Selective mutism in children with and without an autism spectrum disorder: The role of sensory avoidance in mediating symptoms of social anxiety

Despite Selective Mutism (SM) and Autism Spectrum Disorder (ASD) often presenting together in clinical practice, there is no research to guide assessment processes (McKenna et al., 2017), with earlier editions of the DSM hindering professionals' readiness to diagnose ASD and SM together (Valaparla et al., 2018). While SM is currently characterised as an anxiety disorder in which individuals consistently fail to speak in specific social environments where it is expected, despite speaking in other situations, ASD is recognised by deficits in repetitive behaviours and social communication (APA, 2013). Children with ASD are vulnerable to developing SM due to their associated social anxiety (Settipani, et al., 2012; Sharkey & McNicholas, 2008), speech and language difficulties (Cohan et al., 2008; Müller et al., 2008), and sensory impairments, which can involve an under or over responsiveness to stimuli (Henkin & Bar-Haim, 2015). Therefore, this study aimed to explore the relationship between sensory behaviours and social anxiety in children with SM by comparing a group of children with SM both with, and without, an additional ASD diagnosis.

SM is generally accepted as a behavioural response to anxiety (Young et al., 2012), where it is hypothesised that fear physically disables the throat or larynx (Ruiz & Klein, 2013; Sluckin & Smith, 2015). Consequently, SM's link with anxiety stems from its high co-occurrence with anxiety disorders in general (Cunningham, et al., 2006; Cunningham et al., 2004). Although individuals can outgrow SM, symptoms of co-occurring social anxiety disorder often persist (Sutton, 2013); it has been proposed that SM may either be a subtype of social anxiety (Sharkey & McNicholas, 2008; Steinhausen et al., 2006), a severe form of it (Scott & Beidel, 2011), a symptom of social anxiety disorder (Black & Uhde, 1995; Krysanski, 2003) or a developmental variant or pre-cursor to social anxiety disorder (Standart & Courteur, 2003). Yet, there are significant differences between SM and social anxiety disorder, where SM typically manifests

during early childhood (between 2 to 5 years old; Muris & Ollendick, 2015), compared to social anxiety disorder's later average age of onset of 13 years old (Leichsenring & Leweke, 2017); this makes the longitudinal course of SM less clear.

Historical misunderstandings surrounding SM and ASD are evident, given it is now emerging that a high proportion of children with SM are recognised as showing ASD. For example, Kearney & Rede, (2021) found 68.5% of children with SM also presented with a developmental disorder with 46.3% presenting with both anxiety and developmental disorders, suggesting a strong relationship between a developmental delay, anxiety and SM. Additionally, when exploring the association with ASD within individuals identified with SM, a retrospective examination of Swedish medical records revealed that 63% had a form of ASD (29% had ASD, 4% had Asperger's syndrome, and 30% had atypical-ASD) (Steffenburg et al., 2018). Compared to the SM-only group, onset of SM tended to be later for the SM+ASD group; and 33% experienced speech difficulties, compared to 16% of the SM-only group (McKenna et al., 2017).

Such misunderstandings manifest within diagnostic processes, with SM being misdiagnosed as ASD due to the difficulties with social interactions and negative responses to sensory stimulation (Mahmood & Jabeen, 2018; Simms, 2017). Conversely, when SM is neglected in children with ASD, the anxiety around speaking is not addressed, facilitating social anxiety to persist through to adolescence and adulthood (Perednik & Shaughnessy, 2012). Likewise, ASD may be missed in cases of SM due to its most prominent feature of silence which may distract practitioners from noting other characteristics of ASD (Ipci, et al., 2017).

