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Are tantrums in autism distinct from those of other childhood conditions? A comparative prevalence and naturalistic study

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ABSTRACT

Background: While autistic temper tantrums during preschool age are a common challenging behavior, it is unknown whether they are qualitatively and quantitatively different from those arising in other neurodevelopmental conditions.
Method: Tantrum frequency, duration, triggering factors, behavioral components, parental responses and parental perception of their impact on functioning were collected in 48 autistic spectrum (AS) preschoolers and in 47 preschoolers with other neurodevelopmental conditions, aged from 2 to 5 years.
Results: The AS group had more frequent tantrums with no identifiable triggers, a higher proportion of tantrums triggered by communication problems and in the context of demands, and their parents were more likely to give in to their demands in response to tantrums. No other group differences in terms of frequency, duration, perceived impact, triggers, modulators and behaviors were found.
Conclusion: This study did not find an increased frequency of tantrums at a preschool age in youth with and without an AS diagnosis. Further research should now consider if autistic tantrums differ from that of typically developing peers.

1. Introduction

Temper tantrums are developmentally normal up to a certain age and intensity (Tremblay, 2000). According to existing literature, 87% of children between 18 and 24 months have at least one tantrum a month. This rises to 91% between 30 and 36 months, then drops to 59% of children between 42 and 48 months (Bhatia et al., 1990; Osterman & Bjorkqvist, 2010; Potegal & Davidson, 2003). Despite having been the subject of numerous books aimed at supporting parents in the last decade (i.e. Lipsky, 2011), temper tantrums have not received much attention in the peer-reviewed scientific literature. The last Diagnostic and Statistical Manual of Mental Disorders (DSM–5) includes a *disruptive mood dysregulation disorder* diagnosis defined by the presence of irritability and temper tantrums. However, it does not provide a definition of tantrums, beyond them being triggered by frustration (APA, 2013).

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Available descriptions of tantrums in neurotypical preschoolers indicates that they usually last less than 5 min (Potegal, Kosorok, & Davidson, 2003), and are less frequent as children age (Alakortes et al., 2017; Bhatia et al., 1990; Jenkins, Bax, & Hart, 1980; Osterman & Bjorkqvist, 2010; Potegal et al., 2009). They tend to start with angry emotions that subside quickly, followed by distressed or sad emotions which last longer (Potegal et al., 2003, 2009). Fourteen behaviors are particularly common during tantrums: screaming, shouting, crying, whining, falling down, hitting, kicking, pulling/pushing away, stiffening, stomping, throwing and asking for comfort from an adult (Potegal & Davidson, 2003).

Temper tantrums also receive different names depending on the population being studied. “Rage attacks” or “temper outbursts” are mostly used for older children or adults with Gilles de la Tourette syndrome or Obsessive-Compulsive Disorder (Chen et al., 2013; Storch et al., 2012). The use of “meltdown” is more frequent for autistic children in lay literature, and ‘’temper tantrums” is more universally used for young neurotypical children (Potegal & Davidson, 2003). The difference between normal and abnormal tantrums is ill defined, leading some authors to use a ‘’pathological’’ definition when studying typical tantrums. For instance, the definition of tantrums used in Oppositional Defiant Disorder (ODD) has been applied to examine the prevalence of temper tantrums in non-clinical children (Bhatia et al., 1990), yet these tantrums may differ in typical and non-typical conditions. As such, tantrums would be indicative of an underlying psychopathology if too frequent or too intense (Belden, Thomson, & Luby, 2008; Wakschlag et al., 2012). Wakschlag et al. (2012) concluded after studying a large cohort of 1490 preschoolers, that aggression, unpredictability and daily tantrums were more likely indicative of a problem. Wakschlag et al. (2012) also found that a frequency of 10–20 tantrums per month can discriminate between children with or without a psychiatric diagnosis (Attention Deficit/Hyperactivity Disorder or ODD). Additionally, aggression towards caregivers found in more than 50% of tantrums, self-harm observed in tantrums lasting more than 25 min, and tantrums where children cannot soothe themselves, have all been proposed as thresholds indicative of clinical severity (Belden et al., 2008).

