

Sexual Satisfaction of High-Functioning Adults with Autism Spectrum Disorder

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Abstract This study examined the validity of the Interpersonal Exchange Model of Sexual Satisfaction (IEMSS) as a framework for understanding the sexual satisfaction of 205 adults (77 men and 128 women) with high-functioning autism spectrum disorder (HF-ASD) who were in a romantic relationship of at least 3 months duration. Participants completed an online survey that included a background questionnaire, the IEMSS Questionnaire, and a measure of autism symptoms. The results provide support for the validity of the IEMSS in that all the IEMSS components (relationship satisfaction, balance of sexual rewards and costs, balance of relative sexual rewards and costs, equality of rewards, equality of costs) were significantly associated with sexual satisfaction. Relationship satisfaction and the balance of rewards and costs added over and above the other components. The model was not moderated by gender, relationship duration or extent of autism symptoms. However, participants with more autism symptoms related to social functioning reported lower sexual satisfaction as well as lower scores on all of the IEMSS components. There were few gender differences. These results are discussed in terms of the impact of HF-ASD on adults' experiences of their sexual satisfaction with their partner.

Keywords Sexual satisfaction · Autism spectrum disorder · Sexuality · Asperger syndrome · Canada · United States

Introduction

Sexuality is an important aspect of most romantic relationships, including the relationships of cognitively high-functioning individuals with autism spectrum disorder (HF-ASD);

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[1, 2]. Further, sexual satisfaction has been shown to be closely linked to overall well-being, high relationship quality, and relationship stability among neurotypical individuals [3–7]. Although researchers have not investigated the link between the sexual satisfaction and psychological well-being of individuals with autism spectrum disorder (ASD), it is likely that they are linked. Thus, it is important to identify factors affecting the sexual satisfaction of both individuals with and those without ASD. Many individuals with ASD do desire and enter romantic relationships [1, 8–10]. However, a review of the literature revealed no studies that have examined predictors of sexual satisfaction in individuals with HF-ASD. Thus, the goal of this study was to evaluate the utility of the Interpersonal Exchange Model of Sexual Satisfaction (IEMSS); [7, 11] for understanding the sexual satisfaction of adults with HF-ASD in a romantic relationship. Sexual satisfaction refers to an individual's subjective evaluation or feelings about their sexual relationship [11, 12].

The IEMSS proposes that individuals in a relationship are more sexually satisfied if: (1) they are more satisfied with the nonsexual aspects of the relationship; (2) they experience a more favorable balance of sexual rewards to sexual costs in the relationship (i.e., they experience high sexual rewards and low sexual costs); (3) this balance compares favorably to their expected level of sexual rewards and sexual costs (i.e., they experience high relative sexual rewards and low relative sexual costs); and, (4) they perceive greater equality between their own and their partner's sexual rewards and costs. Sexual rewards are exchanges that are positive and pleasurable to the individual; sexual costs are exchanges that cause physical or mental effort or pain, embarrassment, anxiety, or other negative affect [11, 13]. Byers and her colleagues have demonstrated the validity of the IEMSS for neurotypical individuals and couples in both dating and long-term relationships [11, 14–17]. In these studies, the four components of the IEMSS accounted for between 58 and 79 % of the variance in sexual satisfaction. Other researchers have provided independent evidence for the validity of the IEMSS with individuals in dating relationships [18, 19].

ASD is characterized by impairments that may affect sexual relationships and sexual satisfaction [1, 10, 20–22]. Specifically, individuals with ASD typically have deficits in their social interactions and communication that are essential for understanding, developing, and maintaining close personal relationships [20, 23–25]. They may also exhibit repetitive and stereotyped interests and behaviors that interfere with spontaneity in the sexual script and their partner's sexual satisfaction. This is problematic for both the individual with ASD and for their partner because the partner's experience in the sexual relationship has been shown to add to the individual's sexual satisfaction over and above their own experience [15]. Individuals with HF-ASD are also challenged by social stereotypes that typically depict them as asexual or highlight problematic sexual behaviors [26, 27]. Thus, the first goal of this study was to determine the extent to which the IEMSS is useful for understanding the sexual satisfaction of men and women with HF-ASD. In keeping with the IEMSS, we predicted that individuals who report higher relationship satisfaction, a more favorable balance of sexual rewards to sexual costs, a more favorable balance of relative sexual rewards to relative sexual costs, and greater equality of sexual rewards and costs would report higher sexual satisfaction.

The IEMSS proposes that individual characteristics affect the components of the model but do not affect the relationships between these components and sexual satisfaction [7, 11]. For example, the extent of autism symptoms might influence the level or equality of sexual rewards and costs but not the association between these IEMSS components and sexual satisfaction. In keeping with this prediction, Byers and her colleagues have shown that, in neurotypical individuals the IEMSS is robust to the influences of gender, child status,

relationship length, and extent of self-disclosure [7, 14, 17]. However, Peck et al. [19] found in their dating sample that gender moderated the relationship between equality of rewards and sexual satisfaction, such that equality of sexual rewards was associated with higher sexual satisfaction for women but not for men. We examined whether gender, relationship duration, and the extent of autism symptoms moderated the relationships between the model variables and sexual satisfaction in individuals with HF-ASD. We also examined the extent to which autism symptoms are associated with the IEMSS components.