Co-occurring issues with ASD and SM further add to this complexity, for example, while social anxiety disorder is frequently diagnosed alongside ASD (Melfsen et al., 2006; Sukhodolsky et al., 2008), in comparison to SM, ASD is not classified as an anxiety disorder; rather, it is

understood that this anxiety often surrounds social interactions in areas where those with ASD have deficits (Gillott et al., 2001). Although factors that contribute to this anxiety remain unclear (Bellini, 2004), it is noted that individuals with ASD show more persistent, stronger reactions to environmental stimuli considered harmless to others (Mayes et al., 2014), exacerbating environmental triggers, and intensifying the experience of anxiety; often known as sensory sensitivity.

The relationship between sensory hypersensitivity processing patterns and anxiety have long been recognised (Spain et al., 2018). For example, individuals with a low sensory threshold are often quick to notice and respond to stimuli because their systems are easily activated by sensory stimuli resulting in sensory sensitivity and sensory avoidance. Sensory sensitivity refers to a passive self-regulation strategy (called sensors), and sensory avoidance is associated with a more active approach which limits exposure to stimuli (called avoiders); high avoiders are often considered introspective or reclusive (Dunn, 2014). Hypersensitivity to sensory stimuli can be anxiety provoking and lead to sensory overload, whereby the individual responds in an exaggerated manner to stimuli (Boddaert et al., 2004), and/or may completely shut down (Belek, 2018). For example, sensory sensitivities to light, smell and sound may prove distracting or anxiety-provoking in social settings. Similarly, aversions to very specific sensory stimuli (Lord, Rutter & Le Couteur, 1994), may give rise to anticipatory anxiety within familiar or unfamiliar settings, and around meeting familiar or unfamiliar others.

ASD children who exhibit hyperresponsiveness also often display elevated levels of anxiety (Green & Ben-Sasson, 2010; Uljarević et al., 2016) complicating social interactions further (Robertson & Simmons, 2013). As these sensory sensitivities are more pervasive in children with neurodevelopmental disorders and are more likely to be triggered in social situations, children may manage any subsequent distress through withdrawal and muteness, as seen in SM

(Kranowitz, 1998), and/or disengagement in social situations as seen in ASD (Maddox & White, 2015).

Interestingly, recent findings indicate that approximately 75% of children with SM have difficulties in sensory processing, specifically in auditory areas, which can have a negative impact on their ability to talk (Bar-Haim et al., 2004; Muchnik et al., 2013 Schwartz et al., 2006). Specifically, abnormalities in auditory processing tend to be more severe for speech perception (O'Connor, 2012). This aberration frequently expresses itself through atypical self-vocalisation producing speech with an unusual intonation or volume in children with ASD (Chan & To, 2016); and children with SM often report a perception that their voice sounds funny or strange, resulting in them restricting or avoiding speech so that others do not hear them (Boon, 1994; Henkin & Bar-Haim, 2015; Vogel et al., 2019). Indeed, children with SM report sensory demanding environments containing crowds, high volume, or lack of distance as particularly anxiety provoking (Schwenck et al., 2021). It has been speculated that elevated anxiety levels in SM are also the result of sensory processing dysfunction (Engel-Yeger & Dunn, 2001; Royeen & Lane, 1991),

The current study aimed to explore the relationship between sensory behaviours and social anxiety in children with SM, both with and without a co-occurring diagnosis of ASD. While it was hypothesised that both groups would show high levels of social anxiety and sensory hypersensitivity, it was unclear whether levels would significantly differ between the two groups and whether sensory hypersensitivity would account for levels of social anxiety.

