

12-2018

Broad Autism Phenotypic Traits and the Relationship to Sexual Orientation and Sexual Behavior

Lydia R. Qualls

Kathrin Hartmann

James F. Paulson

Old Dominion University, jpgaulson@odu.edu

Follow this and additional works at: https://digitalcommons.odu.edu/psychology_fac_pubs

 Part of the [Clinical Psychology Commons](#), and the [Developmental Psychology Commons](#)

Repository Citation

Qualls, Lydia R.; Hartmann, Kathrin; and Paulson, James F., "Broad Autism Phenotypic Traits and the Relationship to Sexual Orientation and Sexual Behavior" (2018). *Psychology Faculty Publications*. 91.
https://digitalcommons.odu.edu/psychology_fac_pubs/91

Original Publication Citation

Qualls, L. R., Hartmann, K., & Paulson, J. F. (2018). Broad autism phenotypic traits and the relationship to sexual orientation and sexual behavior. *Journal of Autism and Developmental Disorders*, 48(12), 3974–3983. doi:<http://dx.doi.org/10.1007/s10803-018-3556-3>



Broad Autism Phenotypic Traits and the Relationship to Sexual Orientation and Sexual Behavior

Lydia R. Qualls¹ · Kathrin Hartmann^{1,2} · James F. Paulson^{1,3}

Published online: 3 April 2018
© Springer Science+Business Media, LLC, part of Springer Nature 2018

Abstract

Individuals with higher levels of the broad autism phenotype (BAP) have some symptoms of autism spectrum disorder (ASD). Like individuals with ASD, people with higher-BAP may have fewer sexual experiences and may experience more same-sex attraction. This study measured BAP traits, sexual experiences, and sexual orientation in typically developing (TD) individuals to see if patterns of sexual behavior and sexual orientation in higher-BAP resemble those in ASD. Although BAP characteristics did not predict sexual experiences, one BAP measure significantly predicted sexual orientation, $\beta = 0.22$, $t = 2.72$, $p = .007$, controlling for demographic variables (R^2 change = .04, $F = 7.41$, $p = .007$), showing individuals with higher-BAP also reported increased same-sex attraction. This finding supports the hypothesis that individuals with higher-BAP resemble ASD individuals in being more likely than TD individuals to experience same-sex attraction.

Keywords Broad autism phenotype · Sexual behavior · Sexual orientation · Same-sex attraction

Introduction

Autism spectrum disorders (ASDs) are a category of developmental disorder that are characterized by deficits in the areas of social interaction/communication and restricted, repetitive behaviors or interests (American Psychiatric Association 2013). Many people who have characteristics of ASD that are below diagnostic thresholds can be described as having greater levels of the broad autism phenotype (BAP), and experience similar difficulties to people with ASD (Best et al. 2008; Jobe and White 2007; Kunihira et al. 2006; Palmer et al. 2014). People with greater levels of the BAP have been found to have fewer sexual experiences and may experience more same-sex attraction, as is often found in people with ASD (Bejerot and Eriksson 2014;

Byers et al. 2013; Gilmour et al. 2012; Mehzabin and Stokes 2011; Rainie and Madden 2005).

This study used continuous measures of BAP characteristics, sexual experiences, and sexual orientation in a typically developing (TD) population to examine patterns of sexual behavior and sexual orientation, with the expectation that those high in the BAP will show similar characteristics to those reported for people with ASD (Bejerot and Eriksson 2014; Byers et al. 2013; Gilmour et al. 2012). Learning more about sexuality in people with greater levels of the BAP may help inform interventions designed to help them and help individuals with ASD understand their sexual orientation and express their sexuality (Visser et al. 2015).

The Broad Autism Phenotype

Higher levels of the BAP were first studied in family members of ASD individuals and were found to be highly heritable (Bailey et al. 1998; Hoekstra et al. 2007; Piven et al. 1997a). Social and communication difficulties (e.g., having no friends, being awkward or aloof, having inadequate verbal expression, or otherwise odd verbal interactions) have been found in both parents and siblings of those with ASD (Bailey et al. 1998). Family members of those with ASD have also been found to have decreased expressive and receptive language (Piven and Palmer 1997), as well as

✉ Lydia R. Qualls
lqualls@odu.edu

¹ Virginia Consortium Program for Clinical Psychology, 555 Park Avenue, Norfolk, VA 23504, USA

² Department of Psychiatry and Behavioral Sciences, Eastern Virginia Medical School, 825 Fairfax Ave. Suite 710, Norfolk, VA 23507, USA

³ Department of Psychology, Old Dominion University, 5115 Hampton Boulevard, Norfolk, VA 23529, USA

increased difficulty using words to describe their feelings (Szatmari et al. 2008). Piven et al. (1997a) found that, when compared to parents of multiple children with Down's syndrome, parents of multiple children with autism were more likely to have aloof personalities and pragmatic conversation difficulties (corresponding to the diagnostic criteria related to deficits in social and communication), as well as rigidity in behavior (corresponding to the restricted, repetitive interests and behaviors diagnostic criteria; Piven et al. 1997b). Bailey et al. (1998) proposed that these sub-threshold characteristics in family members of those with ASD were phenotypically similar to the characteristics of ASD and labeled these traits as the BAP (Bailey et al. 1998).

