Pelton, M. K., Crawford, H., Robertson, A. E., Rodgers, J., Baron-Cohen, S. and Cassidy, S. (2020) Understanding suicide risk in autistic adults: comparing the interpersonal theory of suicide in autistic and non-autistic samples. Journal of Autism and Developmental Disorders, 50(10), pp. 3620-3637.

http://eprints.gla.ac.uk/250778/

Deposited on: 6 September 2021

<u>Understanding suicide risk in autistic adults: comparing the Interpersonal Theory of Suicide</u>

<u>in autistic and non-autistic samples</u>

Abstract

This study explored whether the Interpersonal Theory of suicide informs our understanding

of high rates of suicidality in autistic adults.   Autistic and non-autistic adults (n=695, mean

age 41.7 years, 58% female) completed an online survey of self-reported thwarted belonging,

perceived burden, autistic traits, suicidal capability, trauma, and lifetime suicidality. Autistic

people reported stronger feelings of perceived burden, thwarted belonging and more lifetime

trauma than non-autistic people. The hypothesised interaction between burdensomeness and

thwarted belonging were observed in the non-autistic group but not in the autistic group. In

both groups autistic traits influenced suicidality through burdensomeness/thwarted belonging.

Promoting self-worth and social inclusion are important for suicide prevention and future

research should explore how these are experienced and expressed by autistic people.

Introduction

Research reports higher suicidality rates amongst adults diagnosed with an autism spectrum condition (ASC) than the general population, but research has yet to explain *how* the unique challenges facing autistic adults lead to suicidality (Cassidy & Rodgers, 2017; Segers & Rawana, 2014). A recent population study reported a nine-fold increase in death by suicide amongst autistic adults[1] (Hirvikoski et al., 2016) and higher rates of suicide ideation have been noted in autistic samples than general population, psychotic and student samples (Cassidy et al, 2014). Autistic adults more frequently experience general population suicide risk factors, such as abuse (Storch et al., 2013) and depression (Cassidy et al., 2014), but also report greater impact of less commonly reported risk factors, such as camouflaging (masking autistic characteristics to fit in) or coping with life without required support (Cassidy, Bradley, Shaw, & Baron-Cohen, 2018). However, studies to date have not applied theoretically based empirical models and so do not provide the detailed insight into suicide mechanisms required to design interventions that meet the specific needs of autistic people (Cassidy & Rodgers, 2017; Franklin et al., 2017; Joiner, 2005; Segers & Rawana, 2014; Van Orden et al., 2010). The current study, thus, explores for the first time how a widely cited theory of suicide, the Interpersonal Theory of Suicide (Joiner, 2005), applies to suicide in autistic adults and whether this is different from non-autistic adults.

(FIGURE 1 ABOUT HERE)

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[1] This study refers to adults without intellectual disability who are reported to be at greatest risk of suicidal behaviour (Hirvikoski 2016).

The ITS proposes that three proximal risk factors for suicide, shown in Figure 1, lead to a lethal or near lethal suicide attempt: 1) strong feelings of 'thwarted belonging' (absence of reciprocal relationships with family, friends and society) and 2) 'perceived burdensomeness' (a belief that others are better off without oneself) (Joiner, 2005) are proposed to jointly lead to a desire for suicide. A suicide attempt will only be made if an individual has 3) 'suicidal capability', a biological change in the body's pain and fear systems that allows rather than inhibits a suicide attempt. The theory suggests this stable trait develops in response to lifetime exposure to painful and frightening experiences (Chu et al., 2017; Joiner, 2005; Van Orden et al., 2010). The ITS has been tested in a range of populations (Anestis, J. C. et al., 2018; Bryan, Hernandez, Allison, & Clemans, 2013; Cole et al., 2013; Czyz, Berona, & King, 2015; Heelis, Graham, & Jackson, 2016; Miller, Esposito-Smythers, & Leichtweis, 2016; Wilson, Kowal, Henderson, McWilliams, & Péloquin, 2013; Wolford-Clevenger et al., 2017) with broad support for the theory reported in a meta-analysis of 122 studies (Chu et al., 2017), and its associations have under-pinned evidence-based efforts to increase identification of suicide risk (Ribeiro, Bodell, Hames, Hagan, & Joiner, 2013) and treatments (Joiner Jr, Van Orden, Witte, & Rudd, 2009a). Our earlier study reported that, in a non-clinical sample, thwarted belonging and perceived burden were associated with suicidality and that this association was not attenuated by high levels of autistic traits (Pelton & Cassidy, 2017). Further, an online survey of 98 autistic adults, reported that thwarted belongingness and perceived burdensomeness were associated with social dissatisfaction and current suicidal ideation (Dow et al., 2019). These studies were small in scale, and concluded with the recommendation that future research should assess the hypotheses of the ITS in a sample of autistic adults with a matched comparison group of non-autistic people. This is the aim of the current study.

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The ITS may be of particular relevance to autistic people: its emphasis on the fundamental human needs of social self-worth and inclusion are conducive with views in the autistic community that the social marginalisation of autistic people should be central to understanding high rates of suicidality (Milton & Moon, 2012). The clinical diagnosis of an ASC comprises social, relationship and sensory differences, narrow interests and repetitive behaviours (APA 2013). Participatory research has reported that poor understanding and acceptance of such differences is associated with reduced social belonging, independence and quality of life and increased mental health difficulties for autistic people (Cage, Di Monaco, & Newell, 2018; Crane, Laura, Adams, Harper, Welch, & Pellicano, 2019; Mason et al., 2018). Autistic people are more likely to report behaviours indicative of thwarted belonging, such as loneliness (Haertl, Callahan, Markovics, & Sheppard, 2013; Hickey, Crabtree, & Stott, 2018; Müller, Schuler, & Yates, 2008), family stress, childhood maltreatment and intimate partner violence (Griffiths et al., 2019) than people who are non-autistic. 'Social camouflaging' (masking autistic mannerisms to 'fit in') (Hull et al., 2017), and the 'double empathy problem' (expectation that autistic people communicate social preferences and emotional states according to non-autistic norms) (Milton, 2012) reduce reciprocity in social interactions and could confer additional risk for thwarted belonging that feels hopeless and permanent (Joiner, 2005). Autistic adults frequently report experiences indicative of perceived burdensomeness, such as higher levels of unemployment (National Autistic Society 2016), incarceration (Fazio, Pietz, & Denney, 2012), homelessness (Stone, 2019), physical illness (Cashin, Buckley, Trollor, & Lennox, 2016; Hirvikoski et al., 2016) and lower self-esteem (Williamson, Craig, & Slinger, 2008) than non-autistic people. Research reports associations between unmet support needs, burdensomeness, poor mental health and suicidality (Camm-Crosbie, Bradley, Shaw, Baron-Cohen, & Cassidy, 2018; Cassidy et al.,

2018). Overall, this could suggest that autistic people experience stronger feelings of thwarted belonging and perceived burden than people who are not autistic.

The ITS proposes that suicidal capability develops in a dose-response relationship with lifetime experience of painful and frightening experiences (Joiner, 2005; Van Orden et al., 2010). Research reports shockingly high rates of trauma amongst autistic people (Griffiths et al, 2019): autistic children report higher rates of maltreatment (McDonnell et al., 2019), removal from their biological birth family (Green, Leadbitter, Kay, & Sharma, 2016), bullying (Maïano, Normand, Salvas, Moullec, & Aimé, 2016) school discipline (including exclusion), police contact and psychiatric hospitalisation (Humphrey, 2008; Turcotte, Shea, & Mandell, 2018). Autistic adults are more likely to be victims of hate crime (Beadle-Brown et al., 2014; Chaplin & M., 2018), sexual victimization (Brown-Lavoie, Viecili, & Weiss, 2014; Weiss & Fardella, 2018), incarceration (Fazio et al., 2012) and engage in non-suicidal self-injury (Cassidy et al., 2018; Maddox, Trubanova, & White, 2017). Overall, this suggests that autistic people experience more painful and frightening traumatic life events, which the ITS hypothesises suggests higher rates of suicidal capability than non-autistic people.

