subscale; QSI-D = Quality of Sex Inventory, dissatisfaction subscale; FSFI = Female Sexual Function Index; reference for Group = WL; t1 = before treatment; t2 = posttreatment (or 10 weeks after t1 if WL); CI = confidence interval; *d* = Cohen's *d* based on the multilevel model estimates. All models had random intercepts.

Table 6
Time and group comparisons and interaction effects from random coefficient analysis models for outcome measures for R2.

Variable	*b*	SE	*p* value	*d*	95 % CI for *b*
Model for SIDI-F					
Constant	18.102	1.082	<.001		[15.980, 20.225]
Time					
t2-t1	9.928	1.036	<.001	1.21	[7.890, 11.967]
t3-t1	8.512	1.005	<.001	1.04	[6.540, 10.485]
Group	0.765	1.391	.583	0.09	[-1.969, 3.499]
Time × Group					
t2-t1 × Group	−0.451	2.032	.825	−0.06	[-4.443, 3.542]
t3-t1 × Group	1.264	2.278	.580	0.15	[-3.261, 5.789]
Model for FSDS-R					
Constant	29.198	1.116	<.001		[27.011, 31.385]
Time					
t2-t1	−8.682	1.006	<.001	−0.98	[-10.658, −6.705]
t3-t1	−11.341	1.009	<.001	−1.28	[-13.324, −9.359]
Group	0.379	1.427	.790	0.04	[-2.420, 3.179]
Time × Group					
t2-t1 × Group	−3.075	2.117	.148	−0.35	[-7.251, 1.100]
t3-t1 × Group	−1.222	2.103	.562	−0.14	[-5.369, 2.925]
Model for QSI-S					
Constant	15.848	1.611	<.001		[12.688, 19.008]
Time					
t2-t1	8.757	1.261	<.001	0.77	[6.283, 11.232]
t3-t1	9.193	1.287	<.001	0.80	[6.664, 11.722]
Group	1.525	2.169	.482	0.13	[-2.741, 5.791]
Time × Group					
t2-t1 × Group	1.741	2.913	.552	0.15	[-4.058, 7.540]
t3-t1 × Group	6.381	2.678	.018	0.56	[1.099, 11.662]
Model for QSI-D					
Constant	16.039	1.394	<.001		[13.306, 18.772]
Time					
t2-t1	−3.999	1.218	.001	−0.31	[-6.410, −1.587]
t3-t1	−4.159	1.216	<.001	−0.32	[-6.567, −1.751]
Group	−1.684	1.857	.364	−0.13	[-5.327, 1.958]
Time × Group					
t2-t1 × Group	−0.348	2.271	.878	−0.03	[-4.816, 4.120]
t3-t1 × Group	−0.289	2.286	.899	−0.02	[-4.788, 4.210]
Model for FSFI					
Constant	18.201	0.655	<.001		[16.917, 19.486]
Time					
t2-t1	5.860	0.609	<.001	1.21	[4.653, 7.067]
t3-t1	5.928	0.578	<.001	1.22	[4.791, 7.065]
Group	0.706	0.864	.415	0.15	[-0.996, 2.407]
Time × Group					
t2-t1 × Group	0.646	1.169	.581	0.13	[-1.662, 2.955]
t3-t1 × Group	1.909	1.279	.139	0.39	[-0.634, 4.451]

