Potentially traumatic experiences and behavioural symptoms in adults with autism and intellectual disability referred for psychiatric assessment

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ABSTRACT

Background: Individuals with autism spectrum disorder (ASD) and intellectual disability (ID) more frequently experience potentially traumatic events (PTEs), and may be more vulnerable to trauma-related symptoms. However, it is unclear how such symptoms are captured on tools used for behavioural and psychiatric assessment in this population.
Aims: To explore whether and how PTEs are associated with symptom reports in adults with ASD and ID.
Methods and procedures: Associations and group differences for death of a close relative and serious disease/injury in a close relative/caregiver/friend were explored in a clinical sample of 171 adults with ASD and ID referred for psychiatric assessment. Symptoms were measured using Aberrant Behavior Checklist (ABC) and Psychopathology in Autism Checklist (PAC).
Outcomes and results: Disease/injury was associated with higher scores on ABC irritability, ABC hyperactivity and self-injurious behaviour. Death was associated with lower scores on ABC lethargy and ABC stereotypic behaviour. Some associations reached significance only when controlling for ASD, ID, or verbal language skills, but the identified associations were not robust. No associations were found for PAC.
Conclusions and implications: There is a risk of under-appreciating the impact of PTEs in this population unless ASD, ID and verbal language skills are taken into account.

What this paper adds

The current, exploratory study provides several hypotheses for future studies regarding the presentation of trauma-related symptoms in adults with autism spectrum disorder (ASD) and intellectual disability (ID). Though the results should be interpreted with caution, they suggest that trauma-related symptoms may be more easily captured on a measure of "challenging behaviours" (Aberrant Behavior Checklist; ABC) than on a screening measure for psychiatric disorder developed for this population (Psychopathology in Autism Checklist). In conjunction with results from previous studies using the ABC to explore trauma-related symptoms, the current results suggest that the ABC scales irritability and hyperactivity in particular may be helpful in trauma assessments in ASD/ID.

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However, multidimensional, idiographic approaches to assessment are likely necessary for adequate recognition of trauma-related symptoms in this population, including taking account of the specific individual's historic and current presentations of ASD, level of ID, and verbal language skills. If these underlying conditions are not included in assessment, there may be a risk of under-appreciating the impact of potentially traumatic experiences on behaviour in this population. Moreover, the results from the current study suggest that caution is required when extrapolating findings regarding manifestations of trauma-related symptoms from individuals with mild/moderate ID to individuals with severe/profound ID. Finally, these results are in line with previous suggestions of self-injurious behaviour as a possible trauma-related symptom in adults with ASD and ID, particularly in individuals with limited verbal language skills.

1. Introduction

Individuals with co-occurring autism spectrum disorder (ASD) and intellectual disability (ID) experience potentially traumatic events more frequently than the general population (McDonnell et al., 2019; Gotby, Lichtenstein, Långström, & Pettersson, 2018; Dinkler et al., 2017; Sullivan & Knutson, 2000). Following such events, these individuals seem to be more vulnerable to develop trauma-related symptoms, including post-traumatic stress disorder (PTSD) (Brewin, Rumball, & Happé, 2019; Haruvi-Lamdan, Horesh, Zohar, Kraus, & Golan, 2020; Kerns, Newschaffer, & Berkowitz, 2015; McCarthy, Blanco, Gaus, Razza, & Tomasulo, 2017; Peterson et al., 2019; Rumball, Happé, & Grey, 2020; Wigham & Emerson, 2015). To meet criteria for PTSD in the DSM-5, the traumatic experience in question must involve threatened or witnessed death, actual or threatened serious injury, or sexual violence (American Psychiatric Association, 2013). In the ICD 11, the traumatic experience is required to be an "extremely threatening or horrific event or series of events" (World Health Organization, 2018).

However, there has been considerable debate regarding what types of events may be considered traumatic experiences (Larsen & Berenbaum, 2017; Wakefield, 2013). Despite their potential influences on an individual's psychological status and well-being, life events have traditionally been conceptualised as distinct from traumatic events (Mol et al., 2005), but it remains unclear whether they are different concepts or part of a continuum (Martorell & Tsakanikos, 2008). Moreover, the subjective perception of an event is critical to the subsequent development of trauma-related symptoms (Ehlers & Clark, 2000), and life events have been found to generate PTSD symptoms in the general population (Larsen & Berenbaum, 2017; Mol et al., 2005). For individuals with ID, establishing a clear distinction between trauma and life events is particularly challenging, because events perceived as harmless by others may be perceived as threatening or traumatic due to these individuals' difficulties in understanding, analysing and coping with events (Kildahl, Helverschou, Bakken, & Oddli, 2020a; Martorell & Tsakanikos, 2008; McCarthy et al., 2017).

In line with this, several authors have suggested that people with ID may develop trauma-related symptoms following less severe incidents than those described in the diagnostic criteria for PTSD (Martorell & Tsakanikos, 2008; McCarthy et al., 2017; Mevissen, Didden, & de Jongh, 2016). Similar suggestions has been made for individuals with ASD, including how the differing characteristics of sensation, perception, social awareness, cognition and understanding in these individuals may alter what events are perceived as traumatic (Brewin et al., 2019; Haruvi-Lamdan, Horesh, & Golan, 2018; Kerns et al., 2015). Recent findings in line with these suggestions have been made for adults with ID (Rittmannsberger, Weber, & Lueger-Schuster, 2020), adults with ASD (Haruvi-Lamdan et al., 2020; Rumball et al., 2020), and adults with co-occurring ASD and ID (Kildahl et al., 2020a). Furthermore, individuals with ASD seem to be at a particularly increased risk of bullying (Haruvi-Lamdan et al., 2020; Zeedyk, Rodriguez, Tipton, Baker, & Blacher, 2014), which has also been linked to development of PTSD symptoms (Hoover & Kaufman, 2018).

1.1. Assessment of PTSD and trauma-related symptoms in ASD and ID

Assessment of psychiatric disorders, including trauma-related disorders, is challenging in individuals with ASD and ID (Bakken, Helverschou, Høidal, & Martinsen, 2016; Kerns et al., 2019; Kildahl, Bakken, Iversen, & Helverschou, 2019; Underwood, McCarthy, Chaplin, & Bertelli, 2015). These individuals often have difficulties verbally reporting traumatic experience and symptoms, and assessments may rely on caregivers' recognition of behavioural expressions of symptoms (Bakken et al., 2016). However, current knowledge regarding behavioural expressions of PTSD seems limited (Daveney, Hassiotis, Katona, Matcham, & Sen, 2019; Kildahl et al., 2019; Rittmannsberger, Kocman, Weber, & Lueger-Schuster, 2019; Rumball, 2019): The symptoms of PTSD that seem most easily observable in this population, those involving altered arousal and reactivity and negative changes to cognition and mood, are not specific to trauma and PTSD (Haruvi-Lamdan et al., 2020; Kildahl et al., 2019). It has therefore been suggested that PTSD and trauma-related symptoms in individuals with ASD and ID may easily be misattributed to the underlying conditions or other, co-occurring conditions such as anxiety, depression or challenging behaviour (Daveney et al., 2019; Kildahl, Helverschou, & Oddli, 2020; Kildahl et al., 2019; Mevissen et al., 2016). Recognition of the more trauma-specific symptoms of re-experiencing and avoidance may rely on caregivers having knowledge of the individual's traumatic experience (Kildahl, Helverschou, Bakken, & Oddli, 2020b; Kildahl et al., 2019).