In autistic children, temper tantrums can occur in association with other challenging behaviors like sleep problems, selective eating, anxiety, irritability, self-harm and aggression (Rzepecka, McKenzie, McClure, & Murphy, 2011). These behaviors, especially aggression, may limit school integration (Goldin, Matson, Tureck, Cervantes, & Jang, 2013; Machalicek, O’Reilly, Beretvas, Sigafoos, & Lancioni, 2007), increase the risk of burnout in healthcare professionals (Hastings & Brown, 2002) and can even lead to hospitalization for autistic children if community services are insufficient (Mandell, 2008). Tantrums are also associated with lower family well-being, higher family distress and higher financial burdens for families (Hodgetts, Nicholas, & Zwaigenbaum, 2013; Lecavalier, Leone, & Wiltz, 2006), and are more predictive of maternal stress than the severity of autism symptoms (Hastings et al., 2005). In a sample of 863 autistic children from 2 to 18 years old, including 71 preschoolers, Maskey, Warnell, Parr, Le Couteur, and McConachie, (2013) reported that tantrums were the third most common complaint of parents after eating and sensory problems. In another cohort, 56.3% of autistic preschoolers had more than 3 tantrums a week (Maskey et al., 2013) and another study found 92% of autistic children from 1 to 17 years old had present or past meltdowns or aggression (Mayes & Calhoun, 2011). Moreover, the prevalence of tantrums within a three-month period was reported in one study (Dominick, Davis, Lainhart, Tager-Flusberg, & Folstein, 2007) to be 70.9% in autistic children (N = 67), of these children 50% started having tantrums after age three and 60% had tantrums on a daily basis. However, in all these studies, the absence of a clinical comparison group does not allow for a conclusive understanding on whether tantrums are more frequent in autism than in other neurodevelopmental conditions.[1]

Risk factors for tantrums have mostly been studied in school years and beyond, yet autism severity has been correlated to the frequency and severity of tantrums in children aged 2–16 (Konst, Matson, & Turygin, 2013). Self-harm, destructive aggression and stereotypical behaviors (Matson et al., 2011), ADHD (Goldin et al., 2013; Tureck, Matson, May, & Turygin, 2013), anxiety (Cervantes, Matson, Tureck, & Adams, 2013), low levels of social adaptation (Matson, Neal, Fodstad, & Hess, 2010), and challenging behaviors in general (Chowdhury, 2012; Farmer et al., 2015; Hartley, Sikora, & McCoy, 2008) are associated with a higher amount or increased intensity of tantrums. Conversely, neither the level of language (Dominick et al., 2007; Maskey et al., 2013; Mayes, Lockridge, & Tierney, 2017; Sipes, Matson, Horovitz, & Shoemaker, 2011), or IQ, is correlated with tantrums in clinical populations (Ando & Yoshimura, 1978; Dominick et al., 2007; Mayes & Calhoun, 2011; Mayes et al., 2012; Tureck, Matson, Cervantes, & Konst, 2014).

In regard to tantrum triggering factors, only one study with 24 preschoolers with psychiatric conditions (including 5 autistic children) examined 4 triggering contexts in professionals’ observations: transitions, problematic interaction with peers, separation from caregiver, and non-compliance to adult demands (Eisbach et al., 2014). To our knowledge, no study has yet examined the time course and behavioral components of tantrums in autistic children during preschool years. Furthermore, most studies cited above used questionnaires that asked about specific behavioral symptoms that can occur during a tantrum, but could also occur in other contexts. For instance, a child can “pull hair”, “cry” or “scream” in multiple circumstances that could not be described as a tantrum. Most studies have measured multiple challenging behaviors at the same time, this is also true for literature on aggression in general, which renders data hard to interpret (Dominick et al., 2007).

Our current research aims to fill in these gaps by comparing tantrums in autistic preschoolers with a clinical control group of age-matched children. Youth in the control group were initially referred for a suspected autism spectrum (AS) disorder and were not given an AS disorder diagnosis. Thus, the current sample reflects a representative population found in specialized child psychiatry clinics and allows us to assess whether the presence of tantrums is associated with a subsequent diagnosis of AS specifically. The primary objective of this study was to describe tantrums in terms of antecedents (contexts in which they arise, triggering and

[1] We use the respectful terms “autistic” children and “autism spectrum” children as it is currently the preferred language to refer to autism in the opinion of autistic people and their relatives (Kenny et al., 2016) and as using person first language can lead to unhelpful biases (Gernsbacher, 2017).