Methods

Participants

One hundred and two parents reported information on their child. After screening out children for missing data (*n* = 17) and those who neither had a confirmed diagnosis of SM or ASD or had yet to be referred for an ASD diagnosis (n= 8), data from 75 mothers remained and whose data was used in the analysis. Eighty percent were British, 9% Australian, 7% American, 1% each were Norwegian, Maltese, Belgian and Hungarian. Parental report of the child's diagnoses was used to divide the children into those with SM and ASD (SM+ASD) and those with SM without ASD (SM-only). Thirty-eight (17 females, 21 males) had a diagnosis of SM+ASD (32 had a formal clinical diagnosis of ASD and 6 were awaiting an ASD diagnosis and/or had been referred for the ASD diagnosis); and 37 had a diagnosis of SM (26 females, 11 males). Based on caregiver report, all the children met the criteria of having a formal clinical diagnosis of SM (*n*=75). All children in the SM+ASD group met the cut-off scores on the Autism Spectrum Screening Questionnaire (>19+). Age at which children received a diagnosis of SM were: SM-only (*M*=3.08, *SD*=2.11); SM+ASD (*M*=3.36, *SD*=2.71). The ASD diagnosis was significantly later than the onset of SM behaviours in the combined group (*M*= 8.28, *SD*=3.48). Five of the SM+ASD had a diagnosis of generalised anxiety disorder, and 9 had a social anxiety disorder. In comparison none of the children with SM had been diagnosed with any anxiety disorder. A comparison of the additional co-occurring issues and demographic data is shown in table 1.

Parents of children from both groups were recruited via a range of online forums who agreed to advertise the study (e.g. Selective Mutism Information and Research Association [SMIRA], Support for Parents of Children with SM). Upon opening an online link, the participant learnt about the study via an online participant information sheet, and once participants completed a consent form with anonymity code, they were given access to the online survey. Demographic variables collected included: their child's age, gender, ethnicity, whether children had a delay in language (YES/NO), age of ASD and/or SM diagnosis, age reported by parents as showing

SM behaviours, and any clinical diagnosis including co-occurring disorders. Caregivers were also asked to describe their relationship to the child as well as who gave the diagnosis and at what age. Finally, all caregivers were asked to complete the questionnaires. The questionnaires were presented in the same order to each participant and took approximately 25 minutes to complete. The questionnaire remained active for three months and participants volunteered to take part. At the end of the study, participants were provided with details of where to seek information and support for any concerns around SM and ASD and were also reminded how they could withdraw their data from the study. Ethical approval for this research was obtained from the University of Hertfordshire University Ethical Advisory Committee (Protocol Number: aLMS/SF/UH/04545(1) and the research was performed in accordance with the Declaration of Helsinki.

Measures

The Selective Mutism Questionnaire (SMQ; Bergman, Keller, Piacentini & Bergman, 2008) was used to measure children's SM behaviours quantitatively; it consists of 17 situations with an expectation to speak that are divided into three sections: school; home and family; social situations. Designed for parental report, the SMQ uses a four-point Likert scale (Always-Never) to provide a score of severity between 0-51; the lowest score representing more profound behaviours of SM. An extra fourth section on the distress caused by SM behaviours was incorporated for exploratory purposes but was not included in the scoring. The SMQ has been found to have good internal consistency (α=.91; School Items α=.91; Home α=.84, Social α=.88 respectively).

*The Autism Spectrum Screening Questionnaire (*ASSQ; Ehlers, Gillberg & Wing, 1999) was used to measure children's ASD behaviours quantitively. Using a trichotomous scale (No-Somewhat-Yes), parents select whether their child stands out from other children using 27

ASD related behaviours, obtaining a score between 0-54. Scores over 17-19 have been suggested to effectively differentiate clinical ASD from similar behaviours within the general population (Posserud et al, 2008). The ASSQ has been found to have good internal consistency (α=.90) for the current study. The items load onto three factors; social difficulties, repetitive movements, and autistic-like style (Posserud et al., 2008).

Revised Children's Anxiety and Depression Scale Parent Reported (RCADS-P; Chorpita et al., 2000). The generalised anxiety disorder (GAD) and social anxiety disorder (SAD) subscales were used to measure features of anxiety commonly presented alongside SM (Melfsen et al., 2006). Marked on a four-point Likert scale (Never-Always), the RCADS-P and its individual subscales have good psychometric properties (Ebesutani et al., 2011). The GAD-subscale consists of five-items totalling a maximum score of 15, has good internal consistency (α=.91). Similarly, the SAD-subscale consists of nine-items totalling a maximum score of 27, has good internal consistency (α=.92).