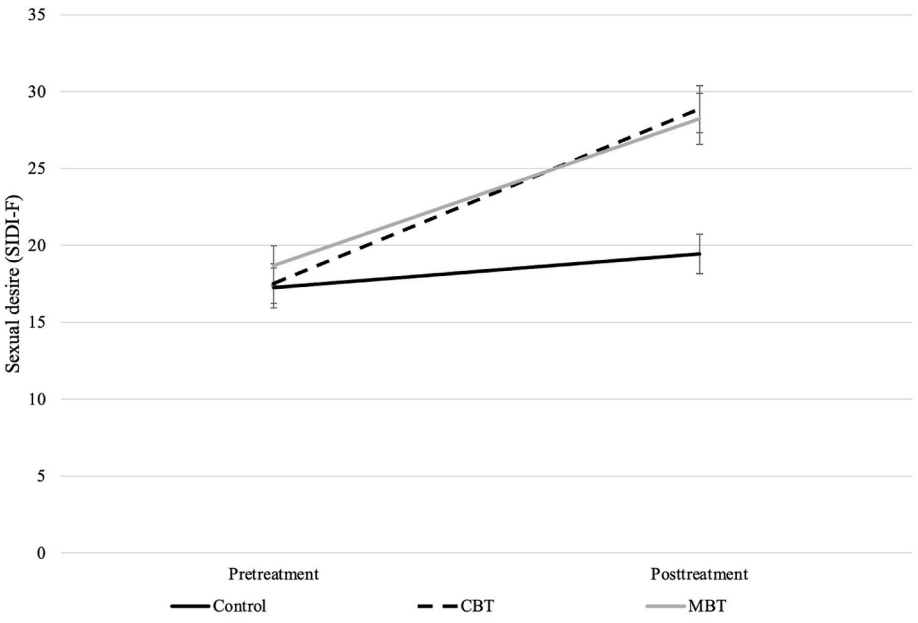
Note. R2 corresponds with the second analysis that compares CBT and MBT to one another, with those originally randomized to wait-list then included into their second randomized arm. SIDI-F = Sexual interest/desire inventory-Female; FSDS-R = Female sexual distress scale-revised; QSI-S = Quality of Sex Inventory, satisfaction subscale; QSI-D = Quality of Sex Inventory, dissatisfaction subscale; FSFI = Female Sexual Function Index; Group = CBT (reference) versus MBT; t1 = before treatment; t2 = posttreatment; t3 = 6 months posttreatment; CI = confidence interval; *d* = Cohen's *d* based on the multilevel model estimates. All models had random intercepts.

by-time interactions from t1 to t2 (Fig. 4). Both, CBT ($p = .006$) and MBT ($p = .003$) showed increases in sexual satisfaction compared to the wait-list control group, with medium/large interaction effects ($d = 0.70$ and 0.81, respectively). For R2, there was a significant group-by-time interaction for t3-t1 comparisons ($p = .018$), indicating that the MBT group improved by 6.38 points more than the CBT group (QSI-S ranges from 0 to 60) between these two time points. There were no significant group-by-time interactions for sexual dissatisfaction (QSI-D), suggesting that this outcome did not change differentially between treatment and wait-list groups. Sexual function (FSFI total score) significantly improved from t1 to t2 for both CBT ($p < .001$) and MBT ($p < .001$) compared to the wait-list control group, with large interaction effects ($d = 1.20$ and 1.23, respectively; Fig. 5). These improvements in sexual function did not differ between treatment groups.

3.4. Treatment satisfaction

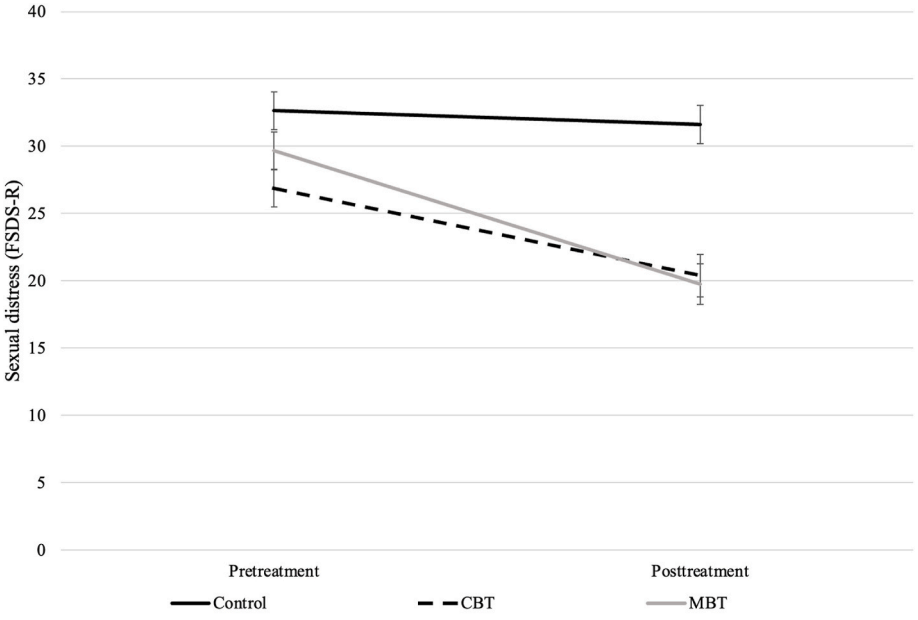
Participants found *eSense* to be easy to navigate, with an average rating of 8.27 ($SD = 1.57$) out of 10. The ease of website navigation did not significantly differ between CBT ($M = 8.03$; $SD = 1.83$) and MBT ($M = 8.54$; $SD = 1.17$), $F_{Welch}(1, 98.15) = 3.13$, $p = .080$. In response to the question asking about the helpfulness of the content, the average rating was 8.13 ($SD = 1.48$) out of 10, with no significant difference between CBT ($M = 7.90$; $SD = 1.75$) and MBT ($M = 8.39$; $SD = 1.05$), $F_{Welch}(1, 95.08) = 3.21$, $p = .076$.