The ITS also proposes that gender differences in suicidal behaviour results from gender differences in the prevalence of thwarted belonging, perceived burden and suicidal capability. Amongst non-autistic people, men are reported to more frequently die by suicide because they are more likely to develop suicidal capability through violent sports, fighting or aggression. Women are more likely to think about suicide as they attach greater importance to social connections making them more vulnerable to thwarted belonging (Joiner, 2005). However, in contrast to the general population, autistic women have been reported more likely to die by suicide than autistic men (Hirvikoski et al., 2016). Autistic women are reported to be more socially motivated than autistic men (Lai, Lombardo, Auyeung,

Chakrabarti, & Baron-Cohen, 2015; Sedgewick, Crane, Hill, & Pellicano, 2019) but struggle to find genuine social reciprocity which could make them more vulnerable to thwarted belonging (Hull et al., 2017; Tint et al., 2018). Autistic women present distinct autistic characteristics which reduce likelihood of diagnosis (Duvekot et al., 2017; Dworzynski, Ronald, Bolton, & Happé, 2012; Evans, Boan, Bradley, & Carpenter, 2018; Ratto et al., 2018) typically associated with poor access to services (Cassidy et al., 2014), employment problems (Cassidy et al., 2014), and poor mental health (Hull et al., 2017; Trubanova, Donlon, Kreiser, Ollendick, & White, 2014), which could contribute to feelings of burdensomeness. Combined unmet support and social needs could explain higher incidence of mistreatment, such as abusive or coercive sexual relationships (Ohlsson Gotby, Lichtenstein, Långström, & Pettersson, 2018), maladaptive coping strategies such as controlled eating (Bargiela, Steward, & Mandy, 2016; Lai et al., 2015) or non-suicidal self-injury (Cassidy et al., 2018; Maddox et al., 2017) than autistic men. Overall, this could suggest that autistic women are more likely to experience thwarted belonging, perceived burden, lifetime trauma and suicidal capability than autistic men.

However, the Interpersonal Theory of Suicide argues that, in addition to being present, it is the *interaction* of theory constructs that provides the unique conjunction consistent with the rarity of suicide (Joiner, 2005; Van Orden et al., 2010). Thus, the theory proposes that the interaction of perceived burden and thwarted belonging are significantly associated with the presence of suicidal desire. Empirically, this interaction has been observed in a range of non-autistic groups, such as American (Van Orden, Witte, Gordon, Bender, & Joiner, 2008) and Chinese undergraduates (Zhang, Lester, Zhao, & Zhou, 2013), community samples (Campos & Holden, 2016), military personnel (Shelef, Fruchter, Mann, & Yacobi, 2014) and American Indians (O'Keefe et al., 2014) with a meta-analysis of 58 studies finding that the interaction of perceived burden and thwarted belonging added unique

variance in suicidal ideation beyond the main effects of each construct (Chu et al., 2017). However, our earlier study suggested that high levels of autistic traits could lead to under-reporting feelings of thwarted belonging, in line with well-documented reports of alexithymia (difficulty in expressing internal emotional states) in autistic people (Bird & Cook, 2013; Pelton & Cassidy, 2017). Furthermore, research has suggested that alternative risk factors such as social camouflaging (Cassidy et al., 2018), social support (Hedley, Uljarević, Wilmot, Richdale, & Dissanayake, 2017) or unmet support needs (Cassidy et al., 2018) may play a more significant role in the development of suicidal thoughts and behaviours in autistic people than non-autistic people. Overall, this could suggest that the model operates differently in autistic people. Thus, this study will explore for the first time whether the hypothesised interaction of perceived burden and thwarted belonging is associated with suicidal ideation in autistic adults and whether this is similar in non-autistic adults.

The ITS represents a novel innovation in suicide theory as it argues that risk factors for suicide ideation are distinct from those for suicide attempt. The construct of suicidal capability is proposed to uniquely enable a suicide attempt when present alongside the temporary cognitive states of thwarted belonging and perceived burden. Thus, suicidal capability theoretically doesn't exert a main effect on suicidal behaviour but, the three-way interaction of thwarted belonging, perceived burden and suicidal capability will transform suicidal ideation into a lethal or near lethal suicide attempt (Joiner, 2005; Van Orden et al., 2010). This three-way interaction has been upheld in samples of firefighters (Chu, Buchman-Schmitt, Hom, Stanley, & Joiner Jr, 2016) and military personnel (Anestis, M. D., Khazem, Mohn, & Green, 2015), but it has received less empirical attention than the two-way interaction described above: the same meta-analysis (Chu et al., 2017) included only 13 studies of the three-way interaction and reported that it was only significantly associated with suicide attempt when suicide attempt history was measured continuously (Chu et al., 2017).

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Factors that trigger transition from suicidal thoughts to behaviours are of great concern in autistic people given reports that autistic people are more likely to attempt suicide (Chen, Pan, Lan, Hsu, Huang, Su, Li, Lin, Wei, Chen, & Bai, 2017), select lethal methods for a suicide attempt yet be unknown to clinical services (Kato et al., 2013) and die by suicide (Hirvikoski et al., 2016) than non-autistic people. Commentators have speculated on the reasons for this suggesting, for example, that autistic people may relate differently to death than non-autistic people or may be more likely to perseverate on death (Gillberg, 2002; Lai, J., Rhee, & Nicholas, 2017). However, empirical research to date has not yet explored how distinct risk factors may lead to suicide attempt versus ideation in autistic people. Thus, this study will explore, for the first time, whether the theoretical three-way interaction of thwarted belonging, perceived burden and suicidal capability is significantly associated with suicide attempt in autistic and non-autistic people.

Furthermore, the ITS argues that suicidal capability is developed through opponent process theory: repeated painful and frightening experiences ultimately render future painful and frightening experiences as bringing emotional and/ or physical pain relief (Joiner, 2005; Solomon & Corbit, 1974). As outlined above, autistic people are more likely to experience lifetime trauma compared to non-autistic people but, in addition, autistic people have been reported to experience a more profound effect of trauma due to absent social support, differences in pain and emotional communication and cognitive rigidity (Kerns, Newschaffer, & Berkowitz, 2015; Rumball, 2018). The functional model of suicidal capability argues that the development of suicidal capability depends on innate vulnerabilities in interaction with the environment (Smith & Cukrowicz, 2010). Thus, differences in pain (Rattaz, Dubois, & Baghdadli, 2016), emotional processing and expression, high trait anxiety and sensory sensitivities (Mazefsky et al., 2013) could suggest that suicidal capability is more quickly developed in autistic people. Thus, this study will explore whether the pathway from

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traumatic life events to suicidal thoughts and behaviours is through suicidal capability and compare whether this is similar to non-autistic people.

Finally, the ITS proposes that distal factors, including oft-cited suicide risk factors - such as mental health difficulties - lead to suicidal behaviour because they increase the likelihood that an individual will experience thwarted belonging, perceived burden (Davidson, Wingate, Grant, Judah, & Mills, 2011; Silva, Ribeiro, & Joiner, 2015; Van Orden et al., 2010). In clinical and non-clinical samples autistic characteristics are independently associated with suicidality beyond other factors, such as psychiatric disorder (Pelton & Cassidy, 2017; Upthegrove et al., 2018), previous suicide attempts (Chen et al., 2017), depression, anxiety, unemployment and satisfaction with living arrangements (Cassidy et al., 2018). Understanding *how* autistic traits associate with lifetime suicidality is vital to inform suicide prevention interventions: autistic traits are not modifiable but support can be provided to reduce the negative social impacts (Joiner Jr, Van Orden, Witte, & Rudd, 2009b; Milton & Moon, 2012). Our ealier study reported that in a non-clinical young adult sample the association between autistic traits and lifetime suicidality was mediated by perceived burden and thwarted belonging suggesting (Pelton & Cassidy, 2017). This study will seek to replicate this finding and compare whether a similar pathway exists for autistic people.

The current study

In summary, the current study aimed to fill a gap in previous research by examining how the ITS explains suicide in autistic people and comparing this to non-autistic people. This study will explore (i) prevalence rates of ITS constructs in autistic and non-autistic people, (ii) whether hypothesised interactions between ITS variables are present in autistic and non-autistic groups (iii) putative pathways from distal factors to suicidal thoughts and

behaviours through theory constructs are similar in autistic and non-autistic people. Specifically, this study hypothesises that,

(i)   Given more frequent reports of loneliness, unmet support needs and trauma, autistic people will report stronger feelings of thwarted belonging and perceived burdensomeness, higher suicidal capability and more frequent lifetime trauma than non-autistic people.

(ii)   Given gender differences in the autistic female phenotype, autistic women will report stronger feelings of thwarted belonging and perceived burden, higher suicidal capability and more frequent lifetime trauma than autistic men.

(iii)   Given broad published support, the respective interactions in ITS variables in association with suicidal ideation and suicide attempt will be observed in the non-autistic group but - given suggested differences in suicidality in autistic people - these may not be observed in the autistic group.

(iv)   In both groups, given the proposed development of suicidal capability in response to lifetime trauma there will be a significant pathway from lifetime trauma through suicidal capability to suicidality but – given reported more profound effect of trauma – the pathway from lifetime trauma to suicidal capability will be stronger in autistic people.

(v)   In both groups, the previously reported pathways from autistic traits to suicidality (Pelton & Cassidy, 2017) through perceived burden and thwarted belonging will be observed.

Methods

Participants

Participants were 695 autistic (64.6% female, mean age= 41.9, 18-90 years) and non-autistic

people (58.7% female, mean age = 41.3, 18-73 years) described in Table 1. Autistic

participants self-reported a diagnosis of ASC from a trained clinician. Mean AQ-S scores in

the autistic group were consistent with published clinical cut off score of >65 indicative of

ASC (Hoekstra et al., 2011a), with AQ-S scores significantly lower in the non-autistic

compared to the autistic group (t(636.98)=-31, p<.001).