Another challenge in psychiatric assessments in individuals with ASD and ID is the current lack of appropriate diagnostic instruments (Bakken et al., 2016; Underwood et al., 2015). Some screening instruments have been developed specifically for this population, such as the Psychopathology in Autism Checklist (PAC) (Helverschou, Bakken, & Martinsen, 2009), and there are well-studied assessment tools for individuals with ID that also seem to be appropriate for individuals with co-occurring ASD, including the Aberrant Behavior Checklist (ABC) (Aman, Singh, Stewart, & Field, 1985; Aman, 2012; Flynn et al., 2017; Halvorsen et al., 2019). However, neither of these instruments includes scales for PTSD or trauma-related symptoms, and it is currently unclear whether and how trauma-related disorders are captured by these measures in adults with ASD and ID.

In a recent study, experienced mental health clinicians were interviewed regarding their experiences identifying PTSD in adults with ASD and ID (Kildahl et al., 2020a). Reports indicated that manifestations of trauma-related symptoms vary considerably between individuals within this population. Level of ID was viewed as contributing to this variation through the often limited communicative and behavioural repertoires of these individuals (see also McCarthy et al., 2017). In line with suggestions by Kerns et al. (2015; see also Haruvi-Lamdan et al., 2018), also ASD was viewed as influencing symptom expression, as was other co-occurring somatic or psychiatric conditions.

1.2. Behavioural symptoms associated with trauma and PTSD in ASD/ID

Using the ABC in a clinical sample of children, adolescents and young adults (ages 4–21) with ASD, Brenner, Pan, Mazefsky, Smith and Gabriels (2018) found reported abuse to be associated with increased irritability and lethargy, as well as loss of interest, intrusive thoughts, and distressing memories using other measures. Mehtar and Mukaddes (2011) used the ABC in a clinical sample of children and adolescents (ages 6–18), finding trauma exposure to be associated with disruptive behaviours. While this study used the Turkish version of the ABC, which has a different factor structure and is therefore difficult to compare to Brenner et al. (2018), the three items comprising the disruptive behaviour scale all concern self-injurious behaviours (SIB) and are included in the irritability scale in the ABC's original factor structure (Aman, 2012; Sucuoğlu, 2003). In a population study based on clinical and social service records, McDonnell et al. (2019) found abuse in children and adolescents with ASD to be associated with aggression, hyperactivity, and temper tantrums. While a substantial proportion of the samples in these studies were children and adolescents with a co-occurring ID; 42 % in Brenner et al. (2018), 72.5 % in Mehtar and Mukaddes (2011), and 48 % in (McDonnell et al., 2019), data on behavioural symptoms were not presented separately for individuals with and without co-occurring ID. More recently, Rittmannsberger, Yanagida, Weber, and Lueger-Schuster (2020) found associations between informant-rated trauma and ABC irritability to be mediated by severity and frequency of PTSD symptoms in a sample of adults with mild to moderate ID and trauma experience (ages 20–56). They also found associations between informant-rated trauma and the ABC scales hyperactivity and inappropriate speech, which were both mediated by PTSD symptom severity.

In 18 adults with severe ID (mean age 30.8 years), of which six had co-occurring ASD, abuse was found to be associated with a range of emotional, physiological and behavioural symptoms of distress (Rowsell, Clare, & Murphy, 2013). This included loss of interest, increased irritability, signs of altered arousal, SIB, and a range of other behaviours including aggressive, non-compliant, stereotyped, sexualized, withdrawn or otherwise disturbed behaviours (Murphy, O'Callaghan, & Clare, 2007; Rowsell et al., 2013). Loss of skills across several domains was reported, including social skills and self-help (Murphy et al., 2007). Also a recent, qualitative study reported onset of SIB following traumatic experiences in adults with ASD and ID (Kildahl et al., 2020b). This is of particular concern, as previous findings suggest that SIB may be highly persistent over time in adults with ID (Totsika, Toogood, Hastings, & Lewis, 2008).

While previous studies have been important in highlighting the impact of trauma on individuals with ASD and ID, it remains unclear how these findings may be translated into clinical practice to aid the *detection* of trauma in mental health services for adults with ASD and ID. The studies have relied on informant report or clinical records, where informants have been aware of the individuals' traumatic experiences. However, informants may not necessarily have knowledge of such experiences, or even understand that an experience is perceived as traumatic, if the individual in question is not able to communicate this verbally (Kildahl et al., 2020a; Kildahl et al., 2019; Kildahl, Helverschou, & Oddli, 2020; Rowsell et al., 2013; Murphy et al., 2007; Ryan, 1994). To improve detection, it would thus be helpful to explore the impact of events which are likely to be reliable for informant report. Moreover, there have been few investigations of potentially traumatic experiences other than abuse, maltreatment or bullying in this population, and there is a lack of studies in adults. Finally, while ASD and ID both seem to influence manifestations of trauma-related symptoms, their relative contributions have been sparsely explored.

1.3. Aims

The current study aims to explore how two potentially traumatic events, the death of a close relative and serious disease/injury in a close relative, caregiver or friend, are associated with group differences in symptom reports in a clinical sample of adults with ASD and ID referred for psychiatric assessment. While these events may not be considered traumatic according to current diagnostic definitions, they are within the range of events suggested as potentially traumatic for individuals with ID (Kildahl et al., 2020a; McCarthy et al., 2017; Mevissen et al., 2016). Specifically, the study addresses three questions:

1 Are there group differences on measures of behavioural symptoms between those who have experienced these events and those who have not?
2 Are associations between these events and symptom measures present when controlling for levels of ASD symptoms, level of ID, and verbal language skills?
3 Are there associations between these events and symptom reports that are only present when controlling for levels of ASD symptoms, level of ID, or verbal language skills?

2. Material and methods

2.1. Sample

Participants were 171 adolescents and adults (48 females, 123 males) aged 14–68 ($M = 27.9$, $SD = 10.8$) with ASD and ID recruited from eight clinics throughout Norway as part of the AUP (Autism, Intellectual Disability, Mental Illness) multicentre study (Helverschou et al., in press). Individuals were eligible for participation if they had confirmed diagnoses of ASD and ID in accordance with the ICD-10 (World Health Organization, 1992), and were referred for psychiatric assessment, or a co-occurring psychiatric disorder was suspected. Level of ID had been classified as mild/moderate in 112 cases (65 %) and severe/profound in 59 cases (35 %). The current study uses data from the initial assessment (T1). No information regarding socio-demographic background was collected, but the vast majority of participants (and adults with ASD and ID in Norway in general) receive disability benefits and live in publicly funded assisted living where services are individually adapted and provided by the local municipalities (see Bakken et al., 2018).

