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BRIEF REPORT

# Brief Report: Personality Mediates the Relationship between Autism Quotient and Well-Being: A Conceptual Replication using Self-Report

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**Abstract** Autism spectrum disorder (ASD) impacts well-being across the lifespan. Individuals with ASD evidence differences in personality traits and self-concept clarity that are predictors of well-being in typically-developing individuals. The current research replicates a growing body of evidence demonstrating differences in well-being and personality between individuals low in ASD characteristics ($n = 207$) and individuals high in ASD characteristics ($n = 46$) collected from the general population using an online survey. Results were consistent in a subsample of demographically matched pairs ($n = 39$ per group) and relative to norms. Further, the current research provides the first evidence that openness, conscientiousness, emotional stability, and self-concept clarity mediate the relationship between ASD characteristics and well-being.

**Keywords** Autism spectrum disorder · Well-being · Personality traits · Self-concept clarity

## Introduction

Deficits in social interaction and social communication across multiple contexts, along with restricted and repetitive patterns of behaviors, interests, and activities diagnostically define autism spectrum disorder (ASD; American Psychiatric Association 2013). Similar to other developmental, physical, and psychiatric disorders self-report well-being is consistently reduced among individuals with ASD (Barneveld et al. 2014; Kamio et al. 2012; Shipman et al. 2011; Van Heijst and Geurts 2015). Recent research has investigated individual differences that mediate the impact of ASD on quality-of-life (e.g., Reed et al. 2016). The current research replicates the relationship between ASD and well-being and extends the exploration of potential mediating factors to test the impact of personality on this relationship.

The Big Five Personality model identifies the traits of openness to experience, conscientiousness, extraversion, agreeableness, and emotional stability. This is the most commonly studied and well-validated conceptualization of individual differences in perceptions of thoughts, feelings, and behavior. Individuals high in ASD characteristics differ from typically-developing (TD) individuals on these traits during childhood (Barger et al. 2016; De Pauw et al. 2011; Fortenberry et al. 2011; Schriber et al. 2014; Suh et al. 2016) and adulthood (Austin 2005; Gallitto and Leth-Steensen 2015; Hesselmark et al. 2015; Ingersoll et al. 2011; Kanai et al. 2011; Schriber et al. 2014; Schwartzman et al. 2016; Strunz et al. 2015; Wainer et al. 2011; Wakabayashi et al. 2006). Recent evidence also suggests that certain patterns of Big Five personality traits in adults who self-identify with ASD correspond to both differential social function and well-being (Schwartzman et al. 2016). We seek to connect the evidence for differences in Big Five traits with research in TD individuals demonstrating that personality is associated with well-being over the lifespan (Steel et al. 2008) and longitudinally (Soto 2015) by testing the hypothesis that personality traits mediate the relationship between ASD characteristics and well-being.

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Modern conceptualizations identify personality as more than Big Five traits (Roberts et al. 2006); therefore, the investigators will extend the exploration of personality into the metacognitive process of self-concept clarity. Self-concept clarity captures "the extent to which the contents of an individual's self-concept…are clearly and confidently defined, internally consistent, and temporally stable" (Campbell et al. 1996, p. 141). For example, two individuals may have identical scores on their personality trait responses but have differing perceptions of how clear this self-view is. A recent study indicates that self-concept clarity is negatively related to ASD characteristics (Berna et al. 2016). Thus, in addition to replicating differences in the content of personality, the current study extends recent work on the relationship of self-concept clarity to ASD characteristics. Further, given that self-concept clarity correlates with a number of indices of psychological well-being in TD samples (e.g., Bigler et al. 2001; Campbell and Lavallee 1993; DeMarree and Rios 2014; Nezlek and Plesko 2001; Usborne and Taylor 2010), we include self-concept clarity as a potential mediator of the relationship between ASD characteristics and well-being.

The current research builds on previous work with two aims (1) to conceptually replicate existing studies of personality and well-being relative to ASD characteristics and (2) expand this work to identify personality in individuals with ASD as a potential mediator of the relationship between ASD characteristics and well-being. The specific hypotheses are as follows: (1) Individuals showing high ASD characteristics on the AQ will exhibit lower levels of well-being, Big Five personality traits, and self-concept clarity compared to individuals low in ASD characteristics and norms of the selected measures. This hypothesis will also be tested in a subsample of individuals matched on demographic variables. (2) Personality traits and self-concept clarity will mediate the relationship between ASD characteristics and well-being.