There was no significant difference in age (t(672.7)=-.55, p=.59) or proportion of female

participants (X^2(1)=2.53, p=.11) between the autistic and non-autistic group. Significantly

more non-autistic people reported being in full time employment (X^2(1)=14.47, p<.001) and

holding a post-graduate degree (X^2(1)=7.30, p<.01) than autistic people. Autistic people

were more likely to report at least one additional neurodevelopmental condition

(X^2(1)=55.45, p<.001) and at least one mental health condition (X^2(1)=106.32, p<.001) than

non-autistic people.

Non-autistic people reported significantly lower lifetime suicidality (t(656.98)=-14.52,

p<.001) than autistic people. Reported rates of past suicide attempt were higher in the

autistic (38.3%) than the non-autistic group (10.5%), our earlier study of 8.6% (Pelton &

Cassidy, 2017) and the UK Adult Psychiatric Morbidity study (6.7%) (McManus,

Bebbington, Jenkins, & Brugha, 2016).

The autistic group was recruited through the Cambridge Autism Research Database, the

Autistica Discover network, local and national autism organisations and social media. The

non-autistic group was recruited through the Cambridge Psychology Database with

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opportunity sampling, Coventry University psychology research participation scheme, social media channels and suicide-focussed research websites to balance group size, mean age and gender frequency with the autistic group. Adverts clearly stated that the study would ask about suicidal thoughts and behaviours but did not specify inclusion criteria based on these.

Materials

Demographics: participants indicated age, gender, living status, employment status, mental health, autism diagnoses and the presence of any other neurodevelopmental disorders.

Thwarted belonging and **perceived burden** were measured using *The Interpersonal Needs Questionnaire 10 (INQ-10).* The INQ 10 is a 10 item validated scale containing two subscales for distinct but related interpersonal constructs that represent the desire to die: 'thwarted belonging' and 'perceived burdensomeness' (Van Orden, Cukrowicz, Witte, & Joiner, 2012). It contains statements such as 'These days the people in my life would be better off if I were gone' and 'these days I think the people in my life wish they could be rid of me' which are responded to on a 7-point scale from 'strongly agree' to 'strongly disagree'. Our steering group of autistic adults advised choosing the INQ-10, with comparable validity (Hill et al., 2015) over the INQ-15 to avoid frustration from questions that could be perceived as similar by autistic people. They also advised changing the instructions to clearly communicate the intended meaning to autistic people without disadvantaging non-autistic people: *'Please read the items below. Click on the option that best describes how you have been feeling. Where the questionnaire refers to 'these days' please consider how you have been feeling in general over the past two weeks'* (original wording in Appendix). The scale author confirmed that change was acceptable prior to administration. (Burdensomeness subscale Cronbach's alpha = .93, Thwarted belonging Cronbach's alpha=.92)

Capability for Suicide was measured using *Acquired Capability for Suicide Scale –*
Fearlessness of Death (ACSS-FAD) (Ribeiro, Witte, Van Orden, Selby, Gordon, Bender, &
Joiner, 2014a). The ACSS-FAD is a validated 7-item scale measuring a sense of fearlessness
around the concept of death. Scale items include 'the prospect of my own death arouses
anxiety in me' and 'I am not at all afraid to die'. Responses are given on a five point Likert
scale with scores from 0 to 4 with higher scores indicating a higher capability for suicide
(Ribeiro, Witte, Van Orden, Selby, Gordon, Bender, & Joiner Jr, 2014). Cronbach's alpha
=.85.

Traumatic life events were measured using *Vulnerability Experience Quotient (VEQ)*
(Griffiths et al., 2019). The VEQ is a 60-item scale which has been developed through
participatory methods with autistic adults to reflect adverse life experiences across 10 themes,
such as childhood maltreatment, non-suicidal self-injury, bullying and victimisation as a child
or adult and discrimination. This scale reflects many of the themes of Painful and
Provocative Events scale designed for use in the ITS but has been developed and validated to
reflect the experiences of autistic people (Griffiths et al., 2019). The response scale has been
amended to give an indication of frequency as this is hypothesised to enable transition from
suicide ideation to attempt. A simplified scale of 'not applicable', 'never', 'once' or 'more
than once' assessed frequency without repeated need for counting instances of traumatic life
events. This response scale has been recommended in a recent psychometric evaluation of
the Painful and Provocative Events Scale (Brown, Roush, Marshall, Mitchell, & Cukrowicz,
2018) and was confirmed with the scale author prior to administration. Cronbach's alpha=
.93

Lifetime suicidal thoughts and behaviours were measured by *Suicide Behaviours Questionnaire – Revised (SBQ-R), item 1:* The first item of the SBQ-R measures lifetime suicidal ideation and/ or attempt with the question 'Have you ever thought about or attempted to kill yourself?'. There are six possible responses from 'never' to 'I have attempted to kill myself and really hoped to die' (Osman et al., 2001). Participant responses are categorised in four subgroups from non-suicidal to suicide attempt. Item 1 was employed in our previous study (Pelton & Cassidy, 2017) and has been reported to demonstrate comparable measurement properties amongst autistic and non-autistic adults (Cassidy et al., 2018)

Autistic characteristics were measured using *Autism Quotient Short Form (AQ-S):* The AQ-S is a 28-item subset of the full 50 item Autism Quotient based upon DSM-IV criteria for autism (APA 2000). The scale includes items such as 'it does not upset me if my daily routine is disturbed' and 'I find it easy to work out what someone is thinking or feeling' with a four item response scale from 1 "definitely agree" to 4 "definitely disagree (Hoekstra et al., 2011b). It is scored using the full four-point Likert scale giving a total range from 28-112 and a cut off of 65 for potential consideration of a clinical diagnosis of autism. Scores are highly correlated with the full AQ-50 and the AQ-S is reported to demonstrate the same latent traits in autistic and non-autistic people (Murray, Booth, McKenzie, Kuenssberg, & O'Donnell, 2014). Cronbach's alpha = .95.

Procedure

Participants were invited to complete a survey of online self-report measure of self-report questionnaires using Qualtrics. The dataset from which participants were drawn also includes possibly autistic people and four-week repeated measures of anxiety and depression. Analyses planned with these data are described in the discussion. Research reports that people feel more able to disclose potentially sensitive information about stigmatised

behaviours such as suicide and self-harm online than in situations where they cannot remain anonymous (Michaels, Chu, Silva, Schulman, & Joiner, 2015; Nock et al., 2008). Participants indicated informed consent to participate via an online form. They were warned of the content of questions in each section, prompted to take breaks and given information about support services throughout the survey. The study materials and scales were designed with the assistance of autistic adults (one male, one female) who suggested modifications to instructions to clarify meaning, suggested substitutions of scales to maximise clarity for autistic people, suggested amendments to online instructions and guidance to reduce risk to ensure that the study was equally accessible for autistic and non-autistic people. The study received ethical approval from Coventry University Psychology Ethics Committee and was approved by the scientific advisory group at the Autism Research Centre, University of Cambridge.

(TABLE 1 ABOUT HERE)

Results

Analytic Approach

Data were analysed in SPSS version 25. Boxplots were examined for univariate outliers and
multivariate outliers were identified using Mahalanobis distance. Non-normal distribution of
burdensomeness in the non-autistic group was addressed with square root transformation:
kurtosis reduced from 5.22 to 2.14 and extreme outliers came within normal distribution.
Independent samples t-tests and three-way ANOVA were used to explore differences in
group means (thwarted belonging, perceived burden, suicidal capability, lifetime trauma).
Multinomial logistic regression explored whether the ITS hypothesised interactions were
associated with past suicide ideation and suicide attempt. Simple linear regressions explored
the association between ITS constructs and suicidal thoughts and behaviours. Mediation
analysis explored the pathways from distal factors to suicidality through ITS constructs using
ordinary least squares path analysis (PROCESS version 3.3 model 4) and employing
bootstrapping for non-normal distribution. PROCESS model 59 explored whether mediation
models were moderated by autism diagnosis.

*Hypothesis (i) autistic people report stronger feelings of thwarted belonging, perceived
burden, higher suicidal capability and more prevalent lifetime trauma than non-autistic
people.*

As shown in Table 1, autistic people reported significantly higher burdensomeness
(t(635.09)=-11.33, p<.001), thwarted belonging (t(652.28)=-16.43, p<.001) and traumatic life
events (t(648.83)=-17.46, p<.001) than non-autistic people, but there was no significant
difference in the mean score for suicidal capability between groups.

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Hypothesis (ii) autistic women report stronger feelings of thwarted belonging, perceived burden, higher suicidal capability and more frequent lifetime trauma than autistic men.