2.2. Research ethics

The AUP multicentre study was approved by the Data Protection Official at the Oslo University Hospital (#2010/19579). Only anonymised data were processed. Due to participants' often limited capacity to consent, written consent was obtained for all participants from their legal guardian.

2.3. Measures

2.3.1. Potentially traumatic events

Events were reported by informants (family members or professional caregivers), using a tool for assessment of service needs and environmental factors (Myrbakk, 2008). The instrument includes questions as to whether any of 15 specific events have been experienced by the participant over the past year. For the current study, two of the events most likely to be reliable for informant report were chosen a priori: Death of a close relative and serious disease/injury in a close relative/caregiver/friend. Specific examples included the death of parents or grandparents, and dementia in parents. Both events were coded as dichotomous variables (yes = 1, no = 0).

2.3.2. Psychopathology in Autism Checklist

The PAC is a screening tool for psychiatric symptoms developed for individuals with ASD and ID (Helverschou et al., 2009). The PAC contains 42 items describing psychiatric symptoms which have been considered not to overlap with symptoms of ASD, and has shown good psychometric properties in individuals with co-occurring ASD and ID (Helverschou et al., 2009). Items are rated by informants on a four-point scale (not a problem = 1, minor problem = 2, moderate problem = 3, severe problem = 4). Scores for 30 items are summed in four scales: psychosis, depression, obsessive-compulsive disorder, and anxiety. The remaining 12 items are summed into a scale of general adjustment difficulties.

2.3.3. Aberrant Behavior Checklist

The ABC is frequently used in assessment of problematic behaviours ("challenging behaviour") in individuals with ID (Aman, 2012; Aman et al., 1985). Good psychometric properties have been demonstrated across varying levels of ID (Aman, 2012; Flynn et al., 2017), in children and adolescents with ASD (Brinkley et al., 2007; Kaat, Lecavalier, & Aman, 2014), and for its Norwegian version (Halvorsen et al., 2019). The ABC contains 58 behaviour descriptions which are rated by informants on a four-point scale (not a problem = 0, mild problem = 1, moderate problem = 2, severe problem = 3). Scores are summed into five scales: irritability/agitation/crying, lethargy/social withdrawal, stereotypic behaviour, hyperactivity/noncompliance, and inappropriate speech.

2.3.4. Self-injurious behaviours

Though the PAC and the ABC both contain items describing SIB, information about SIB is not easily derived from scale scores on either instrument. Two previous studies investigating the properties of the ABC in ASD populations identified SIB as a separate factor (Brinkley et al., 2007; Halvorsen et al., 2019), which is also identical to the disruptive behaviours scale found to be associated with trauma by Mehtar and Mukaddes (2011; Sucuoğlu, 2003). The three items constituting this factor (2, 50, 52) were combined with PAC item 7 "Self-injures" into an ad hoc scale for SIB. The latter item was recoded on a 0–3 scale for this purpose, resulting in this scale having a range of 0−12. The scale showed acceptable internal consistency ($\alpha = 0.79$), and acceptable inter-item correlations (range = 0.40 ± 0.58).

2.3.5. Social Communication Questionnaire

The Social Communication Questionnaire (SCQ), current version (Rutter et al., 2003), containing 40 yes/no items describing ASD symptoms, was completed by informants and used to measure levels of ASD symptoms. Because ranges for SCQ scores differ by level of verbal skill, scores were re-calculated to make ranges 0−39 for all participants.

2.3.6. Level of ID

Level of ID was reported by clinicians as either mild/moderate (score = 0) or severe/profound (score = 1), based on clinical

background information and scores from the Vineland Adaptive Behavior Scales, second edition (Sparrow, Cicchetti, & Balla, 2008). More specific data on intellectual functioning were not available due to the difficulties involved in obtaining such data in individuals with co-occurring, severe cognitive, psychiatric and/or behavioural challenges.

2.3.7. Verbal language skills

For verbal language skills, informants' responses to the PAC (Helverschou et al., 2009) question "How does the client communicate?" were recoded from its four possible responses (a: speaks using whole phrases/sentences, b: uses speech plus alternative communication, c: uses a few words/signs/gestures, d: uses own made up signs/gestures) into a dichotomous variable as "Speaks in complete sentences" (a, score = 0) or "Limited verbal language skills" (b/c/d, score = 1).

2.4. Analysis

Data were analysed in SPSS Statistics 25. For calculation of scales, missing items were treated as scores of "not a problem". Group differences on PAC/ABC/SIB, age, and SCQ were examined for both events using Welch's t-tests (Delacre, Lakens, & Leys, 2017). Separate, binary logistic regressions were used to check whether groups differed for sex, level of ID, or level of verbal language skills.

To determine whether sex and age were confounding factors, Welch's t-tests were used to examine group differences between females and males on the dependent variables and Pearson's correlations were used to examine associations with age. On PAC anxiety, males ($M = 11.65$, $SD = 3.96$) scored significantly higher than females ($M = 9.81$, $SD = 2.76$) $F(1, 124.35) = 12.39$, $p = .001$. Males also scored significantly higher ($M = 13.43$, $SD = 4.85$) than females ($M = 11.90$, $SD = 4.20$), $F(1, 98.46) = 4.22$, $p = .043$ on PAC obsessive-compulsive disorder. Age was negatively associated with ABC irritability, $r(160) = -.18$, $p = .022$, and PAC psychosis $r(160) = -.16$, $p = .048$. All further analyses were controlled for age and sex.

Pearson's correlations were used to check for multicollinearity. No correlations were above 0.8 ($range = 0.00 \pm 0.74$). Hierarchical multiple regressions using the Enter model were used to examine associations between events and PAC/ABC/SIB. Four separate hierarchical regressions were conducted for each outcome measure for each event (A-D). Blocks one and two were identical for all regressions with age and sex being entered in block one, and the event in block two. Covariates were entered in block three, with analysis A (SCQ), B (level of ID), and C (verbal language skills) only including one covariate. For analysis D, the three covariates were entered into the model simultaneously. Cook's distance was used to look for outliers. Data were analysed both with and without the outliers, but due to the heterogeneity of the population under study it was decided to present the results with outliers included. If removal of an outlier changed the significance of the result, this is mentioned in the presentation below. To check for possible moderation effects, interaction terms were created for possible two-way interactions between the respective events and SCQ, level of ID, or verbal language skills. These were entered separately into the final regression model including all three covariates. To correct for multiple comparisons, the Benjamini-Hochberg procedure (Benjamini & Hochberg, 1995) was applied to p-values for t-tests and associations between events and dependent variables uncovered in the regressions.