## Methods

### Participants

Total sample was 253 individuals (55 male, 194 female, 4 other/missing). Age ranged from 18 to 63 ($M = 25.17$, $SD = 11.48$). The sample was 81% Caucasian. Education varied with 19.8% having a high school degree or less, 60.7% having some post-high school education, and 19.4% having at least a college degree.

### Procedures

The study was a cross-sectional survey conducted online. Participants were recruited using online advertisements on ASD related websites, through local colleges, and through physical posting with agencies serving individuals and families with ASD. Inclusion criteria were age 18 or over and successful completion of self-report surveys in an online format. Survey data were collected and managed using REDCap (Research Electronic Data Capture) electronic data capture tools hosted at Canisius College. REDCap is a secure, web-based application designed to support data capture for research studies, providing (1) an intuitive interface for validated data entry; (2) audit trails for tracking data manipulation and export procedures; (3) automated export procedures for seamless data downloads to common statistical packages; and (4) procedures for importing data from external sources (Harris et al. 2009).

### *Measures*

*Autism Spectrum Disorder Characteristics* The Autism-Spectrum Quotient (AQ; Baron-Cohen et al. 2001) was used to quantify variability in ASD characteristics. The AQ consists of 50 statements such as "I tend to have very strong interests, which I get upset about if I can't pursue" and "I find social situations easy". Participants responded to each statement from "definitely agree" (1) to "definitely disagree" (4). Standard AQ scoring was used.

*Well-Being* Well-being was measured with the following commonly utilized measures of psychological adjustment: an abbreviated 15-item form of the Ryff Psychological Well-Being Scale (Ryff 1989; norms: Ryff and Keyes 1995; $n = 4{,}105$), the Life Engagement Test (Scheier et al. 2006; norms: $n = 193$), the Satisfaction with Life Scale (Diener et al. 1985; norms: Pavot et al. 1991; $n = 130$), the Rosenberg Self-Esteem Scale (Rosenberg 1965; norms: Schmitt and Allik 2005; $n = 996$), the anxiety facet scale from the International Personality Item Pool (Goldberg 1999; Goldberg et al. 2006; norms: Johnson 2014; $n = 292{,}037$), and the Center for Epidemiological Studies Depression Scale (Radloff 1977; norms: Van Dam and Earleywine 2011; $n = 243$).

*Personality Content and Clarity* Big Five personality traits were measured with the Ten Item Personality Inventory (TIPI; Gosling et al. 2003; norms: Gosling et al. 2014; $n = 1813$). The Self-Concept Clarity Scale (Campbell et al. 1996; norms: Lodi-Smith and Roberts 2010, $n = 112$) assessed the extent to which a participant has a clear and consistent understanding of self and identity.

*General Health* In order to capture and thus control for variability in general self-reported physical health, participants completed a single item measure of their general health from the SF-36 (Ware and Sherbourne 1992).

*Study Groups*

All participants were divided into two groups based on AQ scores and self-reported diagnoses of ASD. The high ASD characteristics (HASDC; $n=46$) group were individuals who reported AQ scores of 26 or above (Woodbury-Smith et al. 2005) and/or self-reported a diagnosis of ASD ($n=21$). The low ASD characteristics (LASDC; $n=207$) group were individuals who self-reported AQ scores below 26. A secondary set of analyses was conducted with a demographically matched subsample of participants. Matching (versus statistical control) was selected to minimize adding complexity and to expand on the methods used in previous studies (e.g., Hesselmark et al. 2015; Suh et al. 2016). This subsample consisted of 39 pairs of participants matched on age (within 4 years), gender, ethnicity, and educational attainment.

### Analyses

Analyses were conducted in SPSS and R. Descriptive and reliability statistics for each scale can be found in Table 1. Alpha reliability is not appropriate for the TIPI (Gosling et al. 2003) and, therefore, is not reported. All significance testing was two-tailed. Missing data was treated as missing and not imputed.

## Results

As shown in Tables 2 and 3, the HASDC group reported lower well-being and personality with similar variance across most measures for all conducted group contrasts. Across the sample, all measures except autonomy significantly correlated with ASD characteristics. Post hoc analysis based on the reported effect sizes of other studies of ASD and personality suggest the present sample provides power greater than .89 to detect effects for both group level comparisons and overall covariation with ASD characteristics.