Participants also reported considerable satisfaction with treatment ($M = 71.10$, $SD = 19.59$). The levels of treatment satisfaction did not significantly differ between the CBT ($M = 71.83$; $SD = 20.47$) and the MBT programs ($M = 70.26$; $SD = 18.74$), $F(1, 86) = 0.139$, $p = .710$.



Note. Possible range of scores: 0 to 51. Error bars represent ±1 standard error.
Means and standard errors estimated per models reported in Table 5.

Fig. 2. Effects of Treatment (CBT or MBT) and Control on Sexual Desire From t1 to t2.



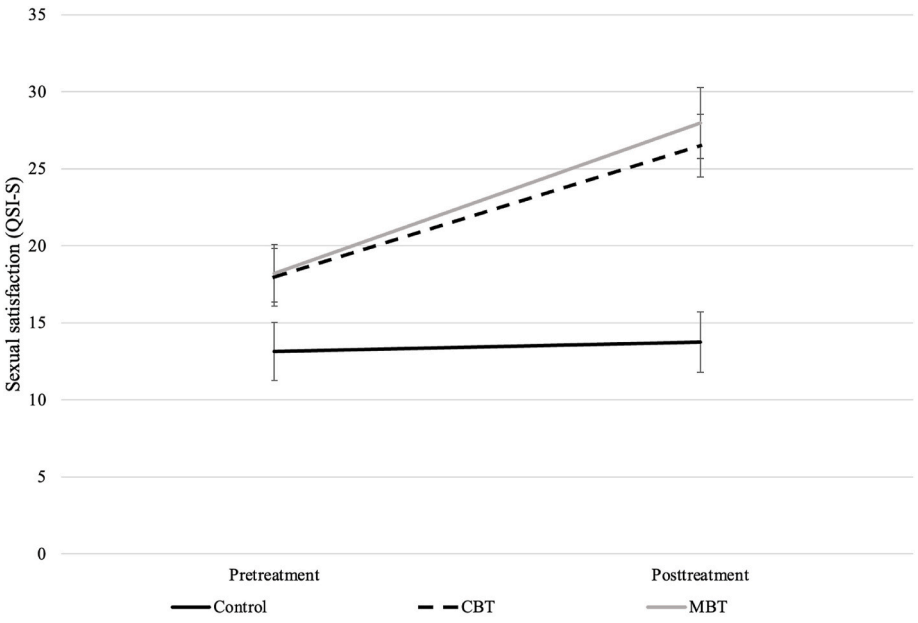
Note. Possible range of scores: 0 to 52. Error bars represent ±1 standard error.
Means and standard errors estimated per models reported in Table 5.

Fig. 3. Effects of Treatment (CBT or MBT) and Control on Sex-Related Distress From t1 to t2.

Additionally, the average score on the HRS-II was 2.53 ($SD = 0.51$), corresponding to homework engagement of "some"/"moderately" to "a lot"/"very." CBT participants ($M = 2.46$; $SD = 0.57$) did not significantly differ from MBT participants ($M = 2.61$; $SD = 0.44$), $F(1, 107) = 2.22$, $p = .139$.