3. Results

3.1. Potentially traumatic events

Death of a close relative had been experienced by 15 participants, while serious disease/injury in a close relative/caregiver/friend had been experienced by 20 participants. One participant had experienced both events. Demographic distribution is presented in Table 1, and logistic regressions for events by demographic variables are presented in Table 2. Significant differences between groups were uncovered for sex, level of ID and verbal language skills for death of a close relative, but not for serious disease/injury. Sample means and group differences by event are presented in Table 3. Only two group differences were statistically significant: Individuals having experienced the death of a close relative had lower ABC stereotypic behaviour scores ($M = 4.00$, $SD = 3.34$) than those who had not ($M = 6.85$, $SD = 4.53$), $F(1, 19.34) = 9.31$, $p = .006$. Those who had experienced this event also had lower ABC lethargy scores ($M = 10.60$, $SD = 9.64$) than those who had not ($M = 16.37$, $SD = 10.05$), $F(1, 17.27) = 5.14$, $p = .036$.

Table 1
Distribution of Events by Sex, Level of Intellectual Disability (ID), and Verbal Language Skills.

	Total sample	Sex		Level of ID		Verbal language skills	
		Females	Males	Mild/moderate ID	Severe/profound ID	Speaks in complete sentences	Limited verbal language skills
Serious disease/injury in a close relative, caregiver, or friend							
Yes	20	2	18	13	7	15	5
No	151	46	105	99	52	85	66
Summary	171	48	123	112	59	100	71
Death of a close relative							
Yes	15	8	7	14	1	13	2
No	156	40	116	98	58	87	69
Summary	171	48	123	112	59	100	71

Note. One individual had experienced, and was included in the "Yes" group for, both events.

Table 2
Binary Logistic Regressions for Events by Demographics.

	B	SE B	Wald χ2	df	p	OR	95 % CI OR
Serious disease/injury in a close relative, caregiver, or friend							
Sex	1.37	0.77	3.21	1	.073	3.94	[0.88, 17.70]
Level of ID	−0.03	0.50	0.00	1	.960	0.98	[0.37, 2.60]
Verbal language skills	0.85	0.54	2.45	1	.119	2.33	[0.81, 6.73]
Death of a close relative							
Sex	−1.20	0.55	4.76	1	.029*	0.30	[0.10, 0.89]
Level of ID	2.12	1.05	4.07	1	.044*	8.29	[1.06, 64.66]
Verbal language skills	1.64	0.78	4.46	1	.035*	5.16	[1.13, 23.61]

Note. Separate analyses were conducted for each of the demographic variables for each event. *p=<.05.

3.2. ABC irritability/agitation/crying

Hierarchical regressions addressing the relationship between serious disease/injury and ABC irritability revealed a significant association only when controlling for verbal language skills, see Table 4. Serious disease/injury, higher SCQ scores, and having limited verbal language skills were all associated with higher scores on ABC irritability. No interactions were identified, and no significant results were found for death of a close relative (Table S1).

3.3. ABC lethargy/social withdrawal

Hierarchical regressions addressing the relationship between death of a close relative and ABC lethargy revealed a significant association, but the regression model was only significant when controlling for SCQ score, see Table 5. Effects of predictors were opposite; higher SCQ scores were associated with higher scores for ABC lethargy, while death of a close relative was associated with lower scores. Removal of one, extreme outlier resulted in the model displaying statistical significance also in block 2. No interactions were uncovered between the event and SCQ. Interactions were not explored for level of ID and verbal language skills due to small group sizes. No significant results emerged for serious disease/injury (Table S2).

3.4. ABC stereotypic behaviour

Hierarchical regressions addressing the relationship between death of a close relative and ABC stereotypic behaviour revealed a significant association only when controlling for SCQ or level of ID, see Table 6. When all covariates were entered into the model, only associations with SCQ and death of a close relative remained significant. Effects of these on ABC stereotypic behaviour were opposite; higher SCQ scores were associated with higher scores on ABC stereotypic behaviour and death of a close relative with lower scores. No interactions were uncovered between the event and SCQ. Interactions were not explored for level of ID and verbal language skills due to small group sizes. Two outliers were identified, but removal of these did not change significance of results. No significant results emerged for serious disease/injury (Table S3).

3.5. ABC hyperactivity/noncompliance

Hierarchical regressions addressing the relationship between serious disease/injury and ABC hyperactivity revealed a significant association when controlling for either SCQ, level of ID, or verbal language skills, see Table 7. The model was not significant without including covariates. When all covariates were entered into the model, verbal language skills was no longer a significant predictor. Serious disease/injury, SCQ scores, and having more severe levels of ID were all associated with higher scores on ABC hyperactivity. No interactions were uncovered, and no significant results were found for death of a close relative (Table S4).

3.6. Self-injurious behaviours

Hierarchical regressions addressing the relationship between serious disease/injury and SIB revealed an association that remained significant throughout all analyses – with and without controlling for covariates, see Table 8. In the model including all covariates, serious disease/injury, higher SCQ scores, and having more limited verbal language skills were all associated with higher scores for SIB. Removing three outliers did not significantly alter the results. The check for moderation effects uncovered a significant interaction between the event and verbal language skills. Including this interaction in the model resulted in the main effects of neither the event nor the other predictors being statistically significant; see Table 8, block 4. To explore the direction of the interaction, separate Welch's t-tests were conducted for serious disease/injury within each level of verbal language skills. Participants with limited verbal language skills who had experienced this event had significantly higher scores for SIB ($n = 5$, $M = 9.60$, $SD = 2.79$) than those who had not ($n = 66$, $M = 5.05$, $SD = 3.51$), $F(1, 5.01) = 11.88$, $p = .018$. For participants speaking in complete sentences, there was no significant difference in SIB score between those who had experienced the event ($n = 15$, $M = 3.73$, $SD = 3.53$) and those who had not ($n = 85$, $M = 2.78$, $SD = 2.83$), $F(1, 17.31) = 0.99$, $p = .334$. No significant results emerged for death of a close relative (Table S5).

Table 3
Age and Scale Scores with Group Differences Examined Using Welch's T-tests.