The Sensory Profile 2 (SP2, Dunn, 2014) is an 86-item caregiver report measure evaluating children's sensory processing patterns at home, school, and in the community. It provides a measure to everyday events in six sensory modalities (i.e. auditory, behavioural sections (i.e. conduct, attention and social) and four sensory patterns (i.e. seeking, avoiding, sensitivity and registration). The Likert scoring of the SP2 represents '0 = Not Applicable and then '1 = Almost Never' to '5 = Almost Always'. The SP2 was normed for children aged 3–14 years and 11 months and demonstrates strong internal consistency (Cronbach's α = .61– .89 across scales).

Analysis

All analysis was conducted using SPSS IBM version 25 (SPSS Inc., Chicago, IL, USA). Independent *t*-tests were carried out to investigate differences in chronological age and age

identified as showing SM behaviours (according to parents' accounts), as well as difference of the SM and Autism symptomology in children with SM both with and without ASD. Subsequently, a series of independent *t*-tests were conducted to also explore anxiety and sensory sensitivity between the groups. To examine relationships between symptomology, anxiety and sensory measures, a series of two-tailed Pearson's correlations were conducted.

Two mediation analyses were carried out using model 4 of the PROCESS macro [Hayes (2022). The first assessed the hypothesis that groups can be differentiated in their social anxiety by patterns of sensory processing assessed by four quadrants of the sensory profile. The second addressed the relationship between group and social anxiety to be mediated by sensory avoidance. Since children with ASD show high anxiety disorders in general (White et al., 2009), the mediation was run with GAD as a covariate.

Categorical data is appropriate to use as an independent variable in a mediation analysis (Iacobucci, 2012). The recommendations of Hayes & Preacher, (2014) were followed, using dummy coding to represent comparisons of interests coded (-1 = SM, 1 = SM +ASD) and using the asymmetric bootstrap Confidence Interval.

Results

Descriptive statistics

Demographic characteristics of children with SM-only and SM+ASD are presented in Table 1. Independent *t*-tests revealed no significant differences in age between the SM only and SM+ASD group. A chi-squared analysis showed a significant difference in language delay, with the children with SM+ASD significantly more likely to report language delay (9 SM vs 28 SM+ASD, (X^2 (2, N = 75) = 16.4, p < .001).

Differences in anxiety and sensory sensitivity

Mean and standard deviations for standardised measures are presented in Table I (Insert Table I). As shown in Table I, a series of independent *t*-tests revealed the children with selective mutism reported significantly higher SM behaviours at school, where in contrast the SM+ASD group could be differentiated by showing higher SM behaviours both socially and at home. The SM+ASD group showed significantly higher scores on all areas of the ASSQ, generalised anxiety, social anxiety and sensory behaviours compared to the SM-only group. The relationships between the child's sex and existence of language delay were addressed in relation to levels of social anxiety, generalised anxiety, and the four sensory quadrants, revealing no significant differences in either of the groups ($t <. 47$, $p > .09$ and $t < 2.26$ p, $>.28$; sex and language delay respectively).

Sensory sensitivity and Anxiety

A series of Pearson correlations were conducted to assess the relationship between autism, selective mutism, anxiety and sensory behaviours, as shown in Table II (Insert Table II). For both groups of children, more severe SM symptoms for both groups, as reflected by lower SM scores, were associated with later SM associated language difficulties. Equally, generalised anxiety was positively correlated with AASQ, social anxiety and total sensory sensitivity for both groups. While higher social anxiety was associated with higher generalised anxiety for both, only in the SM-only group was higher social anxiety found to also be related to higher levels of total sensory behaviours.

To identify whether sensory processing mediated the differences in the way social anxiety was processed, we performed a single-step parallel mediational analysis using the PROCESS macros and instructions provided by Hayes [2022]. This analysis used a bootstrapping method and 10,000 repetitions, simultaneously entering the 4 sensory patterns as mediators.