The traits associated with the BAP have been described as following a roughly normal distribution within the TD population (Best et al. 2008; Hoekstra et al. 2007; Hurst et al. 2007; Pisula et al. 2015). Young adults with higher levels of the BAP are similar to those with ASD in that they have been shown to struggle more with loneliness, creating and maintaining friendships (Jobe and White 2007), depression, anxiety, and being victims of bullying (Kunihira et al. 2006). Higher levels of the BAP also correlate with relationship difficulties. Young adults with greater levels of the BAP have been found to display lower levels of empathy and higher levels of attachment anxiety and avoidance (Lamport and Turner 2014). Husbands with greater levels of the BAP experienced increased dissatisfaction with responsiveness, intimacy, and trust in their relationships (Pollmann et al. 2010). Individuals with greater levels of the BAP have also been found to have less anticipation of social reward, a trait that plays an important role in social interaction and communication, and which is relatively deficient in individuals diagnosed with ASD (Cox et al. 2015).

Sexual Behavior in ASD

Differences in sexual behaviors exist between with individuals with ASD and TD individuals. A survey comparing individuals with ASD ($n = 675$; ages 15 and older) to individuals with TD of similar ages ($n = 8064$) found that participants with ASD were less likely than participants with TD to be in a relationship (50% compared to 70%; DeWinter et al. 2017). This is similar to a survey of higher-functioning adults with ASD (ages 21–73, mean age 35.3) conducted by Byers et al. (2013), who found that only 59% of the sampled group had experienced at least one romantic relationship of 3 months or longer. Additionally, positive experiences in sexual relationships have been found to occur more often among individuals with less severe ASD symptomology (Baron-Cohen et al. 2001). This illustrates that people with ASD form fewer relationships and experience less satisfaction in their relationships than people with TD.

The social interaction and communication deficits inherent in ASD can lead to later difficulty in forming friendships and close romantic relationships (Byers et al. 2012; Carrington et al. 2003; Howlin et al. 2000; Mehzabin and Stokes 2011). Few studies have been conducted regarding partnered sexuality and ASD, and currently little more is known about partnered sexuality and relationships in individuals with ASD.

Sexual Orientation in ASD

Individuals with ASD have shown different patterns of sexual orientation when compared to people with TD. Gilmour et al. (2012) found that women with ASD had significantly lower levels of heterosexuality on the Sell Sexual Orientation Scale (Gonsiorek et al. 1995) when compared to men with ASD and TD men and women. Levels of homosexuality were also higher in ASD women, though not significantly so. The authors also found a higher rate of asexuality among men and women with ASD. Byers et al. (2012) similarly found higher rates of same-sex attraction when they surveyed ASD individuals who had previously been in a relationship for at least 3 months. Almost 42% of the surveyed adults with ASD endorsed a sexual identity other than heterosexual and 55% stated that they were at least somewhat attracted to both men and women (Byers et al. 2012). Furthermore, a meta-analysis by Pecora et al. (2016) reviewed studies examining sexual orientation in individuals with high-functioning autism and found between 15 and 35% of individuals identified themselves as having a non-heterosexual orientation. These results indicate a much higher percentage of same-sex attraction in individuals with ASD than is found in TD individuals (2.3% of Americans; Ward et al. 2014). A recent study by George and Stokes (2018) provides an even higher estimate. They found that 69.7% of an international online sample of adults with ASD reported being non-heterosexual compared to 30.3% of the sample of TD adults. Additionally, Bejerot and Eriksson (2014) found that women with ASD were more often described as “tomboyish” as children than were TD women. They were also more likely to endorse sexual attraction to other women, as well as a lesbian or bisexual identity (Bejerot and Eriksson 2014).

Explanations for these findings differ. Gilmour et al. (2012) posit a lack of suitable opposite-sex partners and less awareness of social norms may contribute to less heterosexuality and higher asexuality in those with ASD. Bejerot and Eriksson (2014) also suggest that the greater incidence of same-sex attraction among the women with ASD they surveyed may be due to the women with ASD placing less emphasis on social norms in their choice of sexual partners. However, Gilmour et al. (2012) noted that in their sample sexual interests and sexual behaviors were highly correlated in both participants with ASD and TD, a finding

that challenges the idea that people with ASD are choosing same-sex partners due to a lack of suitable opposite sex partners.

The Current Study

If the BAP is seen as being a part of the overall autism spectrum (Constantino and Todd 2007), then it is possible that any of the causes of increased same-sex attraction in ASD could also affect those with greater levels of the BAP. It is necessary to know if the patterns of same-sex attraction that have been found in individuals with ASD also exist in people with greater levels of the BAP before research can be done to determine which variables or factors influence the hypothesized higher levels of same-sex attraction of the BAP in common with ASD. Previously, differences between individuals with higher versus lower BAP traits have been measured categorically. In contrast, this study used continuous measures of BAP traits, sexual experiences, and sexual orientation in a TD population to see if those who have higher levels of the BAP show similar patterns of sexual behavior and sexual orientation to what has been reported in the literature for people with ASD.

In this study, we first hypothesized that higher levels of BAP characteristics would be associated with fewer interactive sexual experiences. Secondly, we hypothesized that higher levels of BAP characteristics would be associated with greater same-sex attraction.

Method

Procedure and Participants

A total of 340 individuals entered the study, which was advertised to students at a large mid-Atlantic university, online through social media and psychology research websites, and in psychology classes at a small private liberal arts college in southwestern Virginia. Potential participants could access the survey once they acknowledged being between the ages of 18–30 and indicated their understanding of study details. All measures were administered through an online survey platform that collected data anonymously. Participants recruited at the college and university were compensated for their time with research credit or with extra credit in their psychology course. Cases were removed if they did not acknowledge the notification statement (11), indicated a formal diagnosis of ASD (6), did not complete at least one of the ASD trait measures and entered responses on the dependent measures with more than 33% data missing (137), or pass the validity check questions inserted into the AQ and the BISF scales that asked participants to select a certain response if

they are paying attention (9). Of the 340 individuals who took the study, 177 (132 women, 33 men, 12 other gender) met study criteria and had their data included in the analyses (see Table 1 for additional demographic information). This study was approved by the human subjects' committee and Institutional Review Boards at the participating college and university.