Three-way ANOVA reported there was no significant difference in mean scores for thwarted belonging ($F_{(2,337)}$=.55, p=.575), perceived burdensomeness ($F2,337$)=.27, p=.762), suicidal capability ($F_{(2,337)}$=2.87, p=.058) and traumatic life events ($F_{(2,331)}$=1.21, p=.332) between autistic men and autistic women and those who identify as other gender. As this finding was against the direction of our hypothesis, moderation analysis explored whether the association between any predictor variables (burden, capability, thwarted belonging and traumatic life events) and lifetime suicidality was moderated by gender. We found no significant moderation. Furthermore, in this sample, there was no significant difference in reported lifetime suicidality between autistic men and autistic women ($F_{(2,337)}$=2.08, p=.126). Thus, data from autistic men and women were analysed together in subsequent analyses.

In the non-autistic group[2], independent t-tests showed that non-autistic men reported significantly higher suicidal capability (t(325)=2.02p=.044) and significantly lower perceived burdensomeness (t(296.74)=-2.24, p=.026) than non-autistic women. There was no significant difference in thwarted belonging (t(328)=1.02, p=.27) between non-autistic men and non-autistic women.

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[2] The 'other' gender group were not included as n = 2.

Hypothesis (iii)(a) The interaction of thwarted belonging and perceived burden is significantly associated with suicidal thoughts.

A multinomial logistic regression was undertaken with the categorical outcome variable SBQ-R item 1 (frequencies shown in Table 1) and the predictors thwarted belonging, perceived burden and their interaction term.

As shown in Table 2, in the non-autistic group, participants who reported significantly lower scores of thwarted belonging (Wald $X^2(1)$=18.16, p<.001), and perceived burden (Wald X^2=10.06, p=.002) were more likely to endorse the 'no past suicidality' response option versus 'past suicidal thoughts' and their interaction was significant within the regression (Wald X^2=10.67, p=.001).

(TABLE 2 ABOUT HERE)

In the autistic group, participants who reported higher perceived burden (Wald $X^2(1)$=4.13. p=.04) and thwarted belonging (Wald $X^2(1)$=6.25, p=.01) were more likely to endorse 'past suicide attempt' than 'past suicidal thoughts' and the interaction between thwarted belonging and perceived burden was not significant within the model. The model explained only 10% of the variance in the autistic group versus 31% in the non-autistic group.

Hypothesis (iii)(b): the three-way interaction of thwarted belonging, perceived burden and suicidal capability will be significantly associated with past suicide attempt.

A further multinomial logistic regression was undertaken with the categorical outcome variable SBQ-R item 1 (frequency responses shown in Table 1) and the predictors were

thwarted belonging, perceived burden and suicidal capability, the two-way interaction (belong*burden) and their three-way interaction (belong*burden*capability).

As shown in Table 3, in the non-autistic group, participants who reported significantly lower levels of suicidal capability (Wald $X(1)^2$=5.98, p=.014) were more likely to endorse past suicidal thoughts versus past suicide attempt. The three-way interaction of perceived burden, thwarted belonging and suicidal capability was not significant within the model.

In the autistic group, as shown in Table 3, participants who reported significantly lower levels of suicidal capability (Wald X^2=18.89, p<.001) were more likely to endorse 'past suicidal thoughts' versus 'past suicide attempt' and the three-way interaction of thwarted belonging, perceived burden and suicidal capability was not significant within the model. In the autistic group, the model explained only 15% of the variance versus 34% in the non-autistic group.

(TABLE 3 ABOUT HERE)

Hypothesis (iv): the association between lifetime trauma and suicidality will be significantly mediated by suicidal capability in both groups. In the autistic group the association between trauma and suicidal capability will be significantly strengthened.

Simple linear regressions, shown in Table 4, reported that autistic traits, perceived burden, thwarted belonging, suicidal capability and traumatic life events were significantly associated with lifetime suicidality.

(TABLE 4 ABOUT HERE)

Simple mediation analysis was undertaken with the predictor, lifetime trauma, the mediator, suicidal capability and the outcome variable, suicidality. There was a direct effect of trauma on lifetime suicidality independent of suicidal capability in autistic (c'=.02, p<.001) and non-autistic (c'=.037, p=<.001) groups and a weak but significant indirect effect of trauma on lifetime suicidality through suicidal capability in the autistic group (ab=.0001, 95% CI [.0001, .002]). As shown in Figure 2, moderation analyses reported an attenuated association between lifetime trauma and lifetime suicidality in the autistic group (VEQ*diagnosis=-.016, SE=.004, p<.001) and no significant moderation of other mediation pathway by autism diagnosis.

(FIGURE 2 ABOUT HERE)

Hypothesis (v): the association between autistic traits and suicidality will be significantly mediated by perceived burden and thwarted belonging in autistic and non-autistic groups.

Simple mediation analysis was undertaken with the predictor autistic traits, the mediator thwarted belonging and the outcome variable suicidality. As shown in Figures 3 and 4, results indicated a significant indirect effect of autistic traits on lifetime suicidality through thwarted belonging in both autistic (ab=.008, 95% CI [.004, .012]) and non-autistic groups (ab=.019, 95% CI [.014, .025]). Moderation analysis revealed that the pathway from thwarted belonging and lifetime suicidality was significantly attenuated in the autistic group (belonging*autism diagnosis=-.027, SE=.010, p=.008) as shown in Figure 5 but no other mediation pathway was significantly moderated by autism diagnosis.

(FIGURE 3 ABOUT HERE)

(FIGURE 4 ABOUT HERE)

(FIGURE 5 ABOUT HERE)

A further simple mediation analysis was undertaken with the predictor autistic traits, the mediator perceived burden and the outcome variable suicidality. As shown in Figures 6 and 7, there was a significant indirect effect of autistic traits on lifetime suicidality through perceived burden in both autistic (ab=.004, 95% CI [.002, .007)] and non-autistic (ab=.011, 95% CI [.008, .015]) groups. Moderation analyses reported that the pathway from perceived burden to lifetime suicidality was significantly attenuated in the autistic group (burdensomeness*autism_diagnosis=-.048, SE=.099, p<.001) as shown in Figure 8, but no other pathway was significantly moderated by autism diagnosis.

(FIGURE 6 ABOUT HERE)

(FIGURE 7 ABOUT HERE)

(FIGURE 8 ABOUT HERE)

Discussion

This study aimed, for the first time, to explore whether the associations of the Interpersonal Theory of Suicide are informative for understanding and addressing high rates of suicidality in autistic adults. Autistic adults reported stronger feelings of thwarted belonging, perceived burdensomeness and traumatic life events than non-autistic adults. Autistic men and women reported similar levels of perceived burden, thwarted belonging, traumatic life events and suicidal capability. By contrast, non-autistic men reported higher suicidal capability and weaker feelings of perceived burden than non-autistic women. The proposed interaction between thwarted belonging and perceived burden was present in the

non-autistic group but not the autistic group. In both groups, participants endorsing lower suicidal capability were more likely to report suicide ideation versus attempt. In both groups, there was a direct effect of trauma on lifetime suicidality and autistic traits led to feelings of thwarted belonging and perceived burden, which led to lifetime suicidality. Finally, the pathway from each of thwarted belonging and perceived burden and lifetime trauma to lifetime suicidality was significantly attenuated in the autistic group. Overall, these results add to the limited body of knowledge describing the development of suicidal thoughts and behaviours in autistic people (Cassidy et al., 2018; Hedley, Uljarević, Foley, Richdale, & Trollor, 2018a) as well as extending previous explorations of the influence of autistic traits in the ITS (Pelton & Cassidy, 2017) and how the ITS works in autistic people (Dow et al., 2019).

Our findings echo a well-established body of research reporting higher rates of lifetime suicidality in autistic than non-autistic adults (Chen et al., 2017; Hirvikoski et al., 2016; Kirby et al., 2019). In line with the ITS hypotheses and the hypotheses of this study, this was accompanied by higher levels of thwarted belonging and perceived burden in the autistic group than in the non-autistic group (Joiner, 2005; Van Orden et al., 2010). This finding is consistent with research suggesting that social isolation and burdensomeness may contribute to poor mental health, reduced quality of life and suicidality in autistic adults (Camm-Crosbie et al., 2018; Cassidy et al., 2018; Hedley et al., 2017; McConachie et al., 2018). Autistic people also reported significantly higher rates of traumatic life events than people who were non-autistic, consistent with other recent research (Fuld, 2018; Rumball, 2018; Taylor & Gotham, 2016) and with research suggesting that trauma contributes to suicidality (Storch et al., 2013). Against our expectations there was no significant difference in suicidal capability between the autistic and non-autistic groups.