Results revealed that only sensory avoidance had a significant indirect effect between group and social anxiety (β = .89, *se* = .09, *t* = 5.41, *p* < .001; LCI = .30 HCI= .66). The initial difference between the groups and social anxiety (β = .24, *se* = .83, *t* = 2.13, *p* < .05; LCI = .11 HCI= 3.42) was reduced to a non-significant level once sensory avoidance was included (*Z* = 3.99, *p* < .001, see figure1). All other indirect effects were not significant (Sensory seeking β = -.07, *se* = .06; LCI = -.14, UCI = .09, *p* = .66; Sensory Sensitivity β = .17, *se* = .07; LCI = -.21, UCI = .07, *p* = .31; Low Registration; β = -.15, *se* = .06; LCI = -.20, UCI = .07, *p* = .36). LCI and HCI are higher/lower CI respectively.

(Figure I top).

The findings from the previous regression analysis revealed that the relationship between groups and social anxiety to be differentiated by sensory behaviours, with sensory avoidance a mediator between group and social anxiety. Next a single-step mediational analysis was performed using sensory avoidance as a mediator between groups and social anxiety, including general anxiety as a covariate in the analysis. The mediational analysis was again performed using a bootstrapping method for confidence intervals and 10000 repetitions, using the methods and procedure provided by Hayes (2022).

Results revealed that sensory avoidance still had a significant indirect effect on the relationship between groups and social anxiety (β = .47, *se*= .07, *t* = 3.88, *p* < .001; LCI = .12 HCI= .39). The initial difference of groups on social anxiety, no longer significant when controlling for generalised anxiety, (β = .19, *se* = .72, *t* =1.98, *p* = .058; LCI = -.009 HCI= 2.87) was again decreased significantly when sensory avoidance was included (*Z* = 3.26, *p* < .001; see figure 2). Generalised anxiety had a significant effect on sensory avoidance (β =

.35, $p < .001$) and social anxiety ($\beta = .32$, $p < .01$). These results suggested that the effect of group on social anxiety was partially mediated by the levels of sensory avoidance even when controlling for GAD. Importantly, the alternative model using social anxiety as a mediator of the group- sensory avoidance relationship did not show a mediational effect.

(Figure II top)

Discussion

This was one of the first studies to directly compare children with SM, with and without a diagnosis of ASD on their sensory behaviours and levels of social anxiety. Previous studies have only retrospectively accounted for whether clinically diagnosed children with SM would have met an ASD diagnosis (Steffenburg et al., 2018). Our findings support previous research suggesting a vast percentage of children with SM may be affected by sensory processing difficulties, regardless of other co-occurring diagnoses (Schwartz et al., 2006), although children with SM-only showed significantly less sensory behaviours then the SM +ASD group. The results also revealed that children with an SM+ASD diagnosis had a higher occurrence of a clinical anxiety disorder and showed higher symptoms of both generalised and social anxiety. Importantly, levels of social anxiety levels between the groups became more similar when accounting for levels of sensory avoidance.

While previous research has indicated sensory difficulties underlie anxiety behaviours in children with ASD (Green & Ben-Sasson, 2010; Uljarević et al., 2016), the relationship with social anxiety has been less well established (Spain et al., 2018, Bellini, 2004, Black et al., 2017). Yet, the current findings for the children with ASD carrying the additional SM diagnosis showed sensory avoidance predicted social anxiety even when controlling for symptoms of generalised anxiety. Therefore, the relationship between sensory avoidance and

social anxiety may be a unique characteristic to those showing high levels of both SM and ASD behaviours. This idea was further quantified in our study by the children with SM who showed higher autism symptomology, as measured by the ASSQ, to have more extreme sensory behaviours. Perhaps indicating that those showing subclinical levels of ASD are more vulnerable to sensory avoidance during social interactions.