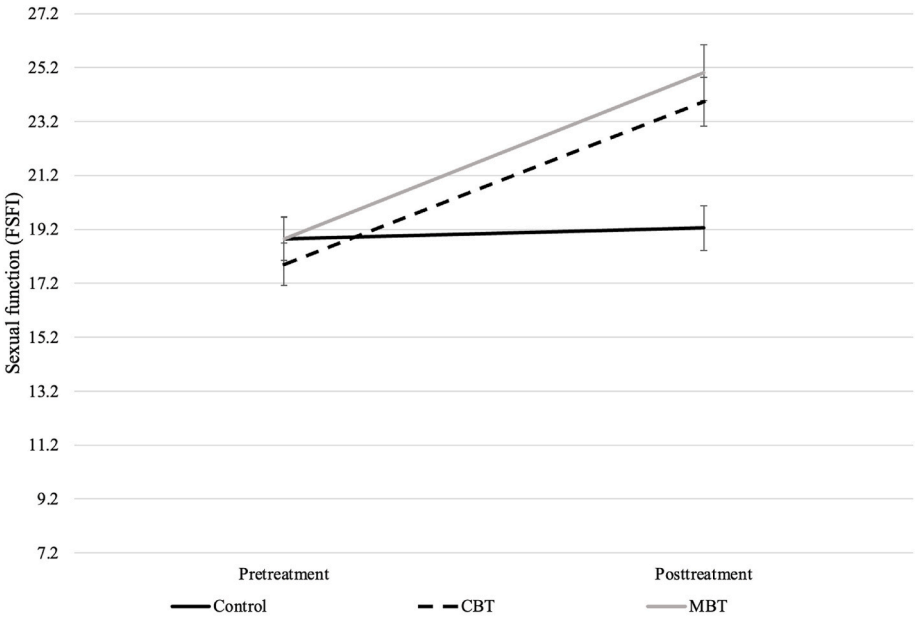
4. Discussion

The overall goal of the current study was to test the efficacy of *eSense* paired with non-expert support against a wait-list control group, and to compare the two arms of *eSense* (CBT and MBT) with one another. Results suggested that both arms resulted in large and statistically significant improvements in the primary endpoints of sexual desire and sexual distress, as well as secondary endpoints of sexual satisfaction and overall sexual function, and that these improvements were maintained for 6 months. Differences in outcomes between CBT and MBT were small, suggesting that both interventions were efficacious in treating core symptoms of SIAD.



Note. Possible range of scores: 0 to 60. Error bars represent ±1 standard error.
Means and standard errors estimated per models reported in Table 5.

Fig. 4. Effects of Treatment (CBT or MBT) and Control on Sexual Satisfaction From t1 to t2.



Note. Possible range of scores: 7.2 to 36. Error bars represent ±1 standard error.
Means and standard errors estimated per models reported in Table 5.

Fig. 5. Effects of Treatment (CBT or MBT) and Control on Sexual Function From t1 to t2.

Importantly, the effects in the current trial (d = .90–1.13 for desire and d = .62–1.0 for distress) were similar to other studies of online interventions for female sexual problems (Mahar et al., 2022), which is noteworthy given that most previous studies included more intensive expert support, and reported completer rather than intent-to-treat analyses (Zarski et al., 2022). Our effects were also in line with more established treatments. For example, Fruhauf and colleagues (2013) found that effects of face-to-face treatment for Hypoactive Sexual Desire Disorder (a diagnostic precursor to SIAD) across approaches averaged d = .91 for improvements in desire and d = .51 for improvements in satisfaction. The 6-month maintenance of effects from *eSense* also mirrors trials of in-person interventions (Brotto et al., 2021; Mestre-Bach et al., 2022) suggesting that, similar to these treatments, *eSense* may lead to long-lasting improvements (Solhaug et al., 2019). Our effects are also of comparable magnitude to studies testing in-person delivery of the specific interventions used in *eSense*. For example, Brotto et al. (2021) reported effect sizes between d = 1.29 to 1.60 for sexual desire and d = −0.83 to −1.17 for sexual distress using an in-person MBT intervention

that inspired the MBT arm of *eSense*. Finally, although not as directly analogous, our effects on primary endpoints are generally larger than those seen for pharmacological interventions (e.g., Jaspers et al., 2016; Pyke & Clayton, 2018), and it is likely that effects after discontinuation of treatment are larger for psychotherapy than for medication. In sum, while replication of the current results and within-study comparisons are needed, our findings suggest that *eSense* may provide similar benefits as more labor-intensive interventions for SIAD, a finding consistent with other areas of mental health (e.g., Carlbring et al., 2018).