Table 1 Demographics of study sample

	N	Percentage
<i>Gender</i>		
Male	33	18.6
Female	132	74.6
Transgender	1	0.6
Genderfluid/genderqueer	4	2.3
Agender	5	2.8
Other	2	1.1
<i>Sexual orientation</i>		
Straight/heterosexual	118	66.7
Lesbian/gay/homosexual	9	5.1
Bi/Pansexual	34	19.2
Other non-hetero orientation	5	2.8
<i>Race</i>		
White	119	67.2
Black or African American	15	8.5
Hispanic/Latino	16	9.0
American Indian/Alaskan	1	0.6
Asian	11	6.2
Multi-racial	14	7.9
Other	1	0.6
<i>Religion</i>		
Christian	79	44.6
Muslim	3	1.7
Jewish	4	2.3
Hindu	2	1.1
Buddhist	3	1.7
Other	6	3.4
Spiritual but not religious	28	15.8
Neither spiritual nor religious	28	15.8
Nothing in particular	24	13.6
<i>Academic classification</i>		
First-year	46	26.0
Sophomore	37	20.9
Junior	33	18.6
Senior	21	11.9
Graduate student	8	4.5
Not in college*	30	16.9

*Of the sample not in college, 7 had less than a high school education, 6 had completed high school, 6 had some college, 1 had a 2-year degree, 5 had a 4-year degree, 4 had a professional degree, and 1 had a doctorate

Measures

Demographics

The demographics questionnaire asked questions concerning participant's gender, race, sexual orientation, family income, participant's income, parent's education, respondent's education, relationship status and history, religion, field of study/occupation, year in college, other psychiatric diagnoses, formal ASD diagnosis, and family member ASD diagnosis.

Autism Spectrum Quotient

The Autism Spectrum Quotient (AQ; Baron-Cohen et al. 2001) is a 50-item self-report measure used to assess symptoms relating to ASD in adults of typical intelligence. It has also been used to assess these traits in TD populations (e.g., Hurst et al. 2007; Jobe and White 2007; Kunihiro et al. 2006). Example items on the AQ include: "I find it difficult to work out people's intentions" and "I am fascinated by numbers." Each item is rated on a 4-point Likert scale that includes *definitely agree*, *slightly agree*, *slightly disagree*, and *definitely disagree*. An overall Cronbach's alpha of .85 was found in this study and a test–retest reliability of .70 was reported by the authors for this scale (Baron-Cohen et al. 2001). The scale also reliably distinguishes between individuals diagnosed with ASD and TD and between those with ASD and Obsessive–Compulsive Disorder or Social Anxiety Disorder (Hoekstra et al. 2008). A total score was calculated by summing ratings from all items. Higher total scores indicate more symptoms of ASD.

Broad Autism Phenotype Questionnaire

The Broad Autism Phenotype Questionnaire (BAPQ; Hurley et al. 2007) is a 36-item self-report measure designed to assess characteristics of the BAP in adults of typical intelligence. While it was first developed to identify characteristics of the BAP in relatives of those with ASD (Hurley et al. 2007), subsequent studies have used this instrument in a general college-age population (Lampert and Turner 2014; Wainer et al. 2011). Example items on the BAPQ include: "I am flexible about how things should be done," "Conversation bores me," and "I like being around other people." Each item is rated on a 6-point (1–6) scale from *very rarely* to *very often*. An overall Cronbach's alpha of .94 was found in this study, and the test has been found to have good criterion related validity in that it correlated with other measures of BAP as well as aspects of social and interpersonal functioning (Ingersoll et al. 2011). Scores for this measure are

averaged, with a higher score indicating greater likelihood of expressing the BAP (Hurley et al. 2007).

Brief Index of Sexual Functioning for Women

The Brief Index of Sexual Functioning for Women (BISF-W; Taylor et al. 1994) is a 22-item self-report index that asks questions organized around three factors: sexual activity, sexual satisfaction, and sexual interest/desire. Test–retest correlations at 1 month ranged from .68 to .78 across the three factors (Taylor et al. 1994). This measure correlates strongly with the Derogatis Sexual Functioning Inventory (DSFI; Derogatis and Melisaratos 1979), with correlation coefficients ranging from .59 to .69 (Taylor et al. 1994). This measure was expanded to 64 questions in the survey for this study, as several questions in the original index ask about multiple behaviors per question. Sample questions include: "Indicate how frequently you have engaged in the following experiences during the past month," "Indicate how frequently you have felt a desire to engage in the following activities during the past month" and "Overall, how satisfied have you been with your sexual relationship with your partner?" Most of the questions on the BISF-W are worded in a way that allows this measure to be given to both male and female participants and it has been used in studies that have included men and women (Byers et al. 2013; Rupp and Wallen 2007). Since the revised version of this measure for this study included men and women, this version of the measure is referred to as the Brief Index of Sexual Functioning (BISF) throughout the rest of this manuscript.

The partnered sexual behaviors in this survey asked about how often participants engaged in kissing, mutual masturbation, petting and foreplay, oral sex, vaginal sex, and anal sex. For this study's sample, answers about the above-partnered sexual behaviors were summed to provide a composite score, BISF Engaged, which was used in the analyses. We found an overall Cronbach's alpha of .88 for this sub-scale.