Although the IEMSS predicts that it is the overall balance of sexual rewards to sexual costs that is important to sexual satisfaction, individuals differ in whether they find specific sexual exchanges rewarding and/or costly [7, 17]. For example, some individuals may find oral sex to be a sexual reward. Likely, these would be individuals who engage in oral sex at about the desired frequency and enjoy doing so. Other individuals may find oral sex to be a sexual cost. This would likely be individuals who would like to engage in oral sex more often or less often than they do or do not enjoy oral sex. For still other individuals, oral sex is neither a reward nor a cost—for example, individuals who do not engage in oral sex and do not want to do so. The second goal of this study was to identify which specific sexual exchanges are most frequently experienced as sexual rewards and as sexual costs among adults with HF-ASD.

Gender Differences

Society, in general, is more permissive to male sexual expression than female sexual expression [28]. Nonetheless, research suggests that, among neurotypical individuals, men and women *in relationships* do not differ in their sexual satisfaction and/or their sexual exchanges [7, 14, 18]. In contrast, Byers et al. [1], using a different but overlapping sample to the current study, found that men with HF-ASD reported better sexual functioning than did women with HF-ASD in a number of areas, including higher sexual satisfaction. However, they did not examine relationship satisfaction or sexual exchanges and many of their participants were not in a relationship at the time. Therefore, we examined whether men and women with HF-ASD who are in a romantic relationship differ in their reports of their level/equality of sexual exchanges, relationship satisfaction, and sexual satisfaction.

Lawrance and Byers [7] examined gender differences in reports of specific rewards and costs in a sample of neurotypical individuals in long-term relationships and found few differences. However, they did find that women were more likely than men to report rewards reflecting emotional, relational qualities of the sexual relationship such as being with the same partner each time you have sex. The women also were more likely than were the men to report costs reflecting physical, behavioral aspects of sexual interactions such as difficulty reaching orgasm. Therefore, we also examined gender differences in the percentage of men and women reporting each sexual exchange as a sexual reward and as a sexual cost.

The Current Study

The goal of the current study was to increase understanding of factors associated with the sexual satisfaction of adults with HF-ASD in a romantic relationship using the IEMSS as a theoretical framework. We only included participants who scored 26 or greater on the autism spectrum quotient (AQ), the cut-off score recommended by Woodbury-Smith et al. [29]. Using this cut-off, which indicates substantial ASD symptoms, the AQ has been demonstrated to have good discriminant validity and good screening properties [29]. We

included both individuals who had and who had not received a professional diagnosis because many adults with ASD have never received such an evaluation [30, 31]. Diagnosis has traditionally focused on children and only recently have professionals become more inclusive in diagnosing ASD in older individuals who are highly verbal and bright. Most likely many adults with HF-ASD were not identified as having ASD during childhood and have not sought a professional diagnosis as an adult in part because of the cost of the assessment.

Method

Participants

Participants both currently in and not in a relationship were recruited for an Internet study of *Sexual Well-Being of High-Functioning Adults with Autism Spectrum Disorders*. Inclusion criteria for the present study included currently being in a romantic relationship of 3 months or longer (to ensure that all participants had some history with their partner), being 21 or older (as required by the IRB in the US), and scoring 26 or above on the AQ. In total, 321 individuals currently in a relationship of 3 months or longer started the survey. Of these, 116 were dropped from the sample: seven because they did not indicate their age or they were younger than 21; 55 because they scored below 26 on the AQ; three because they were transgendered (to increase the homogeneity of the sample); and, 51 because they failed to finish the survey. The people who had and had not completed the survey did not differ in their AQ scores, demographic characteristics (age, gender, religiosity) or relationship characteristics (length of relationship, relationship satisfaction), $F_{multi}(6, 240) = 1.32, p = .25$. The final sample consisted of 77 men and 128 women who ranged in age from 21 to 62 years ($M = 38.6, SD = 9.9$). The sample was largely White (90 %) and highly educated (59 % had completed an undergraduate or graduate degree). Most participants were living in the United States (56 %), Australia/New Zealand (26 %), United Kingdom (10 %), Europe (7 %), or Canada (5 %). On average, they reported that religion was moderately important in their daily life ($M = 4.8, SD = 2.3$ on a 7-point scale). Most (79 %) were living with their spouse or romantic partner and had been in their relationship an average of 9.7 years (range 3 months–40 years). Most participants identified themselves as either heterosexual (77 %) or bisexual (15 %) and were in a mixed-sex relationship (94 %). Participants reported substantial autism-related symptomatology (M on the AQ = 37.3, $SD = 5.3$); 40 % reported that they had received a professional diagnosis. Those with and without a professional diagnosis did not differ in their AQ scores, demographic characteristics (age, gender, religiosity) or relationship characteristics (length of relationship, relationship satisfaction), $F_{multi}(6, 190) = 0.48, p = .827$.

Measures

The *Background Information Form* was used to gather demographic information about the participant including gender, race/ethnicity, age, education, religiosity [rated from *not at all important* (1) to *very important* (7)], geographic region of residence, living situation, and relationship status. It also included a question about the source of their ASD diagnosis.

The *Autism Spectrum Quotient* (AQ); [32] is a 50-item self-report questionnaire assessing autistic traits in adults with average intelligence. It consists of ten items in each of five domains: social skill, attention to detail, communication, imagination, and attention

switching. Responses are given on a 4-point Likert scale and then dichotomized to indicate presence or absence of the symptom. Responses were summed to yield possible scores ranging from 0 to 50 for the total score and 0 to 10 for each of the subscales, with higher scores indicating greater symptomatology. There is considerable research supporting the validity of the AQ as a screening tool for ASD. For example, Woodbury-Smith et al. [29] reported good discriminative validity and good screening properties for the AQ using a screening cut-off of 26. At this cut-off score, 83 % of patients diagnosed with ASD were correctly classified based on their AQ score (sensitivity is .95, specificity 0.52, and positive predictive value of 0.84). Similarly, Sonié et al. [33] found that the AQ differentiated adolescents with HF-ASD from neurotypical adolescents and adolescents with psychiatric disorders with 0.89 sensitivity and 0.98 specificity. Other researchers have also provided evidence for the reliability and validity of the AQ [34–36]. The AQ had adequate internal consistency in the current study ($\alpha = .74$).