Factor analysis indicated a single factor solution (eigenvalue = 5.46) across the well-being scales. An average of the standardized scores across well-being measures was utilized in multiple mediation analysis (Preacher and Hayes 2008) of the impact of personality on the relationship between ASD characteristics and this metric (Table 4). As all of the personality variables had a significant zero-order relationship with the well-being composite ($r$s range from .38 to .61, all $p$-values $\leq .001$), they were all included in the multiple mediation model. As visualized in Fig. 1, openness, conscientiousness, emotional stability, and self-concept clarity partially mediated ($\beta=-.24$, $p<.001$) the direct relationship between ASD characteristics and well-being ($\beta=-.48$, $p<.001$), accounting for significantly more variance than the

**Table 1** Descriptive statistics and reliability statistics for study measures across groups

| | Valid *N* | Minimum | Maximum | Mean | Standard deviation | Alpha reliability |
|---|---|---|---|---|---|---|
| Autism quotient | 252 | .00 | 47.00 | 18.62 | 8.97 | .89 |
| Well-being composite | 252 | −1.86 | 1.39 | .00 | .72 | .88 |
| Autonomy | 252 | 7.00 | 18.00 | 13.11 | 2.61 | .55 |
| Positive relations with others | 247 | 5.00 | 18.00 | 13.25 | 3.30 | .62 |
| Environmental mastery | 250 | 3.00 | 18.00 | 12.56 | 3.17 | .68 |
| Personal growth | 251 | 6.00 | 18.00 | 14.82 | 2.82 | .71 |
| Self-acceptance | 245 | 4.00 | 18.00 | 13.61 | 3.25 | .79 |
| Purpose in life | 234 | 7.00 | 30.00 | 23.75 | 4.75 | .86 |
| Satisfaction with life | 244 | 5.00 | 35.00 | 23.40 | 6.87 | .89 |
| Self-esteem | 227 | 15.00 | 40.00 | 30.62 | 6.10 | .91 |
| Anxiety | 252 | 1.20 | 5.00 | 3.07 | .81 | .88 |
| Depression | 222 | .00 | 44.00 | 17.37 | 10.32 | .90 |
| Personality traits | | | | | | |
| Openness | 253 | 2.50 | 7.00 | 5.31 | 1.09 | NA |
| Conscientiousness | 253 | 1.50 | 7.00 | 5.42 | 1.29 | NA |
| Extraversion | 253 | 1.50 | 7.00 | 4.42 | 1.20 | NA |
| Agreeableness | 253 | 1.00 | 7.00 | 4.72 | 1.08 | NA |
| Emotional stability | 253 | 1.00 | 7.00 | 4.34 | 1.40 | NA |
| Self-concept clarity | 247 | 1.00 | 5.00 | 3.23 | .97 | .93 |
| Control variables | | | | | | |
| Age | 248 | 18.00 | 63.00 | 25.17 | 11.48 | NA |
| General health | 253 | 1.00 | 5.00 | 2.17 | .83 | NA |