Klein Sexual Orientation Grid

The Klein Sexual Orientation Grid (KSOG; Klein et al. 1985) is a 21-item self-report instrument that provides an estimate of a person's past, present, and ideal sexual orientation and preference. On the KSOG, participants rate themselves in seven areas, including "sexual attraction," "sexual behaviors," and "sexual fantasies." To simplify the measure, Floyd and Stein (2002) performed a principle components analysis on the items and identified a principle component of sexual orientation that accounted for a majority of the variance. The factor of sexual orientation was best identified by the questions on sexual attraction, sexual behavior, sexual fantasies, and self-identification. Additionally, they only used the ratings on present and ideal scales to look

at respondents’ current thinking about their sexual orientation. Ratings are done on a seven-point scale ranging from 1 (*Heterosexual Only*) to 7 (*Homosexual Only*). For this study, a 0 point (*Asexual/No one*) option has been added, due to higher rates of asexuality among those with ASD (Gilmour et al. 2012). Scores consist of the average of the ratings for the eight questions (i.e., present and ideal ratings for sexual attraction, sexual behavior, sexual fantasies, and self-identification). Higher scores indicate more homosexual sexual preference. In this study’s sample, Cronbach’s alpha for the eight-question model was .96 and self-reported sexual orientation significantly correlated with sexual orientation as measured by the KSOG, $r = .71$.

Preliminary Analyses

The data were examined for multicollinearity and outliers, which were both within normal limits. A Missing Values Analyses was performed to see what demographic variables were associated with missingness on the test variables. Multiple Imputation was performed for each of the four test measures (AQ, BAPQ, BISF, and KSOG) separately, with five imputations performed for each and correlates of missingness included in the imputation.

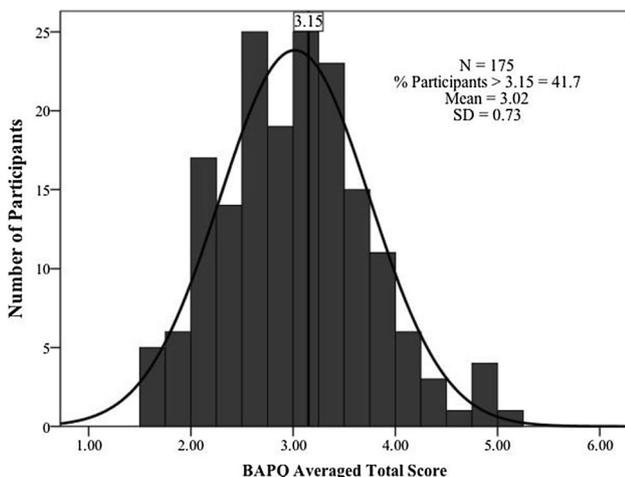


Fig. 1 The distribution of BAP traits (as measured by the BAPQ). The line labeled “3.15” indicates the cut-off for having higher-BAP, measured categorically

To support the assumption that BAP traits are normally and continuously distributed in a TD population, a histogram of that variable was created showing that that assumption is supported. Additionally, including the cut-off for higher-BAP shows that almost half of the sample (41.7%) could be considered to have higher-BAP, demonstrating sufficient variance in this trait to examine the hypotheses (see Fig. 1). In comparison, only 13.6% of participants scored in the clinical range for the AQ.

Primary Analyses

We conducted two sets of hierarchical linear regressions where AQ (AQ Total) and BAPQ (BAPQ Total) served as the predictor variables and sexual orientation measured by the KSOG (KSOG Total) and partnered sexual behaviors measured by BISF Engaged served as the criterion variables. The demographic variables listed in the Data Screening section were used for each regression. Demographic variables that we had planned to include as covariates in the analysis were gender identity, race, religion, family income, participant’s income, parent’s education, respondent’s education, participant’s year in college, and other psychiatric diagnoses. Because about one-third of participants did not include their income or their family’s income, we dropped this variable from final analyses to maximize usable sample size.

Results

To test our first hypothesis, that engaging in partnered sexual behavior would be predicted by BAP traits after controlling for demographic variables, we performed a hierarchical linear regression. The demographic variables were entered in Step 1 and the AQ Total was entered in Step 2, and both sets of variables served as predictors for BISF Engaged. We found that AQ Total was not a significant predictor of BISF Engaged, $\beta = 0.04$, $t = 0.48$, $p = .64$ and did not make a significant change in the model, $\Delta R^2 = .001$, $F = 0.22$, $p = .64$ (see Table 2). Similar results were found when the BAPQ Total was used instead of AQ Total in Step 2, with BAPQ Total not being a significant predictor of BISF Engaged, $\beta = -0.11$, $t = -1.32$, $p = .19$, $\Delta R^2 = .009$, $F = 1.73$, $p = .19$ (see Table 3).

Table 2 Summary of hierarchal regression analyses for demographic variables and AQ predicting partnered sexual behaviors

Predictors	B	SE B	β	t	F	R ²	ΔR^2
Step 1 Demographics					2.26**	.19	–
Step 2					.022	–	.001
AQ	0.02	0.04	0.04	0.48			

AQ Autism Spectrum Quotient
 N = 171; * $p < .05$; ** $p < .01$; *** $p < .005$. Only significant predictors are shown

To test our second hypothesis, that sexual orientation is predicted by BAP traits after controlling for demographic variables, we performed another hierarchical regression. The demographic variables were entered in Step 1, and the AQ Total was entered at Step 2, and both sets of variables served as predictors for KSOG Total. Again, AQ Total was not a significant predictor of KSOG Total, $\beta=0.12$, $t=1.49$, $p=.14$, and did not make a significant change in the model, $\Delta R^2=.012$, $F=2.22$, $p=.14$ (see Table 4). However, when BAPQ Total was entered in Step 2 instead of the AQ Total, BAPQ Total was found to be a significant predictor of KSOG Total, $\beta=0.22$, $t=2.72$, $p=.007$, and made a significant change in the model when demographic variables were held constant, $\Delta R^2=.04$, $F=7.41$, $p=.007$ (see Table 5). Participants that endorsed more BAP traits also endorsed more same-sex attraction.