| | Min–max | Sample | | Serious disease/injury in close relative/caregiver/friend | | | | | | | Death of a close relative | | | | | | |
| | | | | No (*n* = 151) | | Yes (*n* = 20) | | | | | No (*n* = 156) | | Yes (*n* = 15) | | | | |
		M	*SD*	*M*	*SD*	*M*	*SD*	*df*	*F*	*p*	*M*	*SD*	*M*	*SD*	*df*	*F*	*p*
Age	14−68	27.89	10.80	27.36	10.56	31.90	12.00	(1, 23.07)	2.60	.121	27.56	10.83	31.33	5.58	(1, 17.16)	1.84	.192
SCQ	0−39 (15)	22.14	6.52	22.19	6.55	21.77	6.44	(1, 24.50)	0.08	.784	22.17	6.62	21.87	5.58	(1, 18.02)	0.04	.845
PAC general adjustment difficulties	12−48 (24)	28.63	6.52	28.62	6.72	28.65	4.85	(1, 29.68)	0.00	.982	28.60	6.55	28.87	6.44	(1, 16.91)	0.02	.881
PAC psychosis	10−40 (23)	20.49	5.93	20.28	5.92	22.10	5.88	(1, 24.39)	1.69	.206	20.47	6.01	20.80	5.23	(1, 17.76)	0.06	.816
PAC depression	7−28 (14)	15.26	4.99	15.38	5.10	14.30	4.09	(1, 27.47)	1.16	.290	15.35	5.00	14.33	4.97	(1, 16.85)	0.57	.461
PAC obsessive-compulsive disorder	7−28 (16.8)	13.00	4.72	12.97	4.75	13.20	4.56	(1, 24.79)	0.04	.837	13.17	4.79	11.20	3.53	(1, 19.34)	3.98	.060
PAC anxiety	6−24 (10.8)	11.18	3.80	11.11	3.74	11.65	4.26	(1, 23.06)	0.29	.596	11.24	3.82	10.53	3.58	(1, 17.22)	0.52	.480
ABC irritability	0−45	16.84	10.11	16.50	10.20	19.40	9.25	(1, 25.53)	1.70	.204	16.86	10.00	16.60	11.62	(1, 16.06)	0.01	.935
ABC lethargy	0−48	15.86	10.10	14.85	8.62	15.99	10.29	(1, 26.74)	0.30	.591	16.37	10.05	10.60	9.34	(1, 17.27)	5.14	.036*
ABC stereotypic behaviour	0−21	6.60	4.50	6.53	4.51	7.15	4.57	(1, 24.16)	0.33	.573	6.85	4.53	4.00	3.34	(1, 19.34)	9.31	.006**
ABC hyperactivity	0−48	16.65	9.35	16.16	9.26	20.35	9.43	(1, 24.11)	3.50	.073	16.90	9.34	14.07	9.32	(1, 16.82)	1.26	.277
ABC inappropriate speech	0−12	3.78	3.16	3.64	3.11	4.90	3.32	(1, 23.64)	2.59	.121	3.74	3.05	4.20	4.18	(1, 15.47)	0.17	.686
Self-injurious behaviour	0−12	3.94	3.46	3.77	3.33	5.20	4.20	(1, 22.28)	2.15	.157	4.01	3.47	3.13	3.50	(1, 16.73)	0.87	.366

Note. *p*=<.05, **p*=<.01. For scales using cut-off values, these are given in parentheses with the min/max of the scale.

Table 4

Hierarchical Multiple Regression for Serious Disease/Injury in a Close Relative/Caregiver/Friend on ABC Irritability.

Block	Predictors	Unstandardized coefficients			Standardized coefficients		R^2	Adjusted R^2	ΔR^2	F	p
		B	SE	95 % CI	β	p					
1							.049	.037	.049	4.29	.015*
	Age	−0.20	0.07	[−0.34, −0.06]	−.21	.005**					
	Sex	1.73	1.69	[−1.62, 5.07]	.08	.309					
2							.067	.050	.018	3.99	.009**
	Age	−0.22	0.07	[−0.36, −0.08]	−.23	.002**					
	Sex	2.22	1.70	[−1.15, 5.58]	.10	.195					
	Serious disease/injury	4.35	2.40	[−0.39, 9.08]	.14	.072					
A3							.125	.104	.058	5.93	<.001***
	Age	−0.20	0.07	[−0.34, −0.07]	−.22	.004**					
	Sex	2.11	1.66	[−1.16, 5.38]	.09	.204					
	Serious disease/injury	4.41	2.33	[−0.19, 9.01]	.14	.060					
	SCQ	0.38	0.11	[0.15, 0.60]	.24	.001***					
B3							.108	.086	.041	5.02	.001***
	Age	−0.21	0.07	[−0.36, −0.08]	−.23	.002**					
	Sex	2.04	1.67	[−1.27, 5.34]	.09	.225					
	Serious disease/injury	4.29	2.35	[−0.35, 8.93]	.14	.070					
	Level of ID	4.30	1.56	[1.22, 7.37]	.20	.006**					
C3							.111	.090	.044	5.20	.001***
	Age	−0.21	0.07	[−0.35, −0.07]	−.22	.003**					
	Sex	1.76	1.68	[−1.55, 5.07]	.08	.295					
	Serious disease/injury	5.03	2.36	[0.37, 9,69]	.16	.034*					
	Verbal language skills	4.37	1.51	[1.37, 7.36]	.21	.005**					
D3							.151	.120	.084	4.87	<.001***
	Age	−0.20	0.07	[−0.34, −0.07]	−.21	.004**					
	Sex	1.84	1.65	[−1.42, 5.09]	.08	.267					
	Serious disease/injury	4.69	2.33	[0.10, 9.29]	.15	.046*					
	SCQ	0.29	0.12	[0.05, 0.52]	.19	.016*					
	Level of ID	1.97	1.91	[−1.80, 5.74]	.09	.303					
	Verbal language skills	2.05	1.88	[−1.66, 5.77]	.10	.277					

Note. For all block 3 results, ΔR^2 refers to the change from block 2. *p=<.05, **p=<.01, ***p=<.001.

3.7. ABC inappropriate speech and PAC scales

No significant associations were found for either event on ABC inappropriate speech (Tables S6-S7) or PAC scales (Tables S8–S17) using hierarchical regressions. PAC scores were generally elevated, with four of five sample mean scores being above the recommended cut-off values (Helverschou et al., 2009). For ABC inappropriate speech, three outliers were identified whose removal would have resulted in serious disease/injury showing some significant associations at the $p < .05$ level.

3.8. Correction for multiple comparisons

Application of the Benjamini-Hochberg procedure for correction of multiple comparisons using false discovery rates of .05 or .10 resulted in no p-value from any of the significant associations from either t-tests or hierarchical regressions falling below the Benjamini-Hochberg critical value (Table S18).

4. Discussion

4.1. Main findings

In a sample of adults with co-occurring ASD and ID referred for psychiatric assessment, having experienced the death of a close relative within the last year was associated with having lower scores on the ABC scales stereotypic behaviour and lethargy. However, the regression model for lethargy was only significant when controlling for ASD symptoms, while the regression model for stereotypic behaviour was significant only when controlling for ASD symptoms or level of ID. The number of participants with severe/profound ID or limited verbal language skills having experienced this event was very small, and results regarding these factors should be interpreted with particular caution.

Having experienced serious disease or injury in a close relative, caregiver or friend was not associated with significant group differences on any of the included measures, but the regression models found it to be significantly associated with having higher scores for SIB, and higher scores on ABC irritability and hyperactivity. The association with irritability only reached statistical significance when controlling for verbal language skills, and the regression model for hyperactivity only reached significance when controlling for either ASD symptoms, level of ID, or verbal language skills. For the association between serious disease/injury and SIB, an interaction between the event and verbal language skills was uncovered; suggesting that level of verbal language skills may have moderated the

Table 5

Hierarchical Multiple Regression for Death of a Close Relative on ABC Lethargy.