Participants completed the IEMSS Questionnaire [37] which contains the *Global Measure of Relationship Satisfaction*, the *Global Measure of Sexual Satisfaction*, the *Sexual Rewards and Costs Checklist-Revised*, and the *Exchanges Questionnaire*.

The *Global Measure of Relationship Satisfaction* was used to assess satisfaction with the overall relationship [37]. Participants rated their overall relationship with their partner on five 7-point bipolar scales: *good–bad*, *pleasant–unpleasant*, *positive–negative*, *satisfying–unsatisfying*, *valuable–worthless*. Total scores range from 5 to 35 with higher scores indicating greater relationship satisfaction. This measure has been shown to have high internal consistency and test–retest reliability at three and 18 months ($\alpha = .95$ in the current study) [37]. It is significantly correlated with other measures of relationship adjustment as well as with various indicators of positive relationship functioning (e.g., communication), demonstrating its construct validity.

The *Global Measure of Sexual Satisfaction* was used to assess global sexual satisfaction. Respondents provided their ratings on the same scales as for the Global Measure of Relationship Satisfaction. This measure has been shown to have high internal consistency and test–retest reliability at three and 18 months ($\alpha = .94$ in the current study) [37]. It is significantly correlated with other measures of sexual satisfaction as well as with multiple indicators of sexual functioning (e.g., sexual desire), demonstrating its construct validity.

Sexual exchanges in the relationship were assessed using the 6-item *Exchanges Questionnaire*. Participants first indicated, on a 9-point scale with endpoints *not at all rewarding* (1) and *extremely rewarding* (9), how rewarding their sexual relationship was (level of rewards, REW). Second, they indicated how their level of rewards compared to their own expectations about how rewarding their sexual relationship should be (comparison level or relative level of rewards, CL_{REW}) on a 9-point scale with anchors *much less rewarding in comparison* (1) and *much more rewarding in comparison* (9). Third, they rated, on a 9-point scale with anchors *my rewards are much higher* (1) and *my partner's rewards are much higher* (9), how their level of rewards compared to the level of rewards their partner receives in the sexual relationship (perceived equality of rewards). The three remaining items assessed level of costs (CST), relative level of costs (CL_{CST}), and perceived equality of costs using the same format as for rewards. Perceived equality of rewards and costs were recoded such that the mid-point (5 on the original scale), representing perfect equality, was assigned a score of 4, and both endpoints [i.e., both my rewards are much higher (1) and my partner's rewards are much higher (9)] were assigned scores of 0, representing low equality. Similarly, scores of 2 and 8 were recoded to a score of 1, scores of 3 and 7 were recoded to a score of 2, and scores of 4 and 6 were recoded to a score of 3. Thus, higher scores represent greater equality of rewards and costs between

partners. Scores on the two recoded equality scales, (EQ_{REW} and EQ_{CST}), constitute one of the components of the IEMSS. The other two components ($REW-CST$ and $CL_{REW}-CL_{CST}$) are calculated from the remaining four items on the Exchanges Questionnaire by subtracting the cost score from the reward score so that the possible range of scores for both of these measures is -8 to $+8$. As anticipated, test–retest reliabilities for these measures at three and 18 months are moderate [37].

The 58-item *Sexual Rewards/Costs Checklist-Revised* was used to assess specific sexual rewards and costs. Cohen et al. [38] added 12 items to the original scale in order to make it more appropriate for individuals in both mixed-sex and same-sex relationships. Each item represents a sexual exchange (e.g., *level of affection expressed during sexual activity, oral sex*). Before completing these items, participants were instructed about the meanings of the terms “reward” and “cost” using oral sex as an example. Participants indicated whether each sexual exchange represents a reward, a cost, both a reward and a cost, or neither a reward nor a cost in their sexual relationship. We used the item responses to determine the types of sexual rewards and costs experienced by participants. We also computed the number of items endorsed as sexual rewards (Number of Rewards) and sexual costs (Number of Costs) ($\alpha = .95$ and $\alpha = .94$, respectively, in the current study).

Procedure

Following ethical review in Canada and the U.S., we contacted 192 national and international autism organizations selected for: (a) providing a specialty service/resource for adults with ASD; and/or (b) having a reputation as credible by direct experience or recommendation by another expert. These included professional organizations, professionals who serve clients with HF-ASD, online HF-ASD-related message boards, and support groups. Contacts were mostly via email, with some local agencies contacted via phone, to ask for their assistance in recruiting potential participants. Information about the study was provided to each organization or professional, including the advertisement to clients that clearly indicated that this was a study about sexual well-being. They were asked to share the flyer in whatever way would be convenient for them (e.g., post, distribute, place on information table). The flyer directed potential participants to the study website. Once they accessed the website, participants first read an informed consent page describing the purpose of the study, procedures, potential benefits and risks, and confidentiality. Information about how to contact the researchers with any questions about the study was also included. Participants who agreed to participate were linked to an identification number page and the survey. Participants were given an identification number to record or print in order to allow the option of exiting early and returning later.