Our findings highlight the importance of sensory avoidant behaviours in differentiating levels of social anxiety between the SM only and ASD+SM groups. If this is left untreated it is difficult to know when, and how, the ASD behaviours take over. For example, bi-directionally social anxiety can encourage individuals with ASD to withdraw further from social interaction, which reduces the opportunities for children to observe social rules and apply their social knowledge (Spain et al., 2018). Therefore, what the results do indicate is the importance of early identification and intervention.

While in the current study levels of sensory behaviours, generalised anxiety and social anxiety were not differentiated based on the child's sex, this is an avenue for future research. For example, sensory avoidance is usually associated with an exacerbation of anxiety symptoms, with females more likely to adopt this strategy than males (Panayiotou et al., 2017). Female adolescents with ASD have also been found to favour avoidance-based strategies to remove environmental and sensory pressures around them (Jackson, Keville, Ludlow, 2022). Therefore, given the 2:1 female to male ratio estimated in females with SM (Kearney & Rede, 2021) and the findings showing females to be at higher risk from social anxiety, both in typical and neurotypical populations (Kuusikko et al. 2008). The question remains as to whether sensory avoidance within social situations could be a red flag to identify females with an SM who have an ASD diagnosis?

Recognition of atypical sensory processing in ASD and its impact on anxiety and school performance, has previously created the need for whole school-based sensory interventions that are integrated into curriculum activities (Mills & Chapparo, 2017; Mills et al., 2016), normalising adaptations for ASD related stressors. The assumption underpinning the use of such sensory activities means sensory input achieves regulatory, functional, and adaptive outcomes, enhancing and facilitating learning for children with ASD (Bodison & Parham, 2018; Mills et al., 2021). Given the overlap of SM and ASD, alongside more severe presentations of SM behaviour occurring within a school-based environment (Yeganeh et al., 2003) sensory based interventions in schools for children with SM are another avenue to explore including adaptive avoidance, this might include adaptive avoidance of sensory triggers (Jackson et al., 2022).

While the current research mainly focused on sensory and anxiety behaviours, there are other important differences identified in the findings that may act as additional flags to a co-occurring ASD diagnosis. For example, the SM+ASD group was significantly more likely to have a language delay than the SM-only group, indicative of greater complexity, possibly through underlying deficits; some caution with this interpretation is needed as language delay was simply collated through parental report, with no prior definition of language delay provided. Previous findings have also shown children with ASD to have a higher rate of language delays compared to typically developing children (Marchi et al., 2018), the difficulty in language development may be a potential risk factor for those with ASD later developing SM. Alternatively, this may also be due to an underestimation of the prevalence of language delays within the SM-only sample, as there is often a reluctance to diagnose a language impairment alongside SM due to SM previously being poorly classified (Steffenburg et al., 2018).

Similar to findings by Steffenburg et al. (2018), no significant difference was reported in the age of onset for SM behaviours between groups, challenging the assumption that SM is due to their ASD. Moreover, compared to the SM-only group, the SM+ASD group presented with a significantly higher severity of SM overall, suggesting the importance of recognising SM in children with ASD. However, ASD behaviours may overshadow SM behaviours in some children and, therefore, our sample may only reflect the individuals with ASD who present with pervasive SM behaviours in specific contexts, and which are noticeable enough to be recognised and warrant assessment. Consequently, SM may not be identified in some children with ASD due to its lack of presentation in other contexts, or where ASD behaviours are more prominent (Steffenburg et al., 2018). Indeed, in the current study the groups could be differentiated by the context in which their SM behaviours were displayed, with the combined group showing more severe levels at home and in social situations, whereas the SM-only group were identified, as expected, by their SM behaviours at school (Schwartz et al., 2005).