**Table 2** Relationship of well-being to groups and ASD characteristics

| | Group mean (SD) | | | | | LASDC-HASDC | | | Matched LASDC-HASDC | | | Norms-HASDC | | | AQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LASDC | HASDC | Matched LASDC | Matched HASDC | Norms | *t* | *p* | *d* | *t* | *p* | *d* | *t* | *p* | *d* | *r* [95% *CI*] |
| Composite well-being | .16 (.64) | −.72 (.60) | .21 (.66) | −.76 (.56) | NA | 8.45 | <.001 | 1.42 | 6.93 | <.001 | 1.58 | | | | −.48 [−.43, −.27] |
| Autonomy | 13.21 (2.47)[a] | 12.67(3.17)[a] | 13.56 (2.25)[a] | 12.68 (3.26)[a] | 16.56 (3.06) | 1.26 | .21 | .19 | 1.38 | .171 | .31 | 8.48 | <.001 | 1.25 | −.04 [−.18, .10] |
| Positive relations with others | 14.06(2.81) | 9.62 (2.91) | 13.92 (2.86) | 9.53 (2.80) | 16.84 (3.80) | 9.52 | < .001 | 1.55 | 6.77 | <.001 | 1.55 | 12.70 | < .001 | 2.13 | −.60 [−.71, −.49] |
| Environmental mastery | 13.26 (2.74) | 9.36 (3.02) | 13.58 (2.59) | 8.97 (2.96) | 16.80 (3.22) | 8.57 | <.001 | 1.35 | 7.22 | <.001 | 1.66 | 15.43 | <.001 | 2.38 | −.47 [−.59, −.36] |
| Personal growth | 15.26 (2.49)[a] | 12.82 (3.34)[a] | 15.08 (2.80) | 13.16 (3.44) | 17.19 (3.20) | 5.56 | <.001 | .83 | 2.67 | .009 | .61 | 9.11 | <.001 | 1.34 | −.39 [−.52, −.27] |
| Self-acceptance | 14.18 (2.88) | 11.09 (3.60) | 14.33 (3.12) | 10.92 (3.57) | 16.33 (3.79) | 6.20 | <.001 | .95 | 4.47 | <.001 | 1.02 | 9.23 | <.001 | 1.42 | −0.36 [−0.49, −0.24] |
| Purpose in life | 24.47 (4.40) | 20.39 (4.99) | 24.68 (4.51) | 19.92 (5.03) | 25.10 (3.60) | 5.26 | <.001 | .87 | 4.26 | <.001 | 1.00 | 7.07 | <.001 | 1.08 | −.32 [−.47, −.20] |
| Satisfaction with life | 24.46 (6.41) | 18.71 (6.92) | 23.82 (7.47) | 18.37 (7.03) | 23.37 (6.53) | 5.35 | <.001 | .86 | 3.30 | .001 | .75 | 4.06 | <.001 | .69 | −.30 [−.42, −.17] |
| Self-esteem | 31.60 (5.77) | 26.03 (5.52) | 32.97 (5.85) | 25.37 (5.42) | 30.55 (4.95) | 5.59 | <.001 | .99 | 5.67 | <.001 | 1.35 | 5.64 | <.001 | .86 | −.37 [−.51, −.25] |
| Anxiety | 2.96 (.78) | 3.55 (.78) | 2.82 (.80) | 3.59 (.79) | 3.16 (.34) | 4.56 | <.001 | .76 | 4.24 | <.001 | .97 | 7.69 | <.001 | .65 | .30 [.18, .43] |
| Depression | 15.76 (9.80) | 24.70 (9.51) | 15.41 (9.86) | 25.53 (9.24) | 16.40 (13.50) | 5.25 | <.001 | .93 | 4.31 | <.001 | 1.06 | 3.74 | <.001 | .71 | .34 [.22, .47] |

Correlations with AQ scores are partial correlations across the sample controlling for age, gender, ethnicity, educational attainment, and general health ratings

*LASDC* low autism spectrum disorder characteristics group ($n = 182–207$, $n_{matched} = 32–39$), *HASDC* high autism spectrum disorder characteristics group ($n = 40–45$, $n_{matched} = 34–39$). *AQ* autism quotient

[a]Indicates that variance significantly differs per Levene's test for that contrast

**Table 3** Relationship of personality to groups and ASD characteristics

| | Group Mean (SD) | | | | | LASDC-HASDC | | | Matched LADSC-HASDC | | | Norms-HASDC | | | AQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LASDC | HASDC | Matched LASDC | Matched HASDC | Norms | *t* | *p* | *d* | *t* | *p* | *d* | *t* | *p* | *d* | *r* [95% *CI*] |
| Personality traits | | | | | | | | | | | | | | | |
| Openness | 5.43 (1.01)[a] | 4.76 (1.29)[a] | 5.32 (1.11) | 4.79 (1.26) | 5.38 (1.07) | 3.84 | <.001 | .58 | 1.96 | .054 | .45 | 3.86 | <.001 | .52 | −.27 [−.40,−.13] |
| Conscientiousness | 5.61 (1.20) | 4.54 (1.32) | 5.74 (1.08) | 4.49 (1.32) | 5.40 (1.32) | 5.35 | <.001 | .85 | 4.62 | <.001 | 1.05 | 4.36 | <.001 | .65 | −.30 [−.44,−.17] |
| Extraversion | 4.67 (1.11) | 3.32 (.93) | 4.51 (1.21) | 3.36 (.95) | 4.44 (1.45) | 7.69 | <.001 | 1.32 | 4.71 | <.001 | 1.07 | 5.21 | <.001 | .92 | −.45 [−.56,−.33] |
| Agreeableness | 4.90 (.99) | 3.89 (1.13) | 4.65 (1.03) | 3.90 (1.06) | 5.23 (1.11) | 6.12 | <.001 | .95 | 3.19 | .002 | .73 | 8.08 | <.001 | 1.20 | −.41 [−0.52,−0.29] |
| Emotional stability | 4.53 (1.30) | 3.48 (1.51) | 4.49 (1.39) | 3.35 (1.51) | 4.83 (1.42) | 4.81 | <.001 | .75 | 3.70 | .001 | .80 | 6.36 | <.001 | .92 | −.29 [−0.42,−0.17] |
| Self-concept clarity | 3.30 (.98) | 2.87 (.86) | 3.43 (.87) | 2.76 (.81) | 3.35 (.85) | 2.73 | .007 | .47 | 3.43 | .001 | .81 | 3.16 | .002 | .56 | −.26 [−0.39,−0.14] |