Block	Predictors	Unstandardized coefficients			Standardized coefficients		R^2	Adjusted R^2	ΔR^2	F	p
		B	SE	95 % CI	β	p					
1							.000	−.011	.000	0.34	.967
	Age	0.02	0.07	[−0.13, 0.16]	.02	.822					
	Sex	0.19	1.73	[−3.23, 3.62]	.01	.911					
2							.029	.011	.028	1.65	.180
	Age	0.03	0.07	[−0.11, 0.17]	.03	.675					
	Sex	0.84	1.74	[−2.59, 4.27]	.04	.630					
	Death of a close relative	−6.11	2.77	[−11.57, −0.65]	−.17	.029*					
A3							.120	.099	.091	5.65	<.001***
	Age	0.05	0.07	[−0.09, 0.19]	.05	.464					
	Sex	0.68	1.66	[−2.60, 3.96]	.03	.681					
	Death of a close relative	−6.00	2.64	[−11.22, −0.79]	−.17	.024*					
	SCQ	0.47	0.11	[0.25, 0.69]	.30	<.001***					
B3							.029	.006	.000	1.24	.295
	Age	0.03	0.07	[−0.11, 0.17]	.03	.680					
	Sex	0.81	1.75	[−2.64, 4.26]	.04	.643					
	Death of a close relative	−5.99	2.83	[−11.58, −0.41]	−.17	.036*					
	Level of ID	0.36	1.65	[−2.90, 3.62]	.02	.828					
C3							.029	.005	.000	1.23	.300
	Age	0.03	0.07	[−0.11, 0.17]	.03	.678					
	Sex	0.85	1.76	[−2.63, 4.33]	.04	.630					
	Death of a close relative	−6.14	2.83	[−11.72, −0.55]	−.17	.032*					
	Verbal language skills	−0.07	1.61	[−3.24, 3.10]	−.00	.964					
D3							.130	.099	.102	4.10	.001***
	Age	0.05	0.07	[−0.09, 0.19]	.05	.474					
	Sex	1.02	1.68	[−2.29, 4.33]	.05	.544					
	Death of a close relative	−6.84	2.71	[−12.20, −1.48]	−.19	.013*					
	SCQ	0.52	0.12	[0.29, 0.76]	.34	<.001***					
	Level of ID	−0.50	1.93	[−4.31, 3.32]	−.02	.798					
	Verbal language skills	−1.99	1.90	[−5.73, 1.76]	−.10	.297					

Note. For all block 3 results, ΔR^2 refers to the change from block 2. *$p=$<.05, **$p=$<.01, ***$p=$<.001.

relationship between this event and SIB score. There was no overlap between scales found to be associated with the two events, and no associations were uncovered for PAC scales.

In order to check for robustness, a correction for multiple comparisons was applied, and the results indicate that the identified associations are not robust. Although the results failed to meet the specified criteria of the correction in the current sample, there is a possibility that the correction may not have affected the results in a larger sample. Moreover, the inclusion of an instrument (PAC) which provided no significant results may also have contributed negatively. While this underlines the importance of correcting for multiple testing and highlights that these results should be interpreted with caution, the exploratory nature of the current study and the lack of research in this area indicate that these results may be used as hypotheses for further investigation.

4.2. The ABC as a promising tool for use in trauma assessment in ASD/ID

In addition to the current study, three previous studies (Brenner et al., 2018; Mehtar & Mukaddes, 2011; Rittmannsberger, Yanagida et al., 2020) have explored associations between trauma exposure and ABC scores, using different methodologies and focusing on slightly differing populations. In line with the current results, both Brenner et al. and Rittmannsberger, Yanagida et al. found trauma to be associated with higher scores on ABC irritability. Both studies using adult samples (Rittmannsberger, Yanagida et al. and the current study) found trauma to be associated with higher scores on the ABC hyperactivity scale. Rittmannsberger, Yanagida et al. also uncovered an association with ABC inappropriate speech, which would have been found in the present study had the outliers been removed.

Mehtar and Mukaddes (2011) found trauma to be associated with higher scores on a scale consisting of three of the four items included in the current scale for SIB (Sucuoğlu, 2003). These items load on the ABC irritability scale in the original factor structure (Aman, 2012; Aman et al., 1985). While serious disease/injury in a close relative, caregiver or friend may not necessarily be considered a traumatic event according to diagnostic definitions (American Psychiatric Association, 2013), the ABC scales found to be associated with this event are thus in line with those found to be associated with trauma experience in the three previous studies (Brenner et al., 2018; Mehtar & Mukaddes, 2011; Rittmannsberger, Yanagida et al., 2020).

Findings for the two ABC scales associated with death of a close relative are more mixed, with no previous study finding associations with stereotypic behaviour. Brenner et al. (2018) found trauma to be associated with higher scores on ABC lethargy, which is opposite to the finding in the current study. In light of the previous studies and the lack of overlap with the other event, it is possible that the associations found for death of a close relative do not reflect a trauma reaction. Moreover, also studies on bereavement in ID using the ABC have found scores to be elevated for the bereaved group on ABC irritability, lethargy, and hyperactivity (MacHale &

Table 6
Hierarchical Multiple Regression for Death of a Close Relative on ABC Stereotypic Behaviour.

Block	Predictors	Unstandardized coefficients			Standardized coefficients		R^2	Adjusted R^2	ΔR^2	F	p
		B	SE	95 % CI	β	p					
1							.015	.004	.015	1.31	.274
	Age	−0.05	0.03	[−0.12, 0.01]	−.12	.109					
	Sex	0.16	0.77	[−1.36, 1.67]	.02	.838					
2							.045	.028	.030	2.65	.051
	Age	−0.05	0.03	[−0.11, 0.02]	−.11	.155					
	Sex	0.45	0.77	[−1.07, 1.97]	.05	.557					
	Death of a close relative	−2.81	1.22	[−5.22, −0.39]	−.18	.023*					
A3							.176	.156	.131	8.87	<.001***
	Age	−0.03	0.03	[−0.09, 0.02]	−.08	.247					
	Sex	0.37	0.72	[−1.05, 1.79]	.04	.607					
	Death of a close relative	−2.75	1.14	[−5.00, −0.50]	−.17	.017*					
	SCQ	0.25	0.05	[0.15, 0.35]	.36	<.001***					
B3							.058	.035	.013	2.56	.040*
	Age	−0.05	0.03	[−0.11, 0.02]	−.11	.144					
	Sex	0.37	0.77	[−1.15, 1.89]	.04	.630					
	Death of a close relative	−2.45	1.24	[−4.90, 0.01]	−.15	.050*					
	Level of ID	1.09	0.73	[−0.35, 2.52]	.12	.136					
C3							.077	.055	.032	3.46	.010**
	Age	−0.04	0.03	[−0.10, 0.02]	−.10	.182					
	Sex	0.19	0.77	[−1.33, 1.70]	.02	.807					
	Death of a close relative	−2.23	1.23	[−4.66, 0.20]	−.14	.072					
	Verbal language skills	1.66	0.70	[0.28, 3.04]	.18	.018*					
D3							.182	.152	.136	6.07	<.001***
	Age	−0.03	0.03	[−0.09, 0.03]	−.08	.271					
	Sex	0.26	0.73	[−1.17, 1.70]	.03	.718					
	Death of a close relative	−2.61	1.19	[−4.88, −0.25]	−.17	.030*					
	SCQ	0.24	0.05	[0.14, 0.34]	.34	<.001***					
	Level of ID	−0.44	0.93	[−1.98, 1.32]	−.05	.692					
	Verbal language skills	0.79	0.86	[−0.77, 2.48]	.09	.300					

Note. For all block 3 results, ΔR^2 refers to the change from block 2. *p=<.05, **p=<.01, ***p=<.001.