Participants first completed the Background Information Form followed by the Global Measure of Relationship Satisfaction, AQ, Sexual Rewards and Costs Checklist-Revised, Exchanges Questionnaire, and Global Measure of Sexual Satisfaction in that order. Next they completed a number of measures not relevant to the current study. Participants finished with a debriefing page that explained the purpose of the study and provided further resources on sexuality with suggested websites and books.

Results

Descriptive statistics for the variables in the study are reported in Table 1. Participants reported a moderately high level of both sexual rewards and sexual costs. Their level of

Table 1 Descriptive statistics for sexual exchanges, sexual satisfaction, and relationship satisfaction

Variable	Range	Present study		Lawrance and Byers [7]		
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>
Level of rewards (REW)	1–9	6.0	2.2	6.5	2.2	2.40*
Level of costs (CST)	1–9	5.4	2.4	3.1	2.2	10.50***
REW–CST	–8 to +8	0.6	4.1	3.4	4.1	7.20***
Relative reward level (CL_{REW})	1–9	5.1	2.4	5.6	2.2	2.30*
Relative cost level (CL_{CST})	1–9	5.4	2.4	4.2	2.0	5.77***
$CL_{REW}-CL_{CST}$	–8 to +8	–0.3	4.1	1.4	3.6	4.67***
Equality of rewards (EQ_{REW})	0–4	2.6	1.4	3.1	1.2	4.07***
Equality of costs (EQ_{CST})	0–4	2.6	1.4	3.1	1.2	4.07***
Relationship satisfaction	5–35	26.1	7.1	30.2	5.3	6.99***
Sexual satisfaction	5–35	24.8	7.6	28.6	6.6	5.66***

N = 205 (77 men and 128 women)

REW–CST balance of sexual rewards to sexual costs, $CL_{REW}-CL_{CST}$ balance of relative sexual rewards to relative sexual costs, EQ_{REW} equality of sexual rewards, EQ_{CST} equality of sexual costs

* $p < .05$; *** $p < .001$

sexual rewards and costs just met their expectations. They also reported a moderate degree of equality between their own and their partner's sexual rewards and sexual costs. Participants reported moderately high sexual and relationship satisfaction. Table 1 also provides the descriptive statistics on these variables from Lawrance and Byers' [7] sample of neurotypical individuals. We used unpaired *t* tests, to compare the means in the two studies (see Table 1). The results indicate that the current sample of individuals with HF-ASD on average reported significantly less positive functioning on all of these variables including lower REW and CL_{REW} , higher CST and CL_{CST} , lower EQ_{REW} and EQ_{CST} . The largest discrepancies were in CST and REW–CST. The current sample also reported significantly lower relationship and sexual satisfaction than the original sample.

Testing the IEMSS

To test the IEMSS, participants' scores for each of the components of the model (relationship satisfaction, REW–CST, $CL_{REW}-CL_{CST}$, EQ_{REW} , EQ_{CST}) were entered into a multiple regression analysis predicting sexual satisfaction. As recommended by Tabachnick and Fidell [39], two participants who constituted multivariate outliers were dropped from the analyses. As shown in Table 2, the predictors were significantly associated with sexual satisfaction, accounting for 64 % of the variance, $F(5, 197) = 69.42$, $p < .001$. All of the predictors were significantly correlated with sexual satisfaction on a bivariate level. However, only relationship satisfaction and REW–CST added over and above the other predictors.

We tested whether gender, relationship duration, and extent of autism symptoms moderated the relationship between the components of the IEMSS and sexual satisfaction using three separate hierarchical multiple regression analyses. In each instance, the interactions between the moderator and the IEMSS components were calculated using partialled products based on centered variables. The potential moderator was added to the previous analysis in Step 2 and the interaction terms were added in Step 3. In the first

Table 2 Multiple regression analysis predicting sexual satisfaction from the components of the IEMSS

Predictor	<i>r</i>	β	<i>sr</i>
Relationship satisfaction	.51***	.22	.19***
REW–CST	.77***	.63	.40***
CL _{REW} –CL _{CST}	.64***	.06	.04
EQ _{REW}	.28***	.05	.05
EQ _{CST}	.34***	–.04	–.03

$N = 203$ (77 men and 126 women). $R^2 = .64$, $F(5, 197) = 69.42$, $p < .001$

REW–CST balance of sexual rewards to sexual costs, CL_{REW}–CL_{CST} balance of relative sexual rewards to relative sexual costs, EQ_{REW} equality of sexual rewards, EQ_{CST} equality of sexual costs

*** $p < .001$

analysis, gender did not significantly add to the prediction of sexual satisfaction or moderate the relationships between the predictors and sexual satisfaction, $F(1, 196) = 0.03$, $p > .05$ and $F(5, 191) = 0.67$, $p > .05$, respectively. In the second analysis, addition of relationship duration added significantly to the prediction of sexual satisfaction accounting for an additional 1 % of the variance, $F(1, 196) = 5.06$, $p = .026$. However, addition of the interaction terms was not significant at Step 3 indicating that relationship duration did not moderate the relationships between the predictors and sexual satisfaction, $F(5, 191) = 1.30$, $p > .05$. Finally, in the third analysis, although the extent of autism symptoms was associated with sexual satisfaction on a bivariate basis ($r = -.18$, $p = .006$), it did not add to the prediction of sexual satisfaction over and above the other predictors, $F(1, 196) = 0.62$, $p > .05$. The extent of autism symptoms also did not moderate the relationships between the predictors and sexual satisfaction, $F(5, 191) = 1.81$, $p > .05$. Taken together these results indicate that although individuals in shorter relationships and with fewer autism symptoms reported higher sexual satisfaction, as predicted, the relationships between the components of the model and sexual satisfaction were not moderated by gender, relationship length, and extent of autism symptoms.