In addition to symptom improvement, participant satisfaction was high and attrition was low, especially in comparison to typical rates reported in studies of online interventions (Bennett et al., 2020). Our intervention's attrition rate of 20 % is notably low compared to the average dropout rate of 31 % for online interventions (Melville et al., 2010) and the 0–76.6 % range reported for those targeting women's sexual difficulties (Mahar et al., 2022). Homework engagement was also high, which is noteworthy because homework completion is a well-established predictor of positive response to treatment (Kazantzis et al., 2016; Sapkota et al., 2023), but can be challenging in online interventions (Peynenburg et al., 2022). One likely reason for this high engagement was the support provided by navigators.

Previous studies have generally found that individualized support decreases attrition in online interventions (e.g., Musiat et al., 2022). For example, a recent trial used psychology master's students as coaches in an online treatment for genital pain in women (Zarski et al., 2022) and reported a 15 % attrition rate from pre-to-post treatment and medium-to-large effects on pain-related outcomes. However, even master's students with a background in sex therapy can be limited in number (Mollen et al., 2020), difficult to recruit, and expensive to compensate. To maximize scalability, alternative methods of support are needed. Inspired by work demonstrating improved adherence with support from non-experts (e.g., Robinson et al., 2010), the current study is the first of which we are aware to use undergraduate students to augment an online intervention for SIAD. The fact that such support allowed for large improvements, high satisfaction, and low attrition suggests that this format of treatment holds much promise for maximizing scalability and, thus, accessibility to efficacious treatment for SIAD. An important next step is to explore the implementation of this tool in clinical settings, where cost-effective non-expert support could further enhance scalability.

While the overall pattern of results in the current study was promising, engagement and impact could be improved. For example, only 60 % completed 6 or more of the 8 modules of *eSense* by the end of the recommended 12-week period, suggesting that additional time and/or support may be necessary to complete the full program, or that completion of the full program is not necessary. Future studies that allow more flexibility regarding completion, and dismantling studies identifying necessary and sufficient components would provide helpful information.

Additionally, effects for some secondary outcomes were somewhat smaller than those for the primary endpoints (e.g., no significant improvement in sexual dissatisfaction). While sexual function, distress, and satisfaction all tend to be correlated, multiple studies have demonstrated that these outcomes may represent distinct constructs (e.g., Stephenson & Meston, 2010; Stephenson et al., 2013). One potential reason for differing effects is that scales of sexual satisfaction often include references to broader romantic relationships (e.g., "sexual activity with my partner leaves me feeling distant and alone; " Shaw & Rogge, 2016), which are minimally targeted in *eSense*. Formal involvement of relational partners and/or additional interventions focused on relationships (e.g., Doss et al., 2016) may be necessary to see large effects on a broader set of outcomes. Our null effect for dissatisfaction may also be attributable to a floor effect, as participants generally reported relatively low baseline levels of both sexual satisfaction and dissatisfaction. As women experiencing higher levels of sexual dissatisfaction might not have sought out this treatment, future research should target women with greater dissatisfaction to better understand the intervention's impacts.

The efficacy of the MBT and CBT arms of *eSense* was generally quite similar, except that MBT resulted in larger, more stable gains in sexual satisfaction than CBT. This similarity in outcomes is noteworthy because, while MBT has been supported as an efficacious treatment in recent systematic reviews and meta-analyses (JaderekStarowicz; Larraz et al., 2023; Selice & Morris, 2022), CBT has been evaluated less frequently as a treatment for female sexual dysfunction over the past 20 years (Fruhauf et al., 2013). The current results suggest that both treatment approaches can be helpful when delivered online.

While the small treatment arm differences in outcomes must be replicated, it is important to consider possible explanations for these effects. First, MBT may be slightly more efficacious in improving sexual satisfaction. This possible difference could stem from the fact that the MBT platform in *eSense* was created specifically for women with low desire (Brotto & Smith, 2014) based on a theoretical model meant to explain sexual desire in women (Basson, 2000) whereas CBT is based on non gender-specific conceptualizations of sexual problems and theoretical models originally created to explain arousal difficulties in men (Barlow, 1986) before being expanded to women (Wiegel et al., 2007). Given these different theoretical bases, the interventions differ somewhat in their primary targets of treatment (e.g., nonjudgemental awareness of sensations vs. avoidance of sexual activity). It is possible that one set of treatment targets is more relevant and/or easier to change via brief therapy. It may alternatively be that MBT, which was created to be delivered in a group format and to focus on experiential practice, is easier to translate into an online format whereas CBT activities (e.g., weighing evidence for/against thoughts) may benefit more from synchronous expert feedback to implement the skills being taught. Further exploration of user experiences within each arm will be necessary to explore these possibilities.