Due to findings in the literature that show gender as a moderator of the relationship between BAP traits and sexual orientation, we ran a separate hierarchical regression of demographic variables and BAPQ Total predicting sexual orientation on the KSOG for female and male participants, according to reported gender. For female participants, BAPQ Total was still a significant predictor of sexual orientation after controlling for the demographic variables, $\beta=0.23$, $t=2.40$, $p=.018$, $\Delta R^2=.04$, $F=5.76$, $p=.018$. However, for male participants, BAPQ Total was not a significant

predictor of sexual orientation, $\beta=0.18$, $t=1.07$, $p=.299$, $\Delta R^2=.02$, $F=1.15$, $p=.299$.

Discussion

Primary Findings

Findings in the current study further characterize individuals with higher levels of the BAP as resembling individuals with ASD in that individuals with higher levels of the BAP also report higher levels of same-sex attraction. Previous research has suggested that those with ASD were more likely than those with typical development to endorse a non-heterosexual sexual orientation and greater levels of same-sex attraction (Bejerot and Eriksson 2014; Byers et al. 2012; Gilmour et al. 2012), and the current study suggests that this might also be similar for people with greater levels of the BAP; as levels of the BAP go up, the likelihood of same-sex attraction does as well.

The findings in this study build on those of Kuniyama et al. (2006), Jobe and White (2007), Pollmann et al. (2010), and Lamport and Turner (2014) in examining the presentation of the BAP in a TD population, and the similarity of these presentations to those seen in ASD. Kuniyama et al. (2006) reported that anxiety, depression, and

Table 3 Summary of hierarchal regression analyses for demographic variables and BAPQ predicting partnered sexual behaviors

Predictors	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>F</i>	<i>R</i> ²	ΔR^2
Step 1 Demographics					2.21**	.19	–
Step 2					1.73	–	.009
BAPQ	–0.03	0.03	–0.11	–1.32			

BAPQ Broad Autism Phenotype Questionnaire

N = 169; * $p < .05$; ** $p < .01$; *** $p < .005$. Only significant predictors are shown

Table 4 Summary of hierarchal regression analyses for demographic variables and AQ predicting sexual orientation

Predictors	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>F</i>	<i>R</i> ²	ΔR^2
Step 1 Demographics					2.70**	.23	–
Step 2					2.22	–	.012
AQ	0.01	0.01	0.12	1.49			

AQ Autism Spectrum Quotient

N = 165; * $p < .05$; ** $p < .01$; *** $p < .005$. Only significant predictors are shown

Table 5 Summary of hierarchal regression analyses for demographic variables and BAPQ predicting sexual orientation

Predictors	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>F</i>	<i>R</i> ²	ΔR^2
Step 1 Demographics					2.67**	.22	–
Step 2					7.41**	–	.04
BAPQ	0.01	0.01	0.22	2.72**			

BAPQ Broad Autism Phenotype Questionnaire

N = 164; * $p < .05$; ** $p < .01$; *** $p < .005$. Only significant predictors are shown

peer victimization (bullying) were more likely to occur in young adults with greater levels of the BAP. Jobe and White (2007) reported that individuals with greater levels of the BAP were lonelier and had fewer and shorter friendships. Pollmann et al. (2010) examined BAP traits in married couples and found that husbands with greater levels of the BAP experienced increased dissatisfaction with responsiveness, intimacy, and trust in their relationships. Lamport and Turner (2014) found that young adults with greater levels of the BAP have lower levels of empathy and higher levels of attachment anxiety and avoidance. Our study further characterizes the group, that is, similar to individuals with ASD, individuals with higher levels of the BAP have higher levels of same-sex attraction.

Our findings also help characterize the prevalence of the BAP in young adults. While most studies use the AQ to measure the BAP, one other study demonstrated the prevalence of BAP among parents using the BAPQ. Sasson et al. (2013) found BAP prevalence to be 14–23% among parents of children with ASD and 5–9% in parents of children with TD. In contrast, we found a BAP prevalence rate of 41.7% in our young adult sample. There are several potential factors that could influence this, including self-selection due to survey mechanism [the survey by Sasson et al. (2013) was given by mail and our study was administered online], age differences (the parent sample was 35–40 years of age, on average, and our study participants were believed to be between 18 and 30 years of age), an interaction between the two, or some other factor.

It is unknown why same-sex attraction is more common in people with ASD and greater levels of the BAP, although several explanations have been hypothesized. One explanation is that people with ASD have greater difficulty in finding suitable opposite-sex partners, but as noted above, the same study that stated this hypothesis found that the sexual interests of people with ASD were in line with their sexual behaviors (Gilmour et al. 2012). Another possible explanation for this relationship is a single underlying heritability factor for domains contributing to the BAP and ASD (Constantino and Todd 2007) that could also contribute to factors influencing same-sex attraction. Just as the different traits of ASD are inherited together, the trait of increased same-sex attraction could be inherited along with ASD traits. An additional hypothesis is that people with ASD and greater levels of the BAP may also be less sensitive to social stigma regarding same-sex relationships, which might lead them to be more open to expressing their same-sex attraction. A final proposition has been posited by practitioners working with the ASD population: some individuals with ASD report that it is already difficult for them to understand other people in a social relationship. Therefore, in an intimate/romantic relationship, they may prefer to be in a relationship with

individuals who are more like them (i.e., the same gender) because they are easier to understand.