Specific Sexual Rewards and Costs

On average participants reported 34 of the 58 items as sexual rewards and 24 as sexual costs. We examined differences between the number of rewards and number of costs reported by men and women using a 2 (gender) \times 2 (type of exchange) ANOVA. The main effect for type of exchange was significant, $F(1, 204) = 42.79$, $p < .001$, $\eta_p^2 = .17$. Neither the main effect for gender nor the interaction was significant. Participants reported significantly more sexual rewards than sexual costs.

The percentage of participants reporting each sexual reward and cost are presented in Table 3. Between 17 and 91 % of participants identified each sexual exchange as a reward. There were 15 sexual exchanges identified as rewards by more than 75 % of participants. These items included exchanges related to the participant's sensual and sexual response (e.g., *physical sensations from touching, caressing, hugging, extent to which you get sexually aroused*), dyadic emotional and relational qualities (e.g., *how comfortable you and your partner are with each other, how much fun you and your partner experience during sexual interaction*), and the partner's behavior and experience (e.g., *how often your partner experiences orgasm (climax), extent to which your partner is relaxed with you*). Only 15 of the 58 exchanges were identified as sexual rewards by less than half of the participants.

Table 3 Percent and rank of participants reporting each sexual reward and sexual cost

	Sexual rewards		Sexual costs	
	%	Rank	%	Rank
How comfortable you and your partner are with each other	91.2	1	29.4	48
How often your partner experiences orgasm (climax)	84.8	2	31.4	45
Extent to which your partner is relaxed with you	82.0	3	32.0	43
How your partner treats you (verbally and physically) when you have sex	81.9	4	30.4	46
How much fun you and your partner experience during sexual interactions	81.7	5	42.1	29
Extent to which you are relaxed with your partner	81.3	6	39.4	35
How often you experience orgasm (climax)	80.3	7	38.4	38
Extent to which you are physically attracted to/sexually desire your partner	80.2	8	36.6	40
Physical sensations from touching, caressing, hugging	80.0	9	48.3	19
Level of affection you and your partner express during sexual activities	79.4	10	49.0	18
Your partner's ability to please you sexually	76.7	11	44.6	26
Extent to which you and your partner are sexually compatible (i.e., well-matched in terms of your sexual likes/dislikes)	75.7	12	47.5	20
Extent to which you think your partner is physically attracted to/sexually desires you	75.7	12	43.6	27
Extent to which you get sexually aroused	75.2	14	46.5	23
How easy it is for your partner to have an orgasm (climax)	75.2	14	39.1	36
Extent to which you and your partner express enjoyment about your sexual interactions	74.9	16	46.8	22
Your partner being naked in front of you	74.3	17	21.3	53
Extent to which your partner shows consideration for your wants/needs/feelings	74.0	18	40.7	31
How your partner responds to your initiation of sexual activity	73.9	19	37.4	39
Pleasing/trying to please your partner sexually	72.9	20	47.3	21
How confident you feel in terms of your ability to please your partner sexually	72.4	21	44.8	25
Degree of emotional intimacy (feeling close, sharing feelings)	72.2	22	52.2	15
Extent to which sexual interactions with your partner make you feel secure in the relationship	70.9	23	33.0	41
Sexual activities you and your partner engage in to arouse each other	69.5	24	58.6	7
How you feel about yourself during/after engaging in sexual activities with your partner	69.5	24	38.9	37
How easy it is for you to have an orgasm (climax)	69.0	26	50.2	17
Extent to which you and your partner engage in intimate activities (e.g., talking, cuddling) after sex	67.6	27	53.4	14
How much privacy you and your partner have for sex	65.9	28	41.5	30
Extent to which you and your partner communicate your sexual likes and dislikes to each other	65.2	29	55.4	12
Being naked in front of your partner	64.9	30	40.6	32
Extent of control you feel during/after sexual activity	64.9	30	40.1	34
Who initiates sexual activities	61.4	32	59.9	6
Frequency of sexual activities (how often you engage in passionate kissing, sexual fondling, and/or sexual intercourse)	61.0	33	67.8	1
Extent to which you and your partner communicate about sex	61.0	33	56.6	10

Table 3 continued

	Sexual rewards		Sexual costs	
	%	Rank	%	Rank
Oral sex: your partner stimulates you	60.5	35	54.1	13
Extent to which/way in which your partner influences you to engage in sexual activity	60.3	36	55.9	11
Extent to which you feel stressed/relaxed during sexual activities	58.3	37	62.3	5
Extent to which you and your partner are/are not sexually exclusive (i.e., have sex only with each other)	57.7	38	16.4	56
Oral sex: you stimulate your partner	57.1	39	56.7	9
How much time you and your partner spend engaging in sexual activities	56.4	40	67.3	2
Extent to which your sexual relationship with your partner reflects or breaks down stereotypical gender roles (the way women and men are expected to behave sexually)	56.0	41	28.0	49
Amount of spontaneity in your sex life (i.e., extent to which your sex life is unplanned)	54.7	42	63.1	4
Variety in sexual activities, locations, times	54.6	43	58.5	8
Method of protection (from sexually transmitted infections and/or pregnancy) used by you and your partner	44.3	44	20.7	54
Extent to which you and your partner discuss and use protection (from sexually transmitted diseases and/or pregnancy)	43.3	45	16.3	57
Extent to which you engage in sexual activities that you dislike but your partner enjoys	37.4	46	45.3	24
Ability/inability to conceive a child	34.8	47	18.1	55
Extent to which you engage in sexual activities that you enjoy but your partner dislikes	33.7	48	40.6	32
Extent to which you and your partner read/watch sexually explicit material (e.g., erotic stories, pornographic videos)	32.7	49	32.7	42
Extent to which you and your partner use sex toys	32.2	50	27.8	50
Extent to which you and your partner engage in anal sex/anal play	30.5	51	25.6	51
Extent to which you and your partner argue after engaging in sexual activity	28.1	52	25.1	52
Extent to which you and your partner engage in role-playing or act out fantasies	27.0	53	31.9	44
Extent to which your partner talks to other people about your sex life	26.9	54	29.9	47
Feelings of physical discomfort or pain during/after sex	21.1	55	42.6	28
Having sex when you're not in the mood	19.6	56	66.7	3
Having sex when your partner is not in the mood	17.2	57	50.5	16
Worry that you or your partner will get a sexually transmitted infection from each other	17.2	57	8.9	58