The current study used an RCT design, widely regarded as a gold standard in efficacy research (e.g., Backmann, 2017; Hariton & Locascio, 2018). Follow-up studies using different designs, such as a repeated single-case approach (e.g., Kazdin, 2019), could provide a more detailed understanding of how changes unfold over time. A waitlist control condition was chosen instead of an active control to evaluate whether the intervention demonstrated efficacy compared to no treatment, with the broader aim of improving access to treatment for women who might not otherwise receive care. Future research should compare *eSense* to an active control group to assess its efficacy relative to a typical standard of care.

The study had a number of important limitations that should temper interpretation of the findings. Most importantly, our sample was not representative of the population of women with SIAD - including relatively few participants who were members of ethnic or sexual/gender minority groups, or who had limited education, despite our broad recruitment efforts and inclusion criteria which were open to cis- and transwomen. Underrepresentation of these groups is, unfortunately, common in research on sex therapy and related fields (Nichols, 2014; Spengler et al., 2020). It is essential for future research to engage in targeted recruitment of individuals with diverse identities to assess the generalizability of these results and explore the necessity for culturally-specific approaches (e.g., Lassiter et al., 2022).

Relatedly, our inclusion criteria requiring a current relationship and recent sexual activity means our results may not be generalizable to women with more severe avoidance of sexual activity or those not in a relationship. Future studies without those criteria will be important in determining the boundaries of the intervention's generalizability. Because sexual difficulties often occur within the context of a relationship, it might also be beneficial to adapt *eSense* to be a couple program, with an active partner component. Furthermore, given that all participants were assigned weekly support, it is impossible to assess the added value of this support versus *eSense* content alone. While previous feasibility trials that did not include support (e.g., Brotto et al., 2022) provide

relevant information, it will be important for future studies on *eSense* and similar interventions to experimentally manipulate the presence, type, and intensity of support provided (e.g., Le et al., 2023) to identify the conditions that maximize both efficacy and scalability. Additionally, while we were able to report basic information regarding retention and engagement, it will be important for future research to conduct more fine-grained analysis of patterns of usage that predict the best outcomes.

It is also important to note that recruitment occurred from November 2021 to November 2022, which overlapped with the COVID-19 pandemic. While the timeframe represents a period when vaccines were widely available, and lockdowns had largely lifted (e.g., Centers for Disease Control and Prevention, 2023), participants might have still been experiencing pandemic-related stress, which could be one of the myriad reasons contributing to low sexual desire (Masoudi et al., 2022). It will be important to replicate the current results outside of the context of a global pandemic to expand generalizability. Finally, although both CBT and MBT interventions show promise in reducing barriers to accessing effective treatment for women's sexual difficulties, broader societal challenges, such as stigma surrounding discussion of sex, still represent important barriers to treatment accessibility and use. Given research suggesting that this stigma could be mitigated by allowing women to engage in treatment privately and discreetly (Sever & Vowels, 2024), we hope that eSense will contribute to a reduction in such barriers.

The current study provides strong initial evidence of the efficacy of *eSense*. Both CBT and MBT interventions have the potential to address many barriers to accessing treatment for women's sexual concerns. Future research that proactively targets populations most in need of online treatment, identifies necessary and sufficient components of effective treatment, and establishes scalable methods of implementation will simultaneously increase our understanding of how best to treat distressing low desire, and contribute to a broader understanding of sexual health in women.

Data transparency statement: There is currently one other manuscript under review using this same dataset. This manuscript examines the degree to which a history of sexual trauma was predictive of treatment engagement/outcomes, and whether PTSD symptoms changed over time. There is minimal overlap in terms of analyses between the two manuscripts.

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CRediT authorship contribution statement

Elizabeth A. Mahar: Writing – review & editing, Writing – original draft, Supervision, Project administration, Investigation, Formal analysis, Data curation. **Kyle R. Stephenson:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization. **Lori A. Brotto:** Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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