Carey, 2002) or on all five ABC scales (Hollins & Esterhuyzen, 1997). However, it has been suggested that delayed reactions may be common in bereavement in ID (Dodd, Dowling, & Hollins, 2005), and as the current data only included information that death of a close relative had been experienced within the last year, there might have been considerable variation between participants with regard to how recently this event had occurred. It is also possible that the lowered score for ABC lethargy may be a proxy for altered arousal, which was too subtle to be detected by the irritability or hyperactivity scales. However, in light of the lack of robustness and the lack of overlap with previous studies, it remains a possibility that this is a spurious finding.

Recent studies (Haruvi-Lamdan et al., 2020; Kildahl et al., 2020b; Kildahl et al., 2019; Rittmannsberger, Weber et al., 2020) have suggested that certain trauma-related symptoms may be more easily observable in individuals with ASD/ID, in particular symptoms involving altered arousal and reactivity. Several items on the ABC irritability and hyperactivity scales seem to overlap with how these symptoms have been described to manifest in this population (Kildahl et al., 2020b; Kildahl et al., 2019). Moreover, Rittmannsberger, Yanagida et al. (2020) found the relationship between trauma exposure and scores on these scales to be mediated by PTSD symptoms. Together, this suggests that further exploration of the applicability of the ABC in trauma assessment in ASD/ID is justified and may give cause for a cautious optimism.

4.3. Taking account of ASD symptoms, level of ID, and verbal language skills

The current findings highlight the need for trauma assessment in adults with ASD and ID to be multidimensional and take account of ASD symptoms and level of ID (Kerns et al., 2015; Kildahl et al., 2020a; Kildahl et al., 2019; Mevissen et al., 2016). It has also been suggested that ASD severity may be associated with an increased vulnerability to PTSD (Haruvi-Lamdan, Lebendiger, Golan, & Horesh, 2019). All dependent measures found to be associated with either event in the current study were also significantly associated with the ASD symptom measure, indicating that particular attention needs to be paid to ASD symptomology in clinical assessments and future research into the manifestation of trauma-related symptoms in adults with ASD/ID.

Moreover, effects of controlling for level of ID and verbal language skills were not identical, and an interaction was uncovered between one of the events and verbal language skills. This suggests level of ID and verbal language skills need to be considered separately in in explorations of trauma-related symptoms in ASD/ID. The current results are also in line with previous suggestions that SIB may constitute an expression of trauma-related symptoms in adults with ASD and ID, particularly in individuals with more limited verbal skills (Kildahl et al., 2020b; Murphy et al., 2007; Rowsell et al., 2013; see also Daveney et al., 2019; McCarthy et al., 2017; Ryan, 1994). Considering findings that these behaviours may be persistent in individuals with ID (Totsika et al., 2008), this is an important topic for future research. As knowledge concerning expressions of trauma-related symptoms in individuals with severe or profound ID

Table 7

Hierarchical Multiple Regression for Serious Disease/Injury in a Close Relative/Caregiver/Friend on ABC Hyperactivity.

Block	Predictors	Unstandardized coefficients			Standardized coefficients		R^2	Adjusted R^2	ΔR^2	F	p
		B	SE	95 % CI	β	p					
1							.013	.001	.013	1.10	.334
	Age	−0.09	0.07	[−0.22, 0.04]	−.10	.179					
	Sex	−0.82	1.60	[−3.97, 2.33]	−.04	.607					
2							.037	.020	.024	2.17	.095
	Age	−0.11	0.07	[−0.24, 0.02]	−.13	.100					
	Sex	−0.30	1.60	[−3.46, 2.86]	−.01	.852					
	Serious disease/injury	4.63	2.25	[0.19, 9.07]	.16	.041*					
A3							.128	.107	.091	6.09	<.001***
	Age	−0.09	0.06	[−0.22, 0.03]	−.11	.153					
	Sex	−0.42	1.53	[−3.44, 2.59]	−.02	.782					
	Serious disease/injury	4.70	2.15	[0.46, 8.95]	.16	.030*					
	SCQ	0.43	0.10	[0.23, 0.64]	.30	<.001***					
B3							.133	.112	.096	6.38	<.001***
	Age	−0.11	0.06	[−0.24, 0.01]	−.13	.081					
	Sex	−0.56	1.52	[−3.57, 2.45]	−.03	.714					
	Serious disease/injury	4.55	2.14	[0.32, 8.78]	.16	.035*					
	Level of ID	6.08	1.42	[3.28, 8.88]	.31	<.001***					
C3							.109	.087	.071	5.05	.001***
	Age	−0.10	0.06	[−0.23, 0.03]	−.12	.124					
	Sex	−0.84	1.55	[−3.90, 2.22]	−.04	.589					
	Serious disease/injury	5.43	2.18	[1.12, 9.74]	.19	.014*					
	Verbal language skills	5.12	1.40	[2.35, 7.89]	.27	<.001***					
D3							.188	.158	.150	6.32	<.001***
	Age	−0.09	0.06	[−0.22, 0.03]	−.11	.132					
	Sex	−0.72	1.49	[−3.67, 2.22]	−.04	.628					
	Serious disease/injury	4.87	2.11	[0.72, 9.03]	.17	.022*					
	SCQ	0.32	0.11	[0.11, 0.53]	.22	.003**					
	Level of ID	3.95	1.73	[0.55, 7.36]	.20	.023*					
	Verbal language skills	1.54	1.70	[−1.82, 4.90]	.08	.366					

Note. For all block 3 results, ΔR^2 refers to the change from block 2. *p=<.05, **p=<.01, ***p=<.001.

seems particularly limited (Daveney et al., 2019; McCarthy et al., 2017; Wigham & Emerson, 2015), these findings further indicate that caution is advised when generalising existing knowledge obtained in samples of individuals with mild/moderate ID to individuals with severe/profound ID, highlighting an urgent need for research concerning manifestations of trauma-related symptoms in the latter group.

4.4. Clinical implications

The current results suggest that there is a risk of under-appreciating the impact of potentially traumatic events in adults with ASD and ID, unless assessments take account of ASD, ID, and verbal language skills. Due to the heterogeneities of ASD (Lai, Lombardo, & Baron-Cohen, 2014) and ID (Bertelli, Salvador-Carulla, & Harris, 2016), this includes access to the specific individual's developmental history, including their historic and present presentations of ASD, level of ID, and verbal language skills. In conjunction with previous studies, the current results suggest that the ABC may be a helpful tool in assessing the impact of known trauma exposure in adults with ASD and ID, but its results need to be interpreted in context of the individual's previous functioning and other available information. Due to the high prevalence of exposure to potentially traumatic events in this population, it has previously been suggested that trauma symptoms should be routinely explored in individuals with ASD and ID referred for psychiatric assessment, even in the absence of known trauma or abuse (Kildahl, Helverschou, & Oddli, 2020). Elevated scores on the ABC irritability and hyperactivity scales may suggest that further exploration of possible trauma experience and symptoms is warranted, while keeping in mind that elevated scores on these scales are by no means specific to trauma and may have other explanations.