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Against recent research findings, this study reported no significant difference in reported lifetime suicidality between autistic women and men. Recent population studies have reported significantly higher rates of suicidality amongst autistic women than men (Hirvikoski et al., 2016; Kirby et al., 2019), a trend noticeable for its opposite pattern to the non-autistic population. However, this study echoes the findings of another study in our group, which also found no significant difference in suicidality between autistic women and men (Cassidy et al., 2018). Against our hypotheses, there was no significant difference in mean scores on any other study variable between autistic women, men and other gender. This is in contrast to the non-autistic group where the hypotheses of the ITS (Joiner, 2005) were largely upheld with women reporting higher burdensomeness and men reporting higher suicidal capability. This suggests that suicidal behaviour in autistic people may not reflect expected gender-based patterns and processes observed in the non-autistic population. Clinicians should be aware that, in particular, autistic women may be at increased risk if they are assumed to be at lower risk due to female gender. However, these findings are preliminary and future research should explore whether, and how, gender may influence suicidality in autistic adults.

We examined, for the first time, the hypothesised interactions of the ITS in autistic and non-autistic adults. In the non-autistic group, the hypothesis of the ITS regarding suicide ideation was largely upheld: participants reporting lower perceived burden and thwarted belonging were more likely to report no past suicidal behaviour versus suicide ideation and the interaction between the variables was significant. In the autistic group, by contrast, the ITS was not supported: participants reporting stronger feelings of thwarted belonging and perceived burden were more likely to report suicide attempt than suicide ideation or no past

suicidal behaviour. This suggests that there may be differences in how suicidal thoughts and behaviours develop in autistic people and, worryingly, that increases in feelings of thwarted belonging and burdensomeness may lead to suicide attempt rather than ideation. This is in line with commentary and anecdotal report that autistic people may transition to suicide attempt more quickly than people who are not autistic (Kato et al., 2013). Clinicians should be aware that suicidal thoughts and behaviours may develop differently in autistic people and, in the absence of validated care pathways and measures, undertake individualised, detailed risk assessments. Furthermore, there was no hypothesised interaction between thwarted belonging and perceived burden. The ITS proposes that perceived burden and thwarted belonging are related but distinct constructs but our results could suggest that autistic differences – possibly theory of mind (Baron-Cohen, Leslie, & Frith, 1985) or cognitive rigidity - could render them more separate in autistic than non-autistic people. This is in line with our earlier study, which suggested that differences in theory of mind could reduce the expression of these constructs(Pelton & Cassidy, 2017). Overall, this suggests that future research should continue to explore how risk factors for suicide may be different in autistic people as well as considering whether the expression of such states may present differently.

We found only partial support for the suicidal capability construct in both groups: participants reporting significantly lower suicidal capability were more likely to report suicide ideation rather than suicide attempt suggesting that suicidal capability is uniquely associated with suicide attempt. However, the three-way interaction of thwarted belonging, perceived burden and suicidal capability was not significant in either group. This is in line with recent meta-analysis which reported similar findings when suicide attempt was measured dichotomously as in this study (Chu et al., 2017). This is also in line with suicide theorists who agree with Joiner's assertion that a change in the relationship with fear of death and with pain is necessary to transition from suicide ideation to attempt but have argued that

other factors are also significant. For example, the Integrated Motivational-Volitional model describes suicidal capability as only one of many possible volitional moderators that may provide the bridge from suicidal intention to attempt (O'Connor, 2011; O'Connor, Cleare, Eschle, Wetherall, & Kirtley, 2016). This suggests an urgent need for research to explore distinct risk factors for suicide attempt in autistic and non-autistic people. Future research should be theoretically rigorous, explore the applicability of other suicide models and explore alternative pathways to confirm direction of causality. This could also include inductive theoretical research taking as its starting point individual accounts of autistic people, and comparing those against current theoretical accounts to build a valid theory. However, all interpretations of these findings regarding the hypothesised interactions should be considered in the context that, in the autistic group, the variables together accounted for around half the variance compared to the non-autistic group. This is discussed below.

In both groups, trauma was significantly directly associated with lifetime suicidality. This finding is in line with research in non-autistic people reporting significant negative life outcomes, including mental health difficulties and suicidality resulting from trauma (Luukkonen, Räsänen, Hakko, & Riala, 2009). However, this does not fully explain *how* trauma is associated with lifetime suicidality as the direct path does not support the ITS hypothesis that painful and provocative events lead to a change in the body's fear and pain system (suicidal capability) that enables suicidal behaviour. This could suggest that the measure of suicidal capability employed in this study does not truly represent the changes hypothesised to result from trauma (Joiner, 2005). Within this study, we used the most widely validated measure of suicidal capability – the ACSS-FAD - however, this represents a single construct – a reduced fear of death – and the scale author has already concluded that this may be too narrow to measure the changes that lead to suicidality (Ribeiro, Witte, Van Orden, Selby, Gordon, Bender, & Joiner, 2014b). Clinicians should thus be aware that those

with traumatic backgrounds are at increased risk but we don't yet have measures to clearly detail why. Future research should explore whether alternative suicide theories are able to provide detailed empirical evidence regarding the proposed faster transition to suicide attempt amongst autistic people and associated higher rates of death by suicide. An alternative approach would be to take as a starting point the lived experience of those who experience these difficulties and use these to build an inductive theory.

In the autistic group, there was also an indirect effect of trauma on suicidality through suicidal capability but detailed analysis of this finding found this did not support our proposal of a strengthened pathway from trauma to suicidal capability in autistic people. By contrast, we found a significant attenuation of the association between traumatic life events and lifetime suicidality which suggests that trauma (at least sometimes) occurs in the absence of suicidal behaviour for autistic people. Given such high rates of trauma in autistic people, this could suggest that these are everyday experiences for autistic people, against which they become resilient, rather than rare experiences associated with suicidality. This could, however, also reflect the use of our 'once' or 'more than once' rating scale that could under-report trauma for autistic people: the original Painful and Provocative Events Scale designed for non-autistic people includes a range of categorical up to 20 incidents of each painful event (Brown, Roush, Marshall, Mitchell, & Cukrowicz, 2018). It is vital that future research continues to explore how trauma contributes to suicidality alongside continuing research to understand of how trauma impacts autistic people. Suicide prevention efforts should continue to address the enforcement of statutory protection for autistic people with a view to reducing trauma.

The findings of our earlier study (Pelton & Cassidy, 2017), and our hypothesised pathways from autistic traits to suicidality through both perceived burden and thwarted belonging, were upheld. This suggests that feelings of social disconnection and reduced self-

worth associated with autistic traits provide the bridge to suicidal behaviour. This is in line with research linking autistic traits to increased loneliness and social disconnection in autistic and non-autistic populations (Hedley, Uljarević, Wilmot, Richdale, & Dissanayake, 2018; White & Roberson-Nay, 2009), and in line with research suggesting these concepts may link to suicidality (Hedley, Uljarević, Foley, Richdale, & Trollor, 2018b). This supports the ITS model that, in any population group, distal risk factors contribute to suicidality via the two proximal risk factors thwarted belonging and perceived burden (Christensen, Batterham, Mackinnon, Donker, & Soubelet, 2014; Cole et al., 2013; Corbin, 2017; Horton et al., 2016; Miller et al., 2016; Pennings, Finn, Houtsma, Green, & Anestis, 2017; Van Orden et al., 2008). This also suggests that these two concepts may represent modifiable constructs that can be targeted in suicide prevention programmes, thus suicide prevention programmes that promote social inclusion and feelings of self-worth are important in autistic and non-autistic people.

However, we also reported attenuated associations between each of perceived burden, thwarted belonging and lifetime suicidality in the autistic group compared to the non-autistic group. This could, similar to the case of trauma, suggest that these are everyday experiences for autistic people, rather than experiences that differentiate those experiencing suicidal thoughts and behaviours from those who are not. Similar findings have been reported in clinical groups: a study of individuals with a first episode psychosis reported that the concepts of the ITS resonated with the experience of psychosis regardless of suicidality (Heelis et al., 2016). An alternative interpretation, however, is that both thwarted belonging and burdensomeness could be proximal risk factors for suicide in autistic people yet may be experienced and expressed differently by autistic adults. This could suggest that the INQ measure, designed for use in the general population, doesn't capture the same concepts for autistic people. This is in line with a wide body of research reporting the need for measures,

which accurately describe and capture emotional and psychological processes in autistic adults (Cassidy et al., 2018; Cassidy, Bradley, Bowen, Wigham, & Rodgers, 2018; Gotham, Unruh, & Lord, 2015). Indeed, our design group already identified problematic items: for example, 'These days, I feel like I belong' is confusing in its lack of specificity whereas 'These days I often feel like an outsider at social gatherings' could describe everyday autistic life rather than indicate elevated suicidal feelings. In the case of burdensomeness this attenuation of association could support our earlier assertion that the second latent construct of burdensomeness (Van Orden et al., 2010) described as self-hatred, poor self-esteem and agitation could present in autistic people even if differences in theory of mind reduce the ability to consider oneself a burden on others (Pelton & Cassidy, 2017). This is possibly a more likely explanation, as recent qualitative research has identified burdensomeness as a significant theme in autistic quality of life and mental health difficulties (Camm-Crosbie et al., 2018; Crane, L., Adams, Harper, Welch, & Pellicano, 2017). Future research should seek to understand the experience of thwarted belonging and burdensomeness from the perspective of autistic people and identify the specific experiences, if any, which could indicate a desire to die. However, as a first step, future research should explore potential measurement differences in the INQ-10 and ACSS-FAD between autistic and non-autistic people.