N = 203

In terms of sexual costs, none of the sexual exchanges were identified as sexual costs by more than 70 % of the participants. However, five exchanges were identified as costs by between 60 and 70 % of participants. These tended to describe aspects of the sexual script (e.g., *frequency of sexual activity, amount of time you and your partner spend engaging in sexual activity*) as well as the participant's personal experience during sex (*having sex when you're not in the mood, extent to which you feel stressed/relaxed during sexual*

activity). An additional 12 exchanges were identified as sexual costs by 50–60 % of participants. Most of the exchanges (41) were identified as sexual costs by <50 % of participants.

Gender Differences

We examined gender differences in the variables listed in Table 1 using a one-way MANOVA. It was significant, $F_{mult}(10, 194) = 2.36, p = .012, \eta_p^2 = .11$. Follow-up ANOVAs indicated that the men and the women differed on only one of these variables: the men reported significantly lower relationship satisfaction than did the women, $M's = 24.5$ and 27.1 , respectively.

Next, we used Chi square comparisons to determine whether there were significant differences in the percentage of men and women reporting each reward. The same procedure was followed for costs. In keeping with Lawrance and Byers [7], sexual rewards and costs reported by <25 % of the entire sample were not examined because the n 's were considered too small for meaningful comparisons. The sexual exchanges on which there were significant gender differences are reported in Table 4. Significantly more men than women endorsed three of the sexual exchanges as sexual rewards and ten of the exchanges as sexual costs; significantly more women than men reported two of the exchanges as sexual rewards and one of the exchanges as sexual costs.

Autism Symptoms

In order to identify which aspects of the IEMSS are affected by the extent and type of autism symptoms, we examined the zero-order correlations between the components of the model (relationship satisfaction, REW–CST, CL_{REW} – CL_{CST} , EQ_{REW} , EQ_{CST}) and AQ total and subscale scores (see Table 5). Higher total autism symptoms were associated with lower scores on all of the IEMSS components except relationship satisfaction and sexual satisfaction. Examining the subscale scores, higher scores on the social skills subscale were negatively associated with the all of the IEMSS components and sexual satisfaction.

Discussion

The overall goal of this study was to enhance understanding of factors that affect the sexual satisfaction of adults with HF-ASD who are in a relationship using the IEMSS as a theoretical framework. In keeping with research with neurotypical individuals [7, 14, 18, 19], we found support for the validity of the IEMSS for individuals with HF-ASD. As predicted, individuals with a more favorable balance of sexual rewards to sexual costs, a more favorable balance of relative sexual rewards to relative sexual costs, greater equality of sexual rewards and costs, and higher relationship satisfaction reported greater sexual satisfaction. Of these, relationship satisfaction and the balance of rewards and costs appear to be especially important to the sexual satisfaction of individuals with HF-ASD in that these factors contributed uniquely to the model. Lawrance and Byers [7], in their sample of neurotypical adults, also found that relationship satisfaction and the balance of rewards and costs were most strongly associated with sexual satisfaction. This suggests that, despite stereotypes to the contrary, for adults with HF-ASD who are in a relationship, as with neurotypical individuals, the context is important to sexual well-being and sexual satisfaction [1]. We also found that, as predicted, the model was robust to the effects of

Table 4 Specific sexual rewards and costs showing gender differences

Item	Sexual Rewards		Sexual Costs		χ^2
	Men (%)	Women (%)	Men (%)	Women (%)	
Oral sex: your partner stimulates you	71	54			6.18*
Oral sex: you stimulate your partner	68	51			5.47*
How much time you and your partner spend engaging in sexual activities	47	62			3.97*
How easy it is for you to have an orgasm (climax)	80	63			6.77**
Extent to which you think your partner is physically attracted to you/sexually desires you	67	81			5.35*
How often your partner experiences orgasm (climax)			47	22	14.40***
How your partner treats you (verbally and physically) when you have sex			40	25	4.72*
Extent to which your partner is relaxed with you			47	24	11.22***
How comfortable you and your partner are with each other			38	24	4.46*
Extent to which you and your partner argue after engaging in sexual activity			34	20	5.33*
How easy it is for your partner to have an orgasm (climax)			54	31	10.95***
How your partner responds to your initiation of sexual activity			55	27	15.07**
Being naked in front of your partner			28	48	7.85**
Extent to which your partner talks to other people about your sex life			40	24	5.89*
Extent to which you and your partner engage in anal sex/anal play			34	21	4.71*
Extent to which you think your partner is physically attracted to/sexually desires you			57	35	9.20**

$N = 205$ (77 men and 128 women)

* $p < .05$; ** $p < .01$; *** $p \leq .001$

individual characteristics: in this case, gender, relationship duration, and extent of autism symptoms. That is, none of these factors moderated the relationships between the components of the model and sexual satisfaction. Taken together the results suggest that, for individuals in a relationship, the same factors are associated with the sexual satisfaction of individuals with HF-ASD as with the sexual satisfaction of neurotypical individuals. It is important to note that individuals with HF-ASD who are in a relationship constitute a select group amongst individuals with ASD.