Regarding diagnosis, our findings have implication for methods of carrying out assessment. For example, due to a lack of awareness of co-occurring SM and ASD, clinical practice professionals still encounter a significant number of children presenting with both disorders, and subsequently struggle to know how to conduct assessments (McKenna et al., 2017). For example, The Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore & Risi, 1999) is commonly used in the assessment for ASD and utilises four modules depending on the abilities of the individual. However, when a child with potential ASD also presents with SM, an accurate ADOS cannot be conducted within the assessment context due to the potential impact of SM on speech, regardless of competent language ability in other contexts. Therefore, research expanding on the co-occurrence between SM and ASD may aid development of an ADOS-variation that is accessible for these children, who might otherwise

be misdiagnosed (McKenna et al., 2017). Such identification is crucial, given diagnosis triggers access to suitable or appropriate interventions and support in school. Indeed, whilst there is a wealth of literature supporting the effectiveness of cognitive-behavioural interventions for adolescent anxiety (Comer et al., 2019; Higa-McMillan et al., 2016; Silverman et al., 2008), there is a lack of knowledge for treatment for SM (Lorenzo et al., 2021).

This study is not without limitations. Firstly, it is important to address that the age of ASD diagnosis was significantly later than the SM diagnosis in the combined group. This may reflect an uncertainty surrounding ASD criteria within the SM-only group, possibly due to the difficulty detecting ASD in some children with SM and/or historical reluctancies of professionals to diagnose co-occurring ASD and SM (Steffenburg et al., 2018). This may also mean that some of those children who are currently in the SM-only group may still later reach a diagnosis of ASD. Further, intellectual ability was not considered, and it is possible that higher anxiety levels reflect the stronger communication abilities of higher functioning youth. Finally, in the current study we relied on parents' self-report, however, as parents acknowledge themselves, it can be difficult to reliably distinguish anxiety from other ASD behaviours (Simpson et al., 2020). Parent reports can only be based on their observations within the contexts they are in with their child, not all the contexts the child may experience without their parents, thus, these reports may not always match self-reported ratings given by the children. For example, in ASD, parent rated sensory hypersensitivity has minimal relationship with social anxiety, yet in a recent study looking at adolescences with ASD using self-ratings, a relationship was established (Pickard et al., 2020).

In summary our findings continue to support the narrative from the both literature and the ICD-11 (WHO, 2018), of the high co-occurrence between SM and ASD, supporting the potential need for an ASD assessment pathway for children presenting with SM (McKenna et

al., 2017). Key differences were also shown between those with SM and those with co-occurring ASD, with those showing ASD to have later language development and more extreme sensory and anxiety behaviours. Importantly levels of sensory avoidance were found to partially account for differences between the group's social anxiety. Our findings highlight the importance of addressing the co-occurrence of SM and ASD for diagnosis, treatment and prognosis and suggest the potential of contextually based sensory orientated interventions and adaptive avoidance of environmentally based sensory stimuli when appropriate.

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Table I. Descriptive statistics for SM, autism, social and generalised anxiety, and sensory sensitivity standardised measures in children with and without ASD.

	SM-only (n=37)	**SM+ASD (n=38)**	***t(df)***
	Mean(SD)	***Mean(SD)***	
Age (y)	10.51 (4.25)	9 (4.39)	*t*(73)=.13