This study has several strengths: it is the first large-scale study to compare suicidal behaviour in autistic and non-autistic samples within a well-validated theory of suicidal behaviour. This responds to repeated calls within the research literature (Segers & Rawana, 2014) and within the autistic community for theoretically based suicide research in autistic adults (Cassidy & Rodgers, 2017). Thus, it explores an under-researched area and provides a foundation for broader theoretical modelling work within the academic and practitioner communities. This foundation is vital to respond to calls from within the autistic community to explore other specified priorities, including, but not limited to identification of suicidal

thoughts and behaviours, appropriate adaptation of interventions and designing and delivering crisis services that facilitate help-seeking (Cassidy et al 2019).

It is also important to acknowledge this study's limitations. This study included a single outcome variable, lifetime suicidality, whereas the ITS specifies current suicidal ideation, attempt and death by suicide as its outcomes. The key focus of this study was to examine differences between the autistic and non-autistic groups, thus, an outcome variable was selected with known measurement similarities across autistic and non-autistic people (Cassidy et al., 2018). This study has also not explored the role of anxiety and depression and complex mental health difficulties in the autistic group, and the ITS makes specific hypotheses regarding how mental health difficulties impact suicidal behaviour, which should be urgently explored in future research. This study has relied on self-reported autism diagnosis due to sample size required but future research could employ a diagnostic test. Finally, mediation analyses are based upon cross-sectional data so limitations on directions of causality are acknowledged. Future analyses are planned with repeated measures data, which will also explore the role of depression and anxiety. Finally, the study has not explored the potential influence of demographic variables such as age, living or marital status. There is an urgent need to incorporate these into future research studies but these were beyond the scope of this paper.

In summary, this study represents the first large scale study to compare the associations of the ITS in autistic and non-autistic samples. This study provides evidence that perceptions of burdensomeness, reduced social belonging and exposure to traumatic life events are significantly associated with lifetime suicidality in autistic adults and addressing these is vital to reduce suicide rates. However, this study also highlights the importance of understanding how these feelings are experienced and communicated by autistic people and ensuring that our current measures and clinical practices capture these. This study also

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highlights the fact that a model of suicidal behaviour that works for autistic people may need to tailored to reflect distinct experiences, communication and social preferences of autistic people. Public policy should urgently address rates of stigmatising and abusive traumatic experiences of autistic people. Overall, improving inclusion and self-worth and reducing trauma could reduce death by suicide in autistic and non-autistic people.

Appendix

Original wording instructions of the Interpersonal Needs Questionnaire:

"The following questions ask you to think about yourself and other people. Please respond to each question by using your own current beliefs and experiences, NOT what you think is true in general, or what might be true for other people. Please base your responses on how you've been feeling recently. Use the rating scale to find the number that best matches how you feel and circle that number. There are no right or wrong answers: we are interested in what you think and feel."

Figure Captions

Figure 1. Pathways of the Interpersonal Theory of Suicide to be tested in this study

Figure 2. A visual representation of the conditional effect of traumatic life events on lifetime suicidality amongst autistic and non-autistic adults at low, moderate and high frequency of traumatic life events

Figure 3. Simple mediation model for the influence of autistic traits on suicidality through feelings of thwarted belonging in autistic adults

Figure 4. Simple mediation model for the influence of autistic traits on suicidality through feelings of thwarted belonging in non-autistic adults

Figure 5. A visual representation of the conditional effect of thwarted belonging (M) on lifetime suicidality (Y) in autistic (W=0) and non-autistic (W=1) at low, moderate and high levels thwarted belonging

Figure 6. Simple mediation model for the influence of autistic traits on suicidality through feelings of burdensomeness in autistic adults

Figure 7. Simple mediation model for the influence of autistic traits on suicidality through feelings of burdensomeness in non-autistic adults

Figure 8. A visual representation of the conditional effect of burdensomeness on lifetime suicidality in autistic and non-autistic adults amongst those experiencing low, moderate and high feelings of burdensomeness

Figure 1 top

Figure 2 top

Figure 3 top

Direct effect (c')=.007, p=.07
Indirect effect (ab)=.008, 95% CI [.004, .012]

1. AQS=Autism Quotient short form, 2. INQTB=Interpersonal Needs Questionnaire 10 Thwarted belonging subscale, 3. SBQ-R=item 1 Suicidal Behaviours Questionnaire revised

Figure 4 top

Direct effect (c')=.003, p=.44
Indirect effect (ab)=.019, 95% CI [.014, .025]
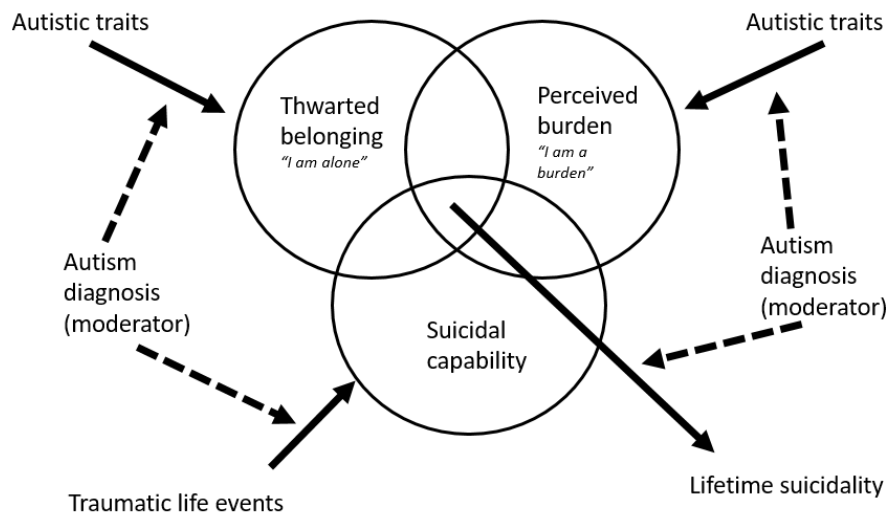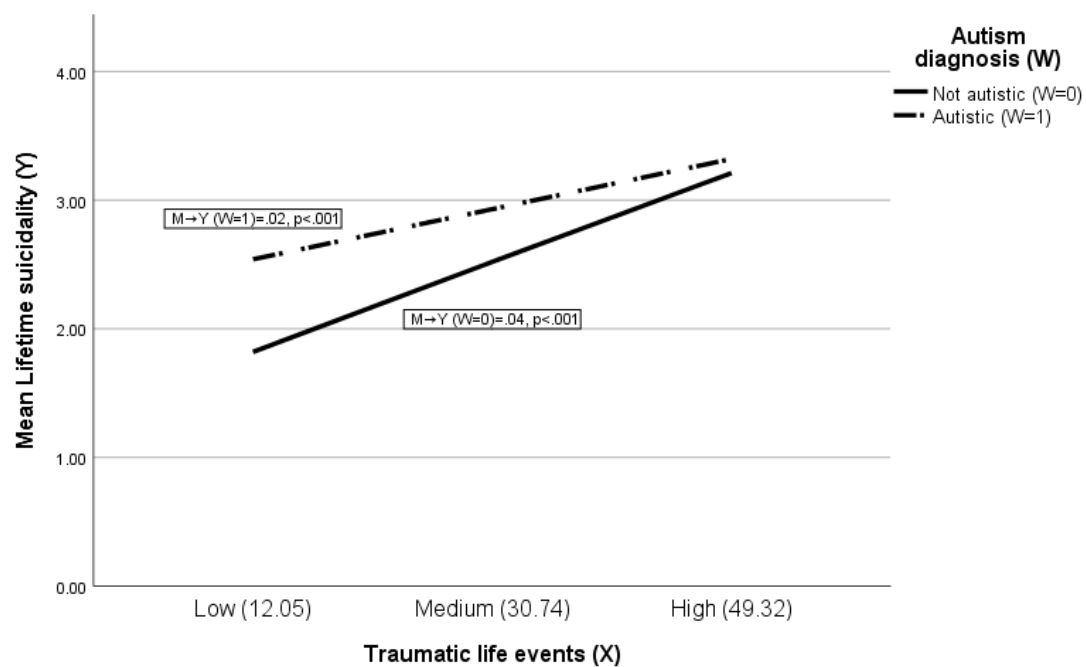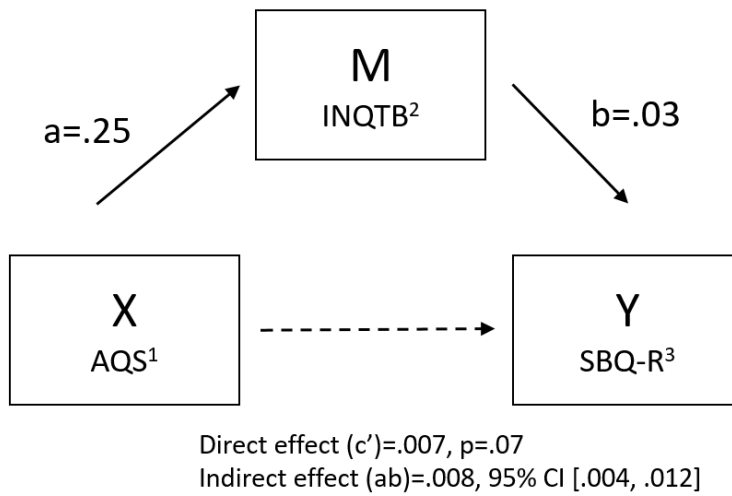
1. AQS=Autism Quotient short form, 2. INQTB=Interpersonal Needs Questionnaire 10 Thwarted belonging
subscale, 3. SBQ-R=item 1 Suicidal Behaviours Questionnaire revised