Although we hypothesized that both the AQ and the BAPQ would predict sexual orientation, only the BAPQ was a significant predictor. There are several possible reasons for this finding. The first is that the BAPQ was specifically designed to measure BAP traits in TD individuals (Ingersoll et al. 2011), whereas the AQ was designed to be used with ASD individuals (Baron-Cohen et al. 2001) even though it has been used in a TD population (e.g., Hurst et al. 2007; Jobe and White 2007). This study only looked at TD individuals, which is perhaps why the BAPQ and not the AQ was a significant predictor. Additionally, the factor structure of the AQ has been found to vary, while that of the BAPQ is fairly consistent (Ingersoll et al. 2011). Having a more consistent factor structure may make the BAPQ a more reliable measure of BAP traits.

The relationship between BAP traits on the BAPQ and sexual orientation on the KSOG was mediated by gender. This mirrors findings in the literature, which shows that women with ASD have more same-sex attraction, but men do not (Gilmour et al. 2012). However, these findings might also be due to the smaller number of male participants enrolled in the study compared to female participants, especially as the effect size of $\beta=0.18$ indicates a small effect, and is close the $\beta=0.23$ effect size for the female participants. It is possible a significant result would have been found with an increased sample size.

Our hypothesis that the AQ and the BAPQ would predict partnered sexual behaviors was not supported. This hypothesis was based on study findings that individuals with higher levels of the BAP suffered more difficulties with interpersonal relationships, similar to those with ASD (Jobe and White 2007; Kunihiro et al. 2006; Lamport and Turner 2014). Based on the previous findings, we hypothesized that individuals with higher levels of the BAP might participate in less partnered sexual behavior. However, it is possible that the social impairments in those with higher levels of the BAP are not debilitating enough to have a significant effect on their partnered sexual behaviors. It is also possible that different levels of social competence are required for sustaining a friendship or a romantic relationship and engaging in a one-off sexual encounter. People with higher levels of the BAP may struggle with sustaining friendships and romantic relationships, but may still engage in sexual relationships.

Clinical Implications

The findings of this study suggest further clinical implications and highlight new directions for interventions. Since members of the LGBT population have higher levels of stress and are more likely to be diagnosed with a psychiatric disorder (Meyer 2003), people on the ASD spectrum

or with higher BAP who identify as LGBT have additional stressors in addition to the stressors associated with ASD characteristics. Being aware of the increased vulnerability of the combined LGBT/ASD-and-higher-BAP population can help providers that interact with this population better treat their unique mental health needs. Additionally, given the higher prevalence of same-sex attraction in the ASD and higher-BAP populations, social skills interventions targeted towards these groups might include lessons on navigating same-sex relationships. Furthermore, those with higher levels of the BAP are not generally the target of social skills groups or other types of interventions even though studies show that they have some of the same deficits in this area as those with ASD (e.g., Jobe and White 2007; Kunihiro et al. 2006). More research is needed on what interventions may be appropriate in the higher-BAP population given that BAP symptoms often do not severely impair functioning enough to come to clinical attention.

Limitations

A major limitation of this study was the large number of cases that had to be dropped from analyses due to missing data. The survey had both measures of BAP traits sequentially at the beginning and took between 45 min and an hour to complete, which likely led some individuals to drop out before they completed the survey. Due to lack of data from these individuals, it is unknown in what ways survey respondents in this group may differ from the final analyzed sample. Additionally, we were unable to analyze data pertaining to income level, which could have further characterized our sample. Another limitation to this study is that the measure used for partnered sexual behaviors was adapted from a larger measure and had not been validated for use on its own. It is possible that this was the reason that we did not find the hypothesized relationship with ASD trait variables. Further research for developing a measure of partnered sexual behavior is needed. An additional limitation is that a question asking about age was accidentally not included in the online survey. Age could have been a moderating variable for engaging in partnered sexual behaviors: older people are more likely to have a partner (Wang and Parker 2014) and may therefore be more likely to engage in partnered sexual behavior on a regular basis. This study also has limited generalizability outside the college population as 83% of the sample reported being in college. However, we did not recruit outside of the college demographic, therefore this limitation was anticipated at the outset of the study. Our study was also limited by having a majority female participants. We were not able to obtain a large enough sample size of male participants to determine if there is a relationship between BAP and sexual orientation with males as well as with females.

Future Directions

Due to the scarcity of literature on TD individuals with higher levels of the BAP, future research with this population might especially focus on romantic partners and sexual orientation. Individuals with higher levels of the BAP suffer from many of the same difficulties of those with ASD (Jobe and White 2007; Kunihiro et al. 2006; Lamport and Turner 2014), yet they are not a population that is often targeted for intervention. Future studies might also investigate the feasibility of screening for higher levels of the BAP in a treatment-seeking population and educating treatment providers on the difficulties that this population is more likely to face. Another promising direction for future investigation could involve designing group interventions that teach interpersonal interaction skills to people with higher levels of the BAP, and testing for beneficial effects of these interventions. Finally, as the BAP and sexuality is such a new area of research, it may benefit from qualitative research, such as interviewing individuals who have greater levels of the BAP about their experiences with romantic partners and their sexuality. This research could help elucidate the possible causes for increased same-sex attraction among people with greater levels of the BAP and ASD and guide hypotheses for further empirical research.

Acknowledgments This study was performed in partial fulfillment of the requirements for a Master's Thesis for LRQ, who wishes to acknowledge the members of her committee. Data from this research was also presented as a poster at the International Meeting for Autism Research in San Francisco, CA on May 11th, 2017.

Author Contributions LRQ conceived of the study idea and design, collected and analyzed the data, and drafted the manuscript. KH participated in the design and coordination of the study. JFP participated in the study design and data analysis for the study. All authors read and approved the final manuscript.