SM			
School	3.32(4.12)	4.00(3.15)	*t*(73)=4.17***
Home	10.43(4.68)	6.68(2.91)	*t*(73)= 1.42
Social	3.21(3.68)	1.68(1.97)	*t*(73) = 2.25*
Total	16.97(9.51)	12.36(6.26)	*t*(73)=2.48*
AASQ			
Social	4.29(4.39)	9.10(4.10)	*t*(73)=-4.89***
Communication	3.70(2.48)	6.44 (2.80)	*t*(73)=4.48***
Repetitive Behaviours	1.89 (2.04)	4.10 (2.73)	t(73)=-3.97***
Motor	1.83 (1.85)	4.10 (2.73)	t(73)=-4.75***
Total	11.7(9.16)	23.76 (9.26)	t(73)=-5.64***
General Anxiety	8.16(5.56)	9.08 (4.34)	t(73)=.79
Social Anxiety	14.72 (7.31)	18.26(7.06)	t(73)=.97*
SP			
Avoiding	60.05 (12.67)	75.68 (9.59)	*t*(73) =6.03***
Sensitivity	37.56 (14.91)	56.44 (15.86)	*t*(73) =5.31***
Seeking	42.75 (16.14)	57.52 (18.48)	*t*(73) =3.68***
Low Reg	40.97 (17.10)	57.55 (12.57)	*t*(73) =4.79***
Auditory	18.14(7.69)	24.52(8.51)	*t*(73) =3.41**
Visual	11.59(3.73)	15.23(5.17)	*t*(73)=3.49**
Touch	17.70(5.44)	27.10(10.27)	*t*(73)=4.93***
Movement	11.11(4.01)	15.68(7.12)	*t*(73)=3.41**
Body	12.51(5.57)	18.89(8.07)	*t*(73)=3.97***
Oral	18.89(9.61)	29.31(10.74)	*t*(73)=4.43***
Conduct	16.81(5.82)	22.29(7.03)	*t*(73)=3.67***
Social emotional	36.43(12.86)	50.97(11.94)	*t*(73)=5.07***
Attention	17.67(7.31)	24.97(9.05)	*t*(73)=3.83***
Total	95.16(27.20)	112.38(20.00)	*t*(73)=5.44***

*Note: *p < .05, **p < .01, ***p < .001*

Selective Mutism (SM) AASQ General Anxiety, Social Anxiety, Sensory Profile (SP2)

Lower Scores on SM reflect more severe SM behaviours

Table II. Standard regression coefficients (Beta) of the four sensory perception subscales predicting SM and anxiety behaviour outcomes.

	1	**2**	**3**	**4**	**5**	**6**	**7**
SM-only							
Age (1)	-	.19	-.39*	-.09	-.33*	-.06	-.28

Age SM diagnosis (2)	.19	-	-.34*	.14	.05	.12	.09
SM (3)	-.39*	-.34**	-	-.07	.03	-.32	-.25
AASQ (4)	-.09	.14	-.07	-	.43**	.25	.69***
General Anxiety (5)	-.33*	.05	.03	.43**	-	.55***	.59**
Social Anxiety (6)	-.06	.12	.32*	.25	.55***	-	.39*
Sensory Profile (7)	-.28	.09	-.25	.68***	.59***	.29*	-
Low Registration	-.85	.02	-.09	.44**	.24	.27	.62***
Sensory Seeking	-.28	-.31	-.05	.54***	.32*	.20	.69***
Sensory Sensitivity	-.27	.09	-.23	.61***	.57**	.35*	.92***
Sensory Avoidance	-.10	.02	-.34*	.53**	.36*	.59***	.78***
SM+ASD							
Age (1)	_	.05	-.04	.07	.19	-.07	.16
Age at SM (2)	.05	_	.42**	-.22	.10	-.16	-.22
SM (3)	-.04	.42**	-	-.07	-.05	-.22	-.05
AASQ (4)	.07	.14	-.07	-	.43**	.25	.68***
General Anxiety (5)	.19	.10	-.05	.38*	-	.47**	.43**
Social Anxiety (6)	-.07	-.16	-.22	.14	.47**	-	.21
Sensory Profile (7)	.16	-.22	-.05	.83***	.43**	.21	-
Low Registration	.09	-.25	.06	.54***	.38*	.03	.71***
Sensory Seeking	.15	-.06	.17	.52**	.23	.07	.72***
Sensory Sensitivity	.27	-.15	.01	.79**	.36*	.14	.93***
Sensory Avoidance	.09	-.08	-.03	.57***	.54***	.49**	.73***

*Note: *p < .05, **p < .01, ***p < .001*

Figure Captions

Figure I. Sensory behaviours as mediators of the relationship between group and social anxiety.

Figure II. Sensory Avoidance as a mediator in the relationship between group and social anxiety