Autism Symptoms and Sexual Satisfaction

The IEMSS proposes that individual characteristics affect the components of the model but not the relationship between the components and sexual satisfaction—that is, the robustness of the model [7, 11]. Consistent with this view, we found that individuals with more autism symptoms reported lower sexual and relationship satisfaction as well as a less favorable balance of actual and relative sexual rewards to sexual costs and less equality of

Table 5 Correlations between IEMSS components and extent of autism symptoms as assessed by the AQ

IEMSS component	Social skills subscale	Attention switching subscale	Communication subscale	Imagination subscale	Attention to detail subscale	Total score
REW–CST	-.24*	-.09	-.12	-.12	-.01	-.20**
CL _{REW} –CL _{CST}	-.25*	-.10	-.08	-.13	-.02	-.20*
EQ _{REW}	-.20**	-.08	-.08	-.06	-.02	-.15***
EQ _{CST}	-.20**	-.05	-.10	-.09	.00	-.15***
Relationship satisfaction	-.18**	.02	.01	.04	.08	.02
Sexual satisfaction	-.23*	-.07	-.16***	-.06	-.01	-.18***

N = 203 (77 men and 126 women)

REW–CST balance of sexual rewards to sexual costs, CL_{REW}–CL_{CST} balance of relative sexual rewards to relative sexual costs, EQ_{REW} equality of sexual rewards, EQ_{CST} equality of sexual costs

* $p < .001$; ** $p < .01$; *** $p < .05$

sexual rewards and sexual costs. Pollmann et al. [40] found in a sample of neurotypical adults, that although husbands and wives did not differ in their relationship satisfaction, husbands but not wives with more autistic traits were less satisfied with their marriage. This suggests that autism symptoms adversely affect sexual satisfaction through their impact on the components of the IEMSS—that is, individuals’ relational and sexual experiences. It is important to note that, in keeping with past research with individuals with HF-ASD living in the community [1, 41], on average participants in the current sample provided a positive view of these aspects of their sexuality. That is, they reported positive sexual well-being albeit not as positive as that of the neurotypical individuals in past research [7].

Researchers have shown that greater deficits in the social skills and communication domains are associated with poorer relationship and sexual well-being in individuals with HF-ASD [1, 10, 32]. However, in the current study, the adverse impact of autism symptoms on sexual exchanges was specific to deficits in social skills and not to other types of autism symptoms, although individuals with more communication symptoms did report lower sexual satisfaction. Research with neurotypical individuals has shown that better sexual and nonsexual relationship communication is associated with greater sexual satisfaction [42, 43]. Thus, our failure to find a relationship between the AQ communication subscale and the IEMSS components may reflect the nature of the items on the scale. That is, the items do not assess the type of communication needed to ensure a mutually pleasurable relationship or sexual script (that is, a favorable balance of rewards to costs.) For example, the communication scale includes items such as “I am often the last to understand the point of a joke”, and “When I talk on the phone I’m (not) sure when it’s my turn to speak.” It is possible that individuals with HF-ASD are less able to communicate their sexual likes and sexual dislikes to their partner effectively. Research is needed that assesses the quality of nonsexual and sexual *relationship* communication and its association with the relationship and sexual well-being in individuals with HF-ASD.

We found that on average our sample of individuals with HF-ASD scored lower on overall sexual satisfaction as well as on all of the components of the model than did the individuals in Byers and colleague’s samples of neurotypical individuals in long-term and dating relationships [7, 14]. This suggests that ASD symptoms adversely affect adults’ experiences of their sexual relationship by reducing sexual rewards and relationship

satisfaction somewhat and by increasing sexual costs substantially. That is, the neurotypical individuals in the previous studies on average reported a high level of sexual rewards and a low level of sexual costs resulting in a favorable balance of sexual rewards to sexual costs (i.e., a substantially higher level of sexual rewards than sexual costs). In contrast, participants in the current study reported a somewhat lower level of sexual rewards and a moderate level of sexual costs resulting in only a slightly favorable balance of level of sexual rewards to sexual costs. Similarly, although participants identified a significantly greater number of sexual rewards than sexual costs, they nonetheless identified a large number of specific sexual costs. Perhaps as a consequence, their balance of rewards and costs just matched their expectations and they perceived an inequality in sexual rewards and costs between themselves and their partner. Research that includes both individuals with HF-ASD as well as a control group matched for important characteristics such as gender and relationship duration would help clarify the similarities and differences between the sexual experiences of individuals with HF-ASD and neurotypical individuals. Research is also needed with both members of the couple to help clarify whether adults with HF-ASD actually experience lower sexual rewards and costs than their partner or merely perceive that they do so, perhaps due to difficulties with perspective taking. Use of the actor-partner interdependence model would allow researchers to determine the reciprocal effects of autism symptoms on the individual and their partner (for couples in which only one partner is on the autism spectrum) and, for couples in which both partners have HF-ASD, on both partners [1, 12, 44].