Table 1
Participant characteristics.

	AS	Non-AS	*p*
Total N	48	47	–
Mean age (months; SD)	*M* = 47.7 (12.3)	*M* = 44.2 (10.3)	0.131(t-test)
Sex	37 M, 11F	38 M,9F	0.802 (Chi2)
Age at first steps (months; SD)	13.19 (2.803)	14.02 (3.213)	0.181 (t-test)
Siblings (N; SD)	1.28 (1.362)	1.28 (1.036)	0.693 (t-test)
Mother education level (years; SD)	14.19 (3.173)	14.15 (2.859)	0.956 (t-test)
Father education level (years; SD) (SD)	14.83 (3.396)	14.68 (3.408)	0.836 (t-test)

Note. AS = autism spectrum. M = male. *M* = mean. F = female. SD = standard deviation.

modulating factors), characteristics of the behavior itself (prevalence, frequency, duration, age at onset) and consequences (caregiver perceptions of, and responses to, these tantrums). The secondary objective was to explore the correlations between tantrums and demographic and psychological variables at this age. We predicted that the AS group would present different types of triggering factors and behavioral characteristics related to tantrums (e.g., more triggering factors related to sensory issues and repetitive and restricted behaviours and greater self-injurious behaviors during tantrums), have more frequent tantrums than the non-autistic group and their tantrums would have a greater impact on their family's well-being compared to the non-autistic clinical group.

2. Methods

2.1. Participants and procedures

Participants were recruited through a specialized outpatient clinic at Rivière-des-Prairies Hospital, Montreal (Canada). The clinic evaluates all children suspected of autism in the north of Montreal and referrals are distributed randomly to the clinicians. All children received a multidisciplinary autism assessment led by two psychiatrists specialized in autism, which included the ADOS^{-2}, a clinical interview with caretakers, cognitive testing (when possible) and direct observation of the child in their natural environment by a clinician was performed when information regarding social behaviors with peers collected from parents was judged insufficient. The final diagnosis, based on DSM 5 criteria, was reached by consensus by the multidisciplinary team. One hundred twenty-four parents of children younger than 6 years referred to the clinic between May 25th 2016 and June 30th 2017 were offered to participate. Four parents (3.2%) refused to participate, 15 (12%) parents could not be reached by the research team and the children of 10 (8%) parents did not present with any tantrums (3 had autism, 7 did not). Our final sample included 95 preschoolers, 20 females (21.1%) and 75 males (78.9%) between 2 and 5.8 years of age (*M* = 3.8, *SD* = 0.94) for whom informed written consent was obtained (see Table 1). Eighty-four participants were assessed with the ADOS^{-2} protocol (module ''toddler'': 7; module 1: 55; 19 module 2: 19; module 3:4). The remaining 11 were either assessed with the ADOS^{-2} before being referred to the clinic or had no sign of autism justifying an ADOS administration. The characteristics of autistic participants are presented in Table 1 and diagnoses of the non-autistic group can be found in Table 2.

2.2. Development

In the absence of an existing questionnaire meeting our objective, we developed a questionnaire based on a thorough review of the literature and on a focus group conducted in two different sessions with 8 healthcare professionals: 3 psychologists, 2 psycho-

Table 2
Comorbid diagnoses.

Diagnosis	AS group N (%)	Non-AS group N (%)
Language delay	NA	36 (76.6)
ADHD	4 (8.3)	19 (40.4)
Global developmental delay	NA	6 (12.8)
Attachment disorder	0	5 (10.6)
Developmental coordination disorder	2 (4.2)	5 (10.6)
Prematurity	0	4 (8.5)
Tic disorder	0	3 (6.4)
Speech fluency disorder	0	1 (2.1)
Selective mutism	0	1 (2.1)
Sleep disorder	2 (4.2)	1 (2.1)
Oppositional defiant disorder	0	2 (4.2)
No diagnosis	0	2 (4.2)

Note. ADHD = attention deficit/hyperactivity disorder. NA = not applicable. Language delay was not formally evaluated in the AS group. Most children in the AS group could not yet be tested for cognitive functions. 24 participants had more than 1 diagnosis.