Correlations with AQ scores are partial correlations across the sample controlling for age, gender, ethnicity, educational attainment, and general health ratings

*LASDC* low autism spectrum disorder characteristics group ($n = 187–207$, $n_{matched} = 36–39$), *HASDC* high autism spectrum disorder characteristics group ($n = 39–46$, $n_{matched} = 34–39$). *AQ* = autism quotient

[a]Indicates that variance significantly differs per Levene's test for that contrast

**Table 4** Multiple mediation of the relationship between ASD characteristics and well-being by personality variables

| | Indirect effect | | Bootstrap 95% confidence interval | |
|---|---|---|---|---|
| | Estimate | SE | Lower | Upper |
| **Openness** | **−.0282** | **.0124** | **−.0559** | **−.0079** |
| **Conscientiousness** | **−.0428** | **.0160** | **−.0790** | **−.0166** |
| Extraversion | −.0295 | .0175 | −.0646 | .0048 |
| Agreeableness | .0126 | .0137 | −.0142 | .0400 |
| **Emotional stability** | **−.0396** | **.0133** | **−.0679** | **−.0167** |
| **Self-concept clarity** | **−.0636** | **.0205** | **−.1052** | **−.0291** |
| *TOTAL* | *−.1911* | *.0345* | *−.2648* | *−.1268* |

Confidence intervals that do not include zero indicate a significant mediating effect and are indicated here in bold. All multiple mediation analyses control for age, gender, ethnicity, educational attainment, and general health

direct model ($R^2\Delta = 0.290$, $p < .001$). Findings were consistent when mediation analyses were done within specific well-being outcomes with conscientiousness and self-concept clarity being the most consistent mediators.

## Discussion

Overall, the current study provides a conceptual replication and extension of previous literature on well-being, personality, and ASD characteristics. For components of well-being, we replicated previous findings for lower levels of happiness and self-esteem as well as higher anxiety and depression in individuals with high ASD characteristics (Barneveld et al. 2014; Kamio et al. 2012; Lopata et al. 2010; Schwartzman et al. 2016; Shipman et al. 2011; Sterling et al. 2008; Van Heijst and Geurts 2015). The replication of these effects underscores the broad impact of the social deficits, problem behaviors, and mood disruptions experienced by individuals with ASD on their quality of life. We also successfully replicated results demonstrating that personality is associated with ASD characteristics in adulthood (Austin 2005; Berna et al. 2016; Ingersoll et al. 2011; Kanai et al. 2011; Schwartzman et al. 2016; Wainer et al. 2011; Wakabayashi et al. 2006). Specifically, higher ASD characteristics were associated with lower openness, conscientiousness, extraversion, agreeableness, emotional stability, and self-concept clarity. These effects held in the overall sample, in a matched subsample of participants, and in comparison to well-being and personality scale norms.

Further, this study extended prior work investigating potential mediators of the relationship between ASD characteristics and well-being (Reed et al. 2016). Specifically, the present findings identify personality as a partial mediator of ASD characteristics in relation to well-being. This finding has potential implications for individuals with ASD or ASD characteristics. In non-ASD samples, lower levels across Big Five traits (Soto 2015; Steel et al. 2008) and self-concept clarity (e.g., Bigler et al. 2001; Campbell and Lavallee 1993; DeMarree and Rios 2014; Nezlek and Plesko 2001; Usborne and Taylor 2010) are related to psychological well-being. In children with ASD, higher levels of Big Five personality traits have been associated with greater emotional and social functioning (Nader-Grosbois and Mazzone 2014) and optimal outcomes in adolescence (Suh et al. 2016). These findings are paralleled in adults with ASD (Schwartzman et al. 2016). The mediation findings in the present research provide preliminary evidence that the deficits individuals with ASD experience in well-being may be influenced, at least in part, by disruptions in personality; particularly