4.5. Limitations

The current study was based on cross-sectional data and no causal inferences may therefore be made. While the current sample may be large for a study involving individuals with co-occurring ASD and ID referred for psychiatric assessment, it remains a small sample and the number of individuals having experienced the potentially traumatic events was limited. This was particularly true for individuals with severe/profound ID and limited verbal language skills, where few participants had experienced the death of a close relative (1 and 2, respectively), which may have led to the effect of level of ID and verbal language skills on the association between this event and symptom measures being underestimated. Moreover, levels of ID and verbal language skills were operationalized as dichotomous variables, and this is likely to have affected results. More differentiated measures of intellectual and verbal abilities would have been necessary to draw conclusions regarding the relative influences of ASD/ID/verbal language skills. However, due to

Table 8

Hierarchical Multiple Regression for Serious Disease/Injury in a Close Relative/Caregiver/Friend on Self-Injurious Behaviour.

Block	Predictors	Unstandardized coefficients			Standardized coefficients		R^2	Adjusted R^2	ΔR^2	F	p
		B	SE	95 % CI	β	p					
1							.027	.016	.027	2.35	.099
	Age	−0.04	0.02	[−0.09, 0.00]	−.14	.072					
	Sex	0.78	0.59	[−0.38, 1.94]	.10	.185					
2							.056	.039	.029	3.32	.021*
	Age	−0.05	0.02	[−0.10, −0.00]	−.16	.033*					
	Sex	0.99	0.59	[−0.17, 2.15]	.13	.093					
	Serious disease/injury	1.87	0.83	[0.25, 3.50]	.18	.024*					
A3							.120	.099	.064	5.67	<.001***
	Age	−0.05	0.02	[−0.09, 0.00]	−.15	.051					
	Sex	0.95	0.57	[−0.17, 2.07]	.12	.095					
	Serious disease/injury	1.90	0.80	[0.32, 3.47]	.18	.019*					
	SCQ	0.13	0.04	[0.06, 0.21]	.25	.001***					
B3							.154	.134	.098	7.56	<.001***
	Age	−0.05	0.02	[−0.10, −0.01]	−.17	.024*					
	Sex	0.89	0.56	[−0.21, 1.99]	.12	.110					
	Serious disease/injury	1.84	0.78	[0.30, 3.39]	.17	.020*					
	Level of ID	2.27	0.52	[1.25, 3.29]	.31	<.001***					
C3							.181	.161	.124	9.16	<.001***
	Age	−0.05	0.02	[−0.09, −0.00]	−.15	.040*					
	Sex	0.73	0.55	[−0.36, 1.81]	.10	.188					
	Serious disease/injury	2.26	0.78	[0.73, 3.79]	.21	.004**					
	Verbal language skills	2.50	0.50	[1.52, 3.49]	.36	<.001***					
D3							.216	.188	.160	7.54	<.001***
	Age	−0.05	0.02	[−0.09, −0.00]	−.14	.043*					
	Sex	0.76	0.54	[−0.31, 1.83]	.10	.164					
	Serious disease/injury	2.12	0.77	[0.61, 3.63]	.20	.006**					
	SCQ	0.08	0.04	[0.00, 0.15]	.15	.049*					
	Level of ID	1.01	0.63	[−0.23, 2.25]	.14	.110					
	Verbal language skills	1.60	0.62	[0.38, 2.83]	.23	.010**					
4							.237	.204	.020	7.22	<.001***
	Age	−0.04	0.02	[−0.09, 0.00]	−.13	.061					
	Sex	0.73	0.54	[−0.33, 1.79]	.10	.176					
	Serious disease/injury	1.15	0.89	[−0.61, 2.91]	.11	.199					
	SCQ	0.08	0.04	[−0.00, 0.15]	.14	.054					
	Level of ID	1.14	0.62	[−0.10, 2.37]	.16	.071					
	Verbal language skills	1.22	0.64	[−0.04, 2.49]	.18	.057					
	Serious disease/injury * Verbal language skills	3.52	1.69	[0.19, 6.85]	.17	.039*					

Note. For all block 3 results, ΔR^2 refers to the change from block 2. For block 4, ΔR^2 refers to the change from block D3 and was significant at $p = .039$.
*p=<.05, **p=<.01, ***p=<.001.

the difficulties involved in obtaining such data in a sample such as the current one, more differentiated measures were not available.

The investigated events were chosen because they were viewed as likely to be reliable for informant report. However, particularly for individuals with more limited verbal skills, it remains possible that they had experienced these events without caregivers' knowledge and that all instances of these events were thus not detected. The current sample had a high degree of co-morbidity; other traumatic experiences (including possible effects of multiple traumatic experiences), life events, or co-occurring psychiatric disorders

(as reflected by the generally elevated PAC scores) were not controlled for and may have influenced scores and results.

The current study did not include a specific measure for PTSD or trauma-related symptoms, nor were the participants assessed according to current diagnostic criteria for PTSD, which limits conclusions regarding the traumatic nature of the events explored. Informant reports for the PAC and the ABC were not collected with the events in mind, but as part of a broad psychiatric assessment, and elevated scores on the ABC scales may therefore have other explanations. However, asking informants specifically about behavioural changes observed in association with the events may have involved a risk of overlooking possible delayed reactions to the events, as well as increasing the risk of interpretational bias on informants' part (see Ryan, 1994).

4.6. Conclusions

In a sample of adults with co-occurring ASD and ID referred for psychiatric assessment, death of a close relative and serious disease/injury in a close relative/caregiver/friend both showed significant associations with reported behavioural symptoms. Several of these associations were not significant unless controlling for ASD symptoms, level of ID, and/or verbal language skills. While the identified associations were not robust and should be interpreted as hypotheses for future studies, these findings highlight the need for idiographic approaches in assessment of trauma-related disorders and symptoms in adults with ASD and ID. Finally, these findings indicate that there is a risk of under-appreciating the impact of potentially traumatic events on behaviour in adults with ASD and ID, and they are in line with previous suggestions of self-injurious behaviours as possible manifestations of trauma-related symptomatology in this population.

CRediT authorship contribution statement

Arvid Nikolai Kildahl: Conceptualization, Methodology, Data curation, Formal analysis, Writing - original draft, Writing - review & editing. **Hanne Weie Oddli:** Conceptualization, Writing - review & editing, Supervision. **Sissel Berge Helverschou:** Conceptualization, Methodology, Validation, Resources, Writing - review & editing, Project administration, Supervision.

Appendix A. Supplementary data

Supplementary material related to this article (Tables S1-S18) can be found, in the online version, at doi:https://doi.org/10.1016/j.ridd.2020.103788.

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