educators, 1 occupational therapists, 1 speech language pathologist, and 1 psychiatrist with an expertise in diagnostic assessments of autism. The content of the focus group was recorded, transcribed (Greenwood & Parsons, 2000; Parsons & Greenwood, 2000) and coded (Corbin & Strauss, 1990). Information provided by the focus groups was then merged to that provided by the autistic and non-autistic tantrum literature and organized by themes using the Antecedent-Behavior-Consequences framework. A preliminary version was piloted with 2 parents, and then reviewed by the professionals, resulting in a final version of the questionnaire. Preliminary analyses were conducted to ensure internal consistency was sufficient for the frequency of the different types of tantrums and their impact (questions 10–22). The consistency of 13 questions were tested through a Cronbach's alpha test, and showed a high level of consistency ($\alpha = 0.88$). The other questions could not be tested this way because they used a checklist format.

2.3. Content and administration

Our definition of temper tantrums was given to parents at the start of the questionnaire: "A *temper tantrum* or *temper outburst* is a short moment during which your child shows an explosion of challenging behaviors like opposition, aggression, cries and/or screams in response to strong emotions. Here's a common example: a child wants a toy in a store, the parent refuses to buy it, the child cries, screams and rolls on the ground." The first section of the questionnaire explores the *context* of the tantrums, i.e. their triggering factors (17-item checklist, and an open-ended question), environmental factors (4-item checklist and an open-ended question) and potential modulators that could enhance the probability of a tantrum without triggering it, such as sickness or fatigue (10-item checklist and one open-ended question). The second section explores the *characteristics* of the tantrums: associated behaviors (16-item checklist and one open-ended question); the age at which tantrums first started ("before 18 months," "18-23 months," "24 to 35," "36 to 47″ and "48 or older"), the mean duration of tantrums and the mean time necessary for the child to go back to their usual mood ("less than 1 min", "between 1 to 5″, "6 to 10″, "11 to 25″ and "more than 25″) based on previous studies (Belden et al., 2008; Potegal et al., 2003; Wakschlag et al., 2012), and the age where the tantrums were at their highest point. The third section explores *parent's response* to the tantrums (9-item checklist and one open-ended question). Nine questions in the fourth section of the questionnaire explores the *frequency* of different tantrums (i.e., all tantrums, tantrums lasting more than 5 min, happening without a parent, with no identifiable trigger, with aggression against objects, with aggression against people, with self-mutilation, where the child cannot self-soothe and that are considered "severe"). Answers were rated on a 5-point likert-type scale, in which the parent indicated the frequency of each of the aforementioned types of tantrum ("every day", "4 to 6 times a week", "1 to 3 times a week", "1 to 3 times a month" and "rarely or never"). The fifth section explores the *impact* of tantrums on the family, daycare center, other children and on the level of caregiver adjustment (change in routine, avoidance of certain situations) needed to manage tantrums, on a 5-point scale ("no impact", "slight impact", "moderate impact", "important impact" or "very important impact").

The questionnaire was administered by the first author (a psychiatrist) to parents during the multidisciplinary assessment when possible (93.7%), or by phone (6.3%). The duration was between 15 and 30 min depending on the level of detail given by parents in the open-ended questions. Only one primary caregiver, who was most acquainted with the child's behaviors, answered the questionnaire. In our sample, 67 mothers (70.5%) and 28 fathers (29.5%) were interviewed.

2.4. Analyses

The primary objective was to describe tantrums in terms of antecedents (contexts in which they arise: triggering and modulating factors), characteristics of the behavior itself (prevalence, frequency, duration, age at onset) and consequences (caregiver perceptions of, and responses to, these tantrums). The secondary objective was to explore the correlations between tantrums and demographic and psychological variables at this age. A Mann-Whitney U Test was run to compare the frequency of all tantrums, mean tantrum duration, mean duration to go back to usual mood, age at first tantrum and perceived impact of tantrums between the two groups. Questions using a checklist format were analyzed by comparing the proportion of children presenting each item with Chi-squared tests. Correlations between the frequency of temper tantrums and caregiver perception of the impact of tantrums, chronological age, age at first steps (as a proxy for intellectual potential; Mayes & Calhoun 2003), and parental level of education were investigated for each group using Spearman's Rank-Order and then compared between groups using a Fisher r to z transformation. For all statistical tests, a significance threshold of 0.05 was used. All statistics were performed using SPSS version 24.0.0.1. Only main results are reported here. Detailed results can be accessed within the supplementary material. A power analysis was performed using G*Power version 3.1.9.2. A sample of 47 participants in each group was enough to detect an effect-size of 0.6 with a two-tailed significance threshold of 0.5 and a power of 80%.