Types of Sexual Rewards and Costs

The results also provide information about the specific aspects of the sexual relationship that individuals with HF-ASD are mostly likely to experience as positive and negative (i.e., sexual rewards and sexual costs). More than three-quarters of participants identified as sexual rewards aspects of their own and their partner's sensual and sexual response (e.g., *physical sensations from touching, caressing and hugging*) as well as of the emotional/relational qualities of the sexual relationship (e.g., *how comfortable you and your partner are with each other*). These results challenge the notion that most people with ASD, or at least with HF-ASD, would primarily be self-focused during sexual activity. Some participants did identify these aspects of the sexual relationship as sexual costs, however. The sexual costs identified most frequently related to aspects of the sexual script (e.g., *amount of time you and your partner spend in sexual activity*) as well as negative affect associated with sexual activity (e.g., *having sex when you are not in the mood*). It may be that individuals with HF-ASD adopt rigid "rules" regarding sexual activity, perhaps influenced by the media, that either does not facilitate creation of a mutually pleasurable and flexible sexual script or leads to dissatisfaction if the sexual script does not match the perceived rules.

Gender

Consistent with findings with neurotypical individuals who are in a relationship, the men and women in this study did not differ in their sexual satisfaction or in any of the variables assessing sexual exchanges [7, 14, 18]. This suggests that overall men and women with HF-ASD experience their sexual relationship similarly. We did find, however, that the men reported somewhat lower relationship satisfaction than did the women. It may be that the women have more realistic expectations for relationships, perhaps because they have been

exposed to more relationship information or have more of a peer group with whom they discuss relationship issues. If so, the men's lower relationship satisfaction again may be because they impose a rigid evaluation of the relationship relative to their expectations.

In addition, in keeping with traditional gender roles [28], we found that a greater percentage of men than women identified their partner's sexual response and sexual experience as sexual costs. However, in contrast to the findings by Lawrance and Byers [7], the women were not more likely than were the men to identify aspects of their sexual response as sexual costs for themselves. Thus, it may be that this difference reflects men in mixed-sex relationships who based their evaluation of their partner's experience on their own doubts about their sexual behavior and/or on stereotypic notions of female sexuality, perhaps obtained from viewing sexually explicit materials (as has been observed clinically). Similarly, Miller and Byers [45] found that men's perceptions of their female partner's desires were more strongly related to their own sexual stereotypes than to their partner's actual self-reported desires. It is also possible that the female sample was more erotophilic than was the male sample. Thus, these gender differences may characterize the sexual relations of the men but not the women in our sample. Of note, although almost a quarter of our sample did not identify as heterosexual, almost all were in a mixed-sex relationship. Dyadic research with same-sex and mixed-sex couples is needed to clarify the extent to which partners differ in their experiences of their sexual relationship.

Conclusion

The findings need to be interpreted in light of both the strengths and the limitations of the study. This was a community sample including participants who had not received formal ASD diagnoses. Thus, we cannot be certain that all individuals would meet full criteria for a diagnosis of ASD. However, scores for all participants exceeded the recommended cut-off on the AQ, and the mean AQ score for the entire sample was significantly above this cut-off. The AQ is well-validated as a research screening instrument that discriminates individuals with ASD from individuals without ASD. As such, it is likely that participants retained in the sample have an ASD. Further, our approach to recruitment (through ASD organizations and online communities) likely enabled us to obtain a much more diverse sample than would be achieved through clinical referrals. That is, this approach allowed us to access both individuals who were not known to the mental health and developmental disability systems as well as those who would not be willing to complete a questionnaire in a research setting that lacked anonymity.

In addition, the extent to which the results are representative of all adults with ASD living in the community is unknown. Participants were highly educated. They were also disproportionately women even though the ratio of males to females with ASD in the general population is 4:1 or higher [46]. The high proportion of women may reflect our recruitment method: we recruited from self-help groups and women are more likely than men to use the Internet to interact with similar others, to seek self-help, and to respond to requests to participate in research [47–50]. Among neurotypical individuals, participants in sexuality research tend to hold more permissive attitudes about sexuality and be more experienced than those who do not volunteer [51, 52]. Thus, it may also be that ASD individuals with the poorest sexual functioning are underrepresented in the sample. Because all our participants were in a relationship of 3 months or longer, the results may not generalize to individuals who have a pattern of unsuccessful relationships. Finally, our finding that almost one-quarter of the sample did not identify as heterosexual may indicate

that sexual minority individuals were more likely to complete the study. However, Gilmour et al. [53] found that individuals with ASD reported a lower level of heterosexuality than did their control group of individuals from the general population. Thus, it may also be that more individuals with ASD identify as a sexual minority.

Nonetheless, this study demonstrates the utility of the IEMSS for enhancing understanding of the sexual satisfaction of adults with HF-ASD and provides important information about their sexual satisfaction. The results also have implications for future research as well as for education and interventions to enhance the sexual satisfaction of individuals with HF-ASD. Quantitative research is needed using matched control groups as well as couples in same-sex and mixed sex relationships to help clarify some of the findings. Qualitative research would be useful in enhancing our understanding the lived experience of individuals with HF-ASD in their sexual relationship, including their experience of various types of sexual exchanges. The results also suggest that it is important to enhance the sexual relationships and sexual satisfaction of individuals with ASD and their partners, and particularly those individuals with more ASD symptoms, by providing education programs aimed at increasing positive exchanges (sexual rewards) and decreasing negative exchanges (sexual costs). Although preliminary, the current results suggest that such programs need to provide normative information (e.g., about the typical sexual script), counter stereotypes and unrealistic expectations for sexuality in relationships, and provide social skills and communication training specific to sexual relationships. In addition, education about adults with high functioning ASD and their positive sexual and relationship experiences is critical in order to dispel myths and negative stereotypes.

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