References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th edn. DSM-5)*. Arlington, VA: American Psychiatric Publishing.
- Bailey, A., Palferman, S., Heavey, L., & Le Couteur, A. (1998). Autism: The phenotype in relatives. *Journal of Autism and Developmental Disorders*, 28(5), 369–392. <https://doi.org/10.1023/A:1026048320785>.
- Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism-spectrum quotient (AQ): Evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders*, 31(1), 5–17.
- Bejerot, S., & Eriksson, J. M. (2014). Sexuality and gender role in autism spectrum disorder: A case control study. *PLoS ONE*, 9(1), 1–9. <https://doi.org/10.1371/journal.pone.0087961>.

- Best, C. S., Moffat, V. J., Power, M. J., Owens, D. G. C., & Johnstone, E. C. (2008). The boundaries of the cognitive phenotype of autism: Theory of mind, central coherence and ambiguous figure perception in young people with autistic traits. *Journal of Autism and Developmental Disorders*, 38(5), 840–847. <https://doi.org/10.1007/s10803-007-0451-8>.
- Byers, E. S., Nichols, S., & Voyer, S. D. (2013). Challenging stereotypes: Sexual functioning of single adults with high functioning autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 43(11), 2617–2627. <https://doi.org/10.1007/s10803-013-1813-z>.
- Byers, E. S., Nichols, S., Voyer, S. D., & Reilly, G. (2012). Sexual well-being of a community sample of high-functioning adults on the autism spectrum who have been in a romantic relationship. *Autism*, 17(4), 418–433. <https://doi.org/10.1177/1362361311431950>.
- Carrington, S., Templeton, E., & Papinczak, T. (2003). Adolescents with Asperger syndrome and perceptions of friendship. *Focus on Autism and Other Developmental Disabilities*, 18(4), 211–218.
- Constantino, J. N., & Todd, R. D. (2007). Autistic traits in the general population. *Archives of General Psychiatry*, 60(5), 524–530. <https://doi.org/10.1001/archpsyc.60.5.524>.
- Cox, A., Kohls, G., Naples, A. J., Mukerji, C. E., Coffman, M. C., Rutherford, H. J. V., ... McPartland, J. C. (2015). Diminished social reward anticipation in the broad autism phenotype as revealed by event-related brain potentials. *Social Cognitive and Affective Neuroscience*, 10(10), 1357–1364. <https://doi.org/10.1093/scan/nsv024>.
- Derogatis, L. R., & Melisaratos, N. (1979). The DSFI: A multidimensional measure of sexual functioning. *Journal of Sex and Marital Therapy*, 5(1), 244–281.
- DeWinter, J., De Graaf, H., & Begeer, S. (2017). Sexual orientation, gender identity, and romantic relationships in adolescents and adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 47(9), 2927–2934. <https://doi.org/10.1007/s10803-017-3199-9>.
- Floyd, F. J., & Stein, T. S. (2002). Sexual orientation identity formation among gay, lesbian, and bisexual youths: Multiple patterns of milestone experiences. *Journal of Research on Adolescence*, 12(2), 167–191. <https://doi.org/10.1111/1532-7795.00030>.
- George, R., & Stokes, M. A. (2018). Sexual orientation in autism spectrum disorder. *Autism Research*, 11(1), 133–141.
- Gilmour, L., Schalomon, P. M., & Smith, V. (2012). Sexuality in a community based sample of adults with autism spectrum disorder. *Research in Autism Spectrum Disorders*, 6(1), 313–318. <https://doi.org/10.1016/j.rasd.2011.06.003>.
- Gonsiorek, J. C., Sell, R. L., & Weinrich, J. D. (1995). Definition and measurement of sexual orientation. *Suicide and Life-Threatening Behavior*, 25(Suppl 1), 40–51.
- Hoekstra, R. A., Bartels, M., Cath, D. C., & Boomsma, D. I. (2008). Factor structure, reliability and criterion validity of the autism-spectrum quotient (AQ): A study in Dutch population and patient groups. *Journal of Autism and Developmental Disorders*, 38(8), 1555–1566. <https://doi.org/10.1007/s10803-008-0538-x>.
- Hoekstra, R. A., Bartels, M., Verweij, C. J. H., & Boomsma, D. I. (2007). Heritability of autistic traits in the general population. *Archives of Pediatrics & Adolescent Medicine*, 161(4), 372–377. <https://doi.org/10.1001/archpedi.161.4.372>.
- Howlin, P., Mawhood, L., & Rutter, M. (2000). Autism and developmental receptive language disorder—a follow-up comparison in early adult life. II: Social, behavioural, and psychiatric outcomes. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 41(5), 561–578. <https://doi.org/10.1111/1469-7610.00643>.
- Hurley, R. S. E., Losh, M., Parlier, M., Reznick, J. S., & Piven, J. (2007). The Broad Autism Phenotype Questionnaire. *Journal of Autism and Developmental Disorders*, 37(9), 1679–1690. <https://doi.org/10.1007/s10803-006-0299-3>.
- Hurst, R. M., Mitchell, J. T., Kimbrel, N. A., Kwakil, T. K., & Nelson-Gray, R. O. (2007). Examination of the reliability and factor structure of the Autism Spectrum Quotient (AQ) in a non-clinical sample. *Personality and Individual Differences*, 43(7), 1938–1949. <https://doi.org/10.1016/j.paid.2007.06.012>.
- Ingersoll, B., Hopwood, C. J., Wainer, A., & Brent Donnellan, M. (2011). A comparison of three self-report measures of the broader autism phenotype in a non-clinical sample. *Journal of Autism and Developmental Disorders*, 41(12), 1646–1657. <https://doi.org/10.1007/s10803-011-1192-2>.
- Jobe, L. E., & White, S. W. (2007). Loneliness, social relationships, and a broader autism phenotype in college students. *Personality and Individual Differences*, 42(8), 1479–1489. <https://doi.org/10.1016/j.paid.2006.10.021>.
- Klein, F., Sepekoff, B., & Wolf, T. (1985). Sexual orientation: A multivariable dynamic process. *Journal of Homosexuality*, 11(1–2), 35–49.
- Kunihira, Y., Senju, A., Dairoku, H., Wakabayashi, A., & Hasegawa, T. (2006). “Autistic” traits in non-autistic Japanese populations: Relationships with personality traits and cognitive ability. *Journal of Autism and Developmental Disorders*, 36(4), 553–566. <https://doi.org/10.1007/s10803-006-0094-1>.
- Lampert, D., & Turner, L. A. (2014). Romantic attachment, empathy, and the broader autism phenotype among college students. *The Journal of Genetic Psychology*, 175(3), 202–213. <https://doi.org/10.1080/00221325.2013.856838>.
- Mehzabin, P., & Stokes, M. A. (2011). Self-assessed sexuality in young adults with high-functioning autism. *Research in Autism Spectrum Disorders*, 5(1), 614–621. <https://doi.org/10.1016/j.rasd.2010.07.006>.
- Meyer, I. H. (2003). Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: Conceptual issues and research evidence. *Psychological Bulletin*, 129(5), 674–697. <https://doi.org/10.1037/0033-2909.129.5.674>.
- Palmer, C. J., Paton, B., Enticott, P. G., & Hohwy, J. (2014). “Subtypes” in the presentation of autistic traits in the general adult population. *Journal of Autism and Developmental Disorders*, 45(3), 1291–1301. <https://doi.org/10.1007/s10803-014-2289-1>.
- Pecora, L. A., Mesibov, G. B., & Stokes, M. A. (2016). Sexuality in high-functioning autism: A systematic review and meta-analysis. *Journal of Autism and Developmental Disorders*, 46(11), 3519–3556. <https://doi.org/10.1007/s10803-016-2892-4>.
- Pisula, E., Kawa, R., Danielewicz, D., & Pisula, W. (2015). The relationship between temperament and autistic traits in a non-clinical students sample. *PLoS ONE*, 10(4), e0124364. <https://doi.org/10.1371/journal.pone.0124364>.
- Piven, J., & Palmer, P. (1997). Cognitive deficits in parents from multiple-incidence autism families. *The Journal of Child Psychology and Psychiatry*, 38(8), 1011–1021. <https://doi.org/10.1111/j.1469-7610.1997.tb01618.x>.
- Piven, J., Palmer, P., Jacobi, D., Childress, D., & Arndt, S. (1997a). Broader autism phenotype: Evidence from a family history study of multiple-incidence autism families. *The American Journal of Psychiatry*, 154, 185–190. <https://doi.org/10.1176/ajp.154.2.185>.
- Piven, J., Palmer, P., Landa, R., Santangelo, S., Jacobi, D., & Childress, D. (1997b). Personality and language characteristics in parents from multiple-incidence autism families. *American Journal of Medical Genetics: Neuropsychiatric Genetics*, 74, 398–411.
- Pollmann, M. M. H., Finkenauer, C., & Begeer, S. (2010). Mediators of the link between autistic traits and relationship satisfaction in a non-clinical sample. *Journal of Autism and Developmental Disorders*, 40(4), 470–478. <https://doi.org/10.1007/s10803-009-0888-z>.