3. Results

3.1. Frequency of tantrums

Ninety-five of the 105 screened participants (90.5%) had at least 1 tantrum in the last three months. Eighty-five of these 95 participants (89.5%) had tantrums at least once a week and with a mean duration of less than 5 min in most cases. The AS group had a significantly higher frequency of tantrums without an apparent trigger ($U = 880$, $p = 0.032$, $r = -0.22$). Otherwise, the groups did not differ regarding the frequency of any other type of tantrums (all $p > 0.05$), including all tantrums ($U = 1056.6$, $p = 0.562$, $r = -0.059$), and age at first tantrum ($U = 998$, $p = 0.302$, $r = -0.106$), mean duration of tantrums ($U = 1003.5$, $p = 0.283$, $r = -0.110$) and mean time necessary for a complete return to calm. However, the children who had a mean duration of more than 25 min were all in

the AS group (see figures 1,2,3 in supplementary material).

3.2. Antecedents of tantrums

The three triggering factors most commonly reported were caregiver refusals (45|93.8% of AS, 47|100% non-AS participants); interruptions of child's activity, (43|89.5% AS, 39|83.0% non-AS participants) and difficulty of self-expression (37|77.1% AS, 27|57.4% non-AS participants). Only this latter triggering factor was more frequent in the AS group ($\chi^2(1) = 4.165$, $p = 0.041$); all other $p > 0.05$). The three modulating factors most commonly reported were: fatigue (28|58.3% AS, 24|51.1% non-AS participants), specific locations (25|53.2% AS, 25|52.1% non-AS participants), and hunger (19|39.6% AS, 15|31.9% non-AS participants). None of these modulating factors were found to have a significant statistical difference of proportion between the two groups (all $p > 0.05$). The AS group had a significantly higher frequency of tantrums without an identifiable trigger ($U = 867.5$, $p = 0.038$).

3.3. Characteristics of tantrums

The three behaviors most commonly reported in association with tantrums were: crying (46 AS|95.8%, 46 |97.9% non-AS participants); screaming (39|81.3% AS, 40|85.1% non-AS participants), and verbal or non-verbal requests (42|87.5% AS, 31|65.1% non-AS participants). Only this latter behavior was more frequent in the AS group ($\chi^2(1) = 6.193$, $p = 0.016$). Age at first tantrum, mean duration of tantrums and mean time necessary for a complete return to calm did not differ between groups (all $p > 0.05$), but the children who had a mean duration of more than 25 min ($n = 6$) were all in the AS group.

3.4. Consequences of tantrums (parental response)

The three parental responses most commonly reported were: talk to reassure the child, (45|93.8% AS, 44|93.6% non-AS participants); distract the child (40|83.3% AS, 39|83.0% non-AS participants) and scold (33|68.8% AS, 36|76.6% non-AS participants). Parents of AS participants (41|85.4%) were more likely than parents of non-AS children (27|57.4%) to give their children what they wanted in response to a tantrum ($\chi^2(1) = 9.132$, $p = 0.003$). There was a trend for parents of non-AS children to use time-outs more often ($\chi^2(1) = 4.141$, $p = 0057$).

3.5. Perceived impact

The two groups did not differ regarding the impact of tantrums perceived by parents at home, at daycare/school or with brothers/sisters (all $p > 0.05$).

3.6. Factors associated with frequency

Frequency of tantrums did not correlate with chronological age (AS: $r = -0.145$, $p = 0.325$; non-AS: $r = -0.152$, $p = 0.306$), age at first steps (AS: $r = 0.017$, $p = 0.911$; non-AS: $r = 0.029$, $p = 0.847$) or maternal education (AS: $r = 0.002$, $p = 0.991$; non-AS: $r = 0.17$, $p = 0.910$) in either group. The only variable significantly correlated to the frequency of all tantrums was parents' perception of the impact of tantrums at home in both the AS ($r = 0.442$, $p < 0.002$) and the non-AS ($r = 0.366$, $p = 0.011$) groups. The strength of correlation did not differ between groups ($Z = -0.43$, $p = 0.662$).