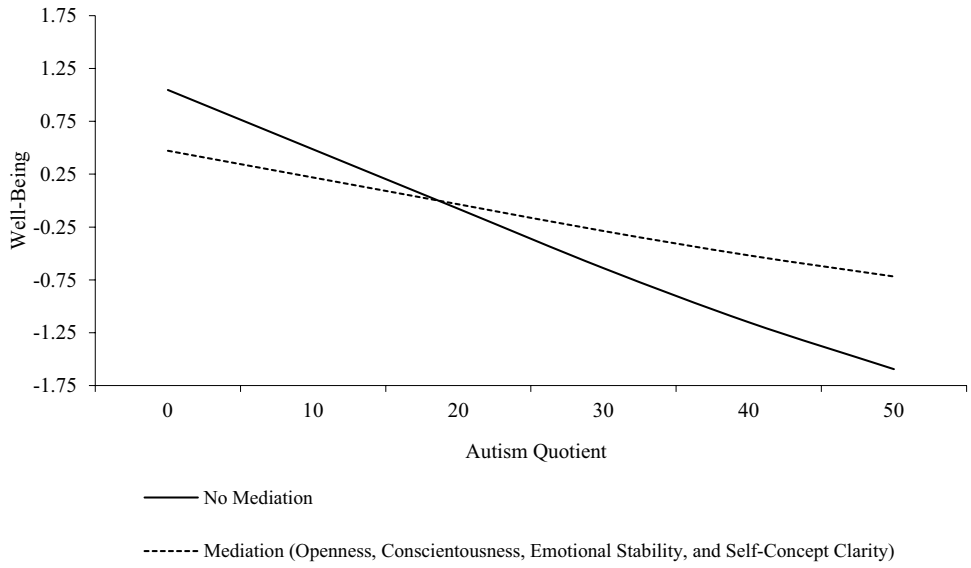


**Fig. 1** Mediating effect of personality on the relationship between ASD characteristics and well-being

openness, conscientiousness, emotional stability, and self-concept clarity.

## Limitations and Future Directions

The current study is limited by the use of online self-report as the data collection method. However, evidence suggests that this modality is efficacious for personality research (Gosling et al. 2004). Further, participants with ASD are comfortable with this modality of assessment (Haas et al. 2016), and there is accumulating evidence that they are able to effectively self-report (Hesselmark et al. 2015; Schriber et al. 2014). Future studies should replicate these findings across additional modalities of assessment including reports from informants such as parents or spouses in order to broaden the perspectives and potential validity of responses.

A unique aspect of the current study is the inclusion of a majority of female and highly educated participants in the sample. However, this may limit the generalizability of the results. Generally, research related to ASD is focused on males with lower educational attainment as they comprise a majority of the clinical population, though research specifically on females and highly educated individuals is emerging. The results of the matched sample comparisons support a consistent pattern of individual differences across gender and education.

Another limitation is in the instrumentation used to identify ASD characteristics. The AQ is insufficient to assign a diagnosis of ASD; however, AQ scores have been demonstrated to have strong discriminant validity between individuals with ASD and TD individuals (Ruzich et al. 2015; Woodbury-Smith et al. 2005). The current study used high-AQ scores to differentiate the HASDC group from the LASDC group. Future work should focus on individuals with independent diagnostic confirmation above and beyond ASD characteristics.

The current study is also limited by not characterizing the functional level (cognitive and/or language skills) of participants. While it could be assumed that the sample was relatively high functioning because all of the participants could complete the survey forms and approximately 80% had some post-high school education, this was not tested explicitly. Future work should provide specific characterization of functional level with well-validated measures.

Future studies should also measure personality processes beyond the Big Five and self-concept clarity such as variations in non-Big Five traits, goal pursuits, affective states, motivational constructs, and narrative identity. Future studies could also investigate the role of personality and ASD in the context of other important life outcomes impacted by personality such as physical health and cognitive decline (Curtis et al. 2015; Roberts et al. 2007).

Finally, well-being and personality in ASD must be explored longitudinally as well as in experimental and intervention contexts in order to specifically test the causal directions of the mediation effects. Differences in personality across the lifespan may impact overall function above and beyond the specific social and behavioral deficits characteristic of ASD. The impact that these differences may have and the potential for interventions to promote healthy development suggests a new direction for research in ASD.

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**Author Contributions** JDR conceived of the study, contributed to its design and coordination and drafted the manuscript; JLS contributed to its design and coordination, analyzed the data, and helped to draft the manuscript; PLH participated in the design and assisted with measurement and provided critical feedback on the manuscript; SMS participated in the design and assisted with measurement and provided critical feedback on the manuscript; CL participated in the design and coordination and helped to draft the manuscript; MLT assisted with design and recruitment and helped to draft the manuscript. All authors read and approved the final manuscript.

**Compliance with Ethical Standards**

**Ethical Approval** All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

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