Figure 5 top

Figure 6 top

Direct effect (c')=.002, p=.005
Indirect effect (ab)=.004, 95% CI [.002, .007]

1. AQS=Autism Quotient short form, 2. INQPB=Interpersonal Needs Questionnaire 10 Perceived burden
subscale, 3. SBQ-R=item 1 Suicidal Behaviours Questionnaire revised

Figure 7 top

Direct effect (c')=.004, p=.26
Indirect effect (ab)=.011, 95% CI [.008, .015]

1. AQS=Autism Quotient short form, 2. INQPB=Interpersonal Needs Questionnaire 10 Perceived burden subscale, 3. SBQ-R=item 1 Suicidal Behaviours Questionnaire revised
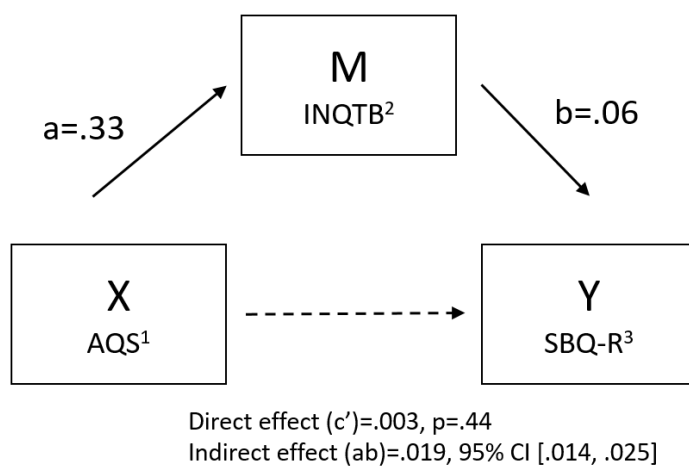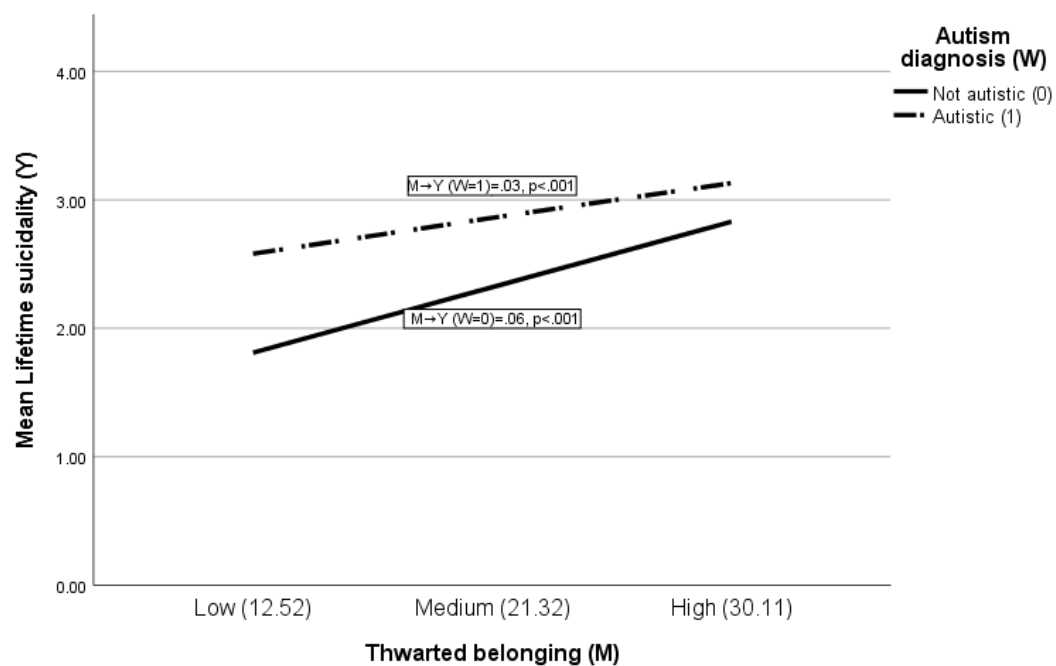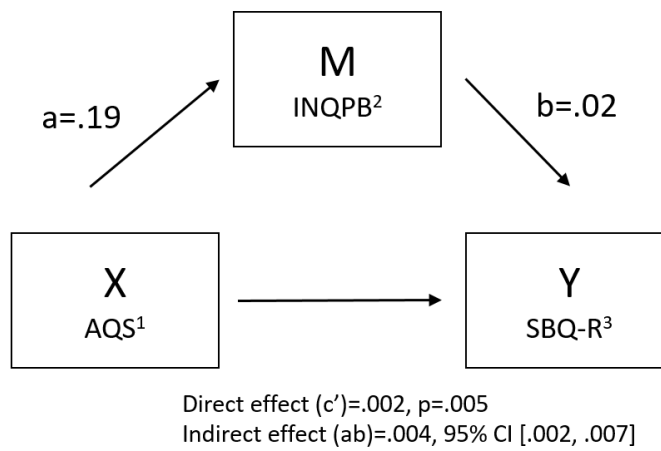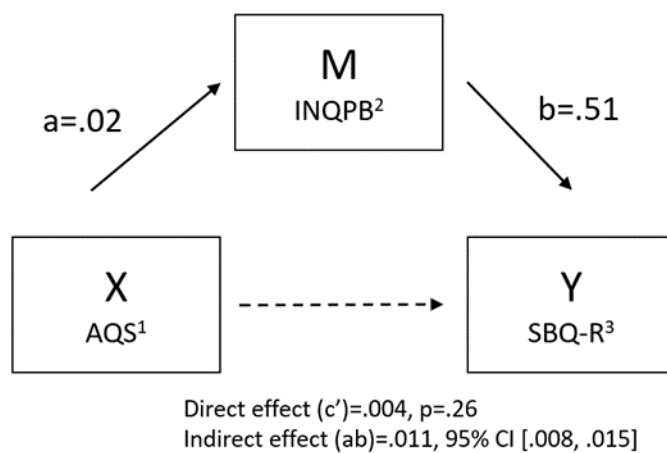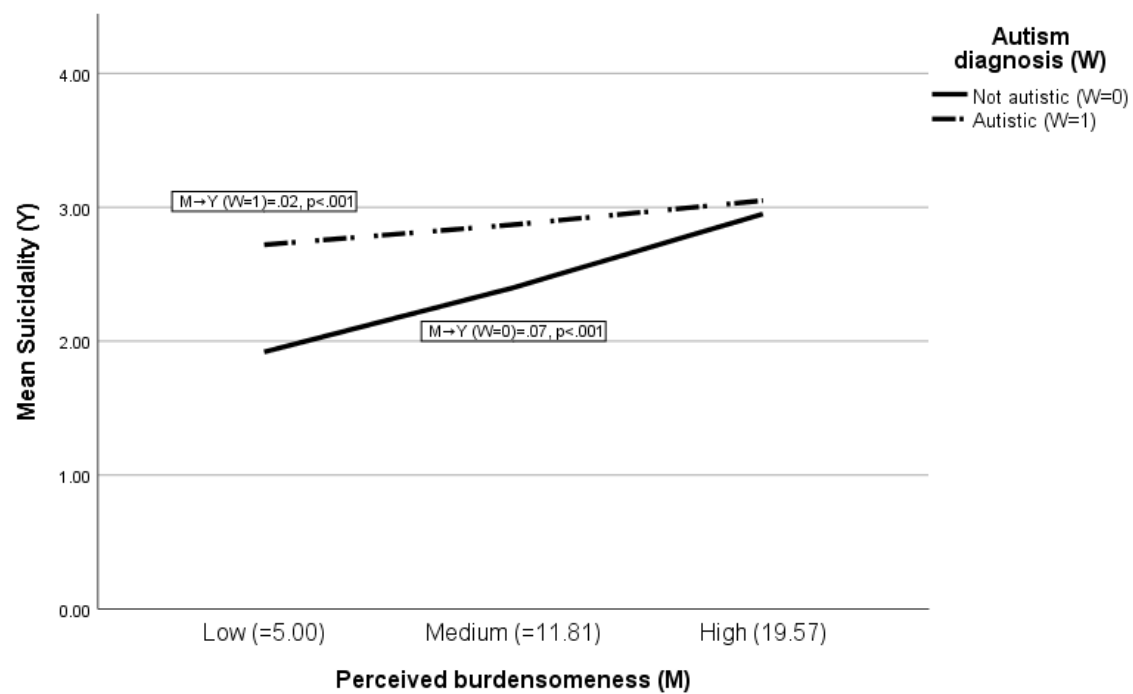
Figure 8 top