- Rainie, B. L., & Madden, M. (2005). Not looking for love: The state of romance in America. Retrieved from <http://www.pewinternet.org/2006/02/13/romance-in-america/>.
- Rupp, H. A., & Wallen, K. (2007). Sex differences in viewing sexual stimuli: An eye-tracking study in men and women. *Hormones and Behavior*, *51*(4), 524–533. <https://doi.org/10.1016/j.yhbeh.2007.01.008>.
- Sasson, N. J., Lam, K. S. L., Childress, D., Parlier, M., Daniels, J., & Piven, J. (2013). The Broad Autism Phenotype Questionnaire: Prevalence and diagnostic classification. *Autism Research*, *6*(2), 134–143. <https://doi.org/10.1002/aur.1272>. The.
- Szatmari, P., Georgiades, S., Duku, E., Zwaigenbaum, L., Goldberg, J., & Bennett, T. (2008). Alexithymia in parents of children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *38*(10), 1859–1865. <https://doi.org/10.1007/s10803-008-0576-4>.
- Taylor, J. F., Rosen, R. C., & Leiblum, S. R. (1994). Self-report assessment of female sexual function: Psychometric evaluations of the brief index of sexual functioning for women. *Archives of Sexual Behavior*, *23*(6), 627–643.
- Visser, K., Greaves-Lord, K., Tick, N. T., Verhulst, F. C., Maras, A., & van der Vegt, E. J. M. (2015). Study protocol: A randomized controlled trial investigating the effects of a psychosexual training program for adolescents with autism spectrum disorder. *BMC Psychiatry*, *15*, 1–10. <https://doi.org/10.1186/s12888-015-0586-7>.
- Wainer, A. L., Ingersoll, B. R., & Hopwood, C. J. (2011). The structure and nature of the broader autism phenotype in a non-clinical sample. *Journal of Psychopathology and Behavioral Assessment*, *33*(4), 459–469. <https://doi.org/10.1007/s10862-011-9259-0>.
- Wang, W., & Parker, K. (2014). Record share of Americans have never married: As values, economics and gender patterns change. Washington, DC: Pew Research Center's Social & Demographic Trends Project.
- Ward, B. W., Dahlhamer, J. M., Galinsky, A. M., & Joestl, S. S. (2014). Sexual orientation and health among U.S. adults: National Health Interview Survey, 2013. *National Health Statistics Reports*, *77*, 1–12.