Table 1. Participant characteristics and descriptive statistics

Participant characteristics	Non-autistic group			Autistic group		
	Male (n=118)	Female (n=219)	Other gender (n=2)	Male (n=124)	Female (n=206)	Other gender (n=20)
Age mean (SD)	43.68 (18.47)	40.0 (13.95)	24.5 (3.54)	44.65 (13.82)	41.13 (13.29)	33.05 (10.56)
Range (min-max)	72 (18-90)	56 (18-74)	5 (22-27)	52 (18-70)	55 (18-73)	36 (18-54)
N (%) endorsing postgraduate degree	48 (40.7%)	103 (47%)	0	48 (38.7%)	67 (32.5%)	7 (35%)
Living with support n (%)	21 (17.8%)	21 (9.6%)	1 (50%)	42 (33.9%)	43(20.9%)	5 (25%)
Employed full time n (%)	55 (46.6%)	86 (39.3%)	1 (50%)	40 (32.3%)	55 (26.7%)	5 (25%)
Diagnosed with neurodevelopmental cond n endorsing n=yes (%)	14 (11.9%)	14 (5.9%)	1 (50%)	36 (29%)	62 (30.1%)	8 (40%)
Diagnosed with at least one co-occurring mental health condition n=yes (%)	26 (22%)	75 (34.2%)	1 (50%)	76 (61.3%)	148 (71.8%)	16 (80%)
Descriptive statistics mean (sd)	Male (n=118)	Female (n=219)	Other gender (n=2)	Male (n-124)	Female)(n=206)	Other gender (n=20)
Burdensomeness (INQ10 PB)	6.19 (12.49)	7.25 (5.11)	22 (8.49)	14.61 (7.65)	14.85 (8.20)	16.05 (9.05)
Thwarted belonging (INQ10 TB)	17.18 (8.06)	16.16 (7.91)	31.5 (4.95)	26.43 (6.70)	25.61 (6.93)	26.15 (5.67)
Suicidal capability (ACSSFAD)	17.23 (6.87)	15.61 (6.91)	15.5 (16.26)	17.38 (6.63)	15.77 (7.58)	18.65 (5.64)
Traumatic life events (VEQ)	17.80 (12.65)	22.37 (15.66)	51.5 (31.82)	42.67 (18.46)	45.80 (17.81)	43.75 (14.78)
Mean autistic traits (AQ-S)	63.45 (12.49)	59.64 (12.55)	76.5 (7.78)	89.62 (12.04)	91.85 (11.15)	89.75 (9.00)
Mean lifetime suicidality (SBQ-R)	2.00 (.90)	2.16 (1.01)	3 (1.41)	3.01 (.90)	3.19 (.82)	3.30 (.73)
Breakdown of past suicidal behaviour by type n (%)	Non-autistic combined male, female and other gender			Autistic combined male, female and other gender		
No past suicidal thoughts or behaviours	106 (31.7)			16 (4.7)		
Past suicidal thoughts	120 (35.9)			55 (16.1)		
Past suicide plans	73 (21.9)			140 (40.9)		
Past suicide attempt	35 (10.5)			131 (38.3)		

Table 2: Logistic regression exploring the association between thwarted belonging, perceived burden and their interaction and past reported suicidal thoughts and behaviours in autistic and non-autistic adults

Non-suicidal versus suicide ideation	Non-autistic adults				Autistic adults			
		95%CI for Odds ratio				95% CI for Odds ratio		
	b(SE)	Lower	Odds ratio	Upper	b(SE)	Lower	Odds ratio	Upper
Intercept	8.57 (2.23)				.41 (.90)			
Belong	-.39 (.092)*	.57	.68	.81*	-.06 (.06)	.85	.95	1.06
Burden	-3.01 (.95)*	.01	.05	.32*	-.05 (.04)	.87	.95	1.04
Belong*burden	.117 (.036)*	1.05	1.12	1.21*				
Suicide plan versus suicide ideation								
Intercept	-3.39 (1.82)							
Belong	.029 (.09)	.87	1.03	1.22	-.58 (.60)			
Burden	.936 (.67)	.69	2.55	9.39	.02 (.03)	.97	1.02	1.07
Belong*burden	-.007 (.03)	.94	.99	1.05	05 (.03)	1.00	1.05	1.11
Suicide attempt versus suicide ideation								
Intercept	-2.65 (2.24)				.			
Belong	-.09 (.10)	.74	.91	1.11	.64			
Burden	.28 (.79)	.28	1.32	6.17	.05 (.03)*	1.0	1.05	1.11
Belong*burden	.04 (.03)	.97	1.03	1.10	.07 (.03)*	1.01	1.07	1.31
Note R^2=.31 (Cox & Snell), .34 (Nagelkerke). Model X^2(9)=128.29, p<.001					Note R^2=.10 (Cox & Snell), .11 (Nagelkerke). Model X^2(6)=36.67, p<.001. *p<.001.			

Table 3 Logistic regression exploring the association between thwarted belonging, perceived burden, suicidal capability and their interactions and past reported suicidal thoughts and behaviours in autistic and non-autistic adults

	Non-autistic people				Autistic people			
		95%CI for Odds ratio				95%CI for Odds ratio		
Non-suicidal versus suicide attempt	**b(SE)**	**Lower**	**Odds ratio**	**Upper**	**b(SE)**	**Lower**	**Odds ratio**	**Upper**
Intercept	7.91 (1.47)*				2.78 (1.14)			
Belong	-.22 (.06)**	.72	.80	.90	-.11 (.06)**	.81	.90	.99
Burden	-.61 (17)*	.39	.54	.76	-.12 (.04)**	.82	.89	.97
Suicidal capability	-.05 (.04)	.89	95	1.02	-.04 (.04)	.89	.96	1.04
Belong*burden	.02 (.01)**	1.01	1.02	1.03				
Suicide ideation versus suicide attempt								
Intercept	4.23 (2.4)				3.32 (.79)			
Belong	.08 (.11)	.90	.91	1.12	-.05 (.03)**	.90	.95	1.00
Burden	-.36 (.82)	.71	.92	1.17	-.07 (.82)**	.88	.93	.99
Suicidal capability	-.08 (.03) *	.87	.87	.98	-.11 (.03)*	.86	.90	.94
Belong*burden	-.03 (.03)	.99	.99	1.01				
Suicide plan versus suicide attempt								
Intercept	-.12 (2.33)				1.53 (.62)			
Belong	.11 (.10)	.93	1.03	1.14	-.03 (.02)	.94	.97	1.00
Burden	.58 (72)	.87	1.06	1.31	-.02 (.02)	.94	.98	1.03
Suicidal capability	.04 (.03)	.92	.98	1.05	.03 (.02)	.94	.97	1.01
Belong*burden	-.04 (.03)	.99	.99	1.00				
	*Note R^2=.34 (Cox & Snell), .36 (Nagelkerke). Model X^2(12)=136.46, p<.001 *p<.001 **p<.05*				*Note R^2=.15 (Cox & Snell), .17 (Nagelkerke). Model X^2(9)=56.88, p<.001 *p<.001 **p<.05*			

Table 4. Simple linear regressions showing associations between lifetime suicidality and all predictor variables (thwarted belonging, perceived burden, capability, traumatic life events and autistic traits) in autistic and non-autistic groups

	Autistic group			Non-autistic group		
Predictor	R^2	F statistic (df)	p value	R^2	F statistic (df)	p value
Thwarted belong (INQTB)	.078	29.74 (1,340)	<.001	.211	90.293 (1,332)	<.001
Perceived burden (INQPB)	.063	23.86 (1,340)	<.001	.227	97.476 (1,332)	<.001
Capability (ACSS)	.037	9.77 (1,341)	<.001	.010	4.489 (1,330)	.035
Traumatic life events (VEQ)	.190	103.07 (1,335)	<.001	.349	173.856 (1,322)	<.001
Autistic traits (AQS)	.042	15.35 (1,330)	<.001	.040	14.412 (1,317)	<.001

Compliance with ethical standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of Coventry University (ref p61841) and with the 1964 Helsinki declaration and its later amendments or comparable ethical approval standards. Informed consent was obtained from all individual participants included in the study. This article does not contain any studies with animals performed by any of the authors.

The authors declare that they have no conflict of interest.

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