4. Discussion and implications

The aim of this study was to describe the prevalence and behavioral profile of temper tantrums in a group of autistic children in comparison to non-autistic children with another clinical diagnosis. Our main findings suggest that the frequency, duration and perceived parental impact of tantrums do not distinguish children with and without AS in a clinical sample.

4.1. Frequency, duration and age of onset

The mean duration of tantrums observed is consistent with what has been described in neurotypical preschoolers (Potegal et al., 2003). The only type of tantrum more frequent in autism were those without an *identifiable* trigger, which may result from a general difficulty for parents to understand the emotions and intentions of an autistic child (Brewer et al., 2015). Autistic children did not have more or longer temper tantrums and those tantrums were not perceived as having a greater impact on their families compared to the non-autistic clinical control group, contrary to our hypotheses. Furthermore, the small effect sizes for these non-significant differences suggest that no clinically relevant differences were missed due to a lack of power. These findings contrast with the few studies comparing temper frequency between autistic and non-autistic clinical groups of children, for instance with ADHD (Goldin et al., 2013; Tureck et al., 2013). However, most comparative studies did not measure tantrums in isolation, rather they were computed from a composite index of multiple behaviors directly or indirectly linked to tantrums. For instance, in the ASD − CC scale (Matson & Wilkins, 2008), tantrums are included in a subscale of 10 items that may be present during a tantrum, but that are not necessarily specific to tantrums and is therefore not informative on behaviors specific to tantrums.

In the current study, no single demographic factor was significantly correlated to tantrum frequency. Age has been linked to

frequency in some past studies (Bhatia et al., 1990; Dominick et al., 2007; Potegal & Davidson, 2003), but not in others (Belden et al., 2008; Bronsard, Botbol, & Tordjman, 2010; Hill et al., 2014). This may be due to an insufficient age range to detect a correlation, because tantrums tend to persist at an older age in children with psychiatric conditions (Belden et al., 2008; Carlson, Potegal, Margulies, Gutkovich, & Basile, 2009; Dominick et al., 2007). In favor of this latter interpretation, a more general measure of so-called maladaptive behaviors, including tantrums, shows a decline with age in most longitudinal studies, but after the preschool period (Anderson, Maye, & Lord, 2011; Chowdhury, 2012; Gray et al., 2012; Kring, Greenberg, & Seltzer, 2010; Melville et al., 2008; Shattuck et al., 2007; Woodman, Smith, Greenberg, & Mailick, 2015).

4.2. Antecedents of tantrums

The most common triggering factors were frustration and interruptions during tasks, as in Eisbach et al. (2014). All 16 triggering factors on our questionnaire occurred in at least some participants, which demonstrates how diverse triggering factors can be. While stereotypical behaviors have been correlated with self-injurious and aggressive behaviors in past studies (Dominick et al., 2007; Kanne & Mazurek, 2011; Lecavalier, 2006), they were present here in only 12.5% of AS children as a perceived trigger (and in 14.6% as a behavior during tantrums). There was no difference between the groups at this level, contrary to our hypothesis. Stereotypical behaviors could therefore represent a more general marker of the autistic phenotype without being associated with tantrums. Hypersensitivity to sound was, surprisingly, only present in 14.6% of AS children as a perceived trigger, and there was no statistical difference between the groups for this variable. Loud sounds are aversive to many autistic individuals (Lillian & Rebecca, 2010), but they seem to be insufficient to initiate tantrums in many preschoolers. Alternatively, it may indicate that it is difficult for parents to notice such a hypersensitivity in preschoolers, especially if they have communication problems. Only inferred difficulties in verbal expression was related to more tantrums in the autistic group, even though 76.6% of children in the control group had a speech delay. This difference is consistent with the tendency of children with speech delay to use non-verbal communication to express their intent, which may not be the case in autistic preschoolers.

4.3. Characteristics of tantrums

The most common behaviors observed during tantrums in both groups was “crying,” as was reported in a previous study of a large cohort of neurotypical children (Potegal & Davidson, 2003). Screaming behaviour was second when combining the two groups, and this has also been found in neurotypical children (Potegal & Davidson, 2003). The second most frequent behavior in the autistic group was “asking for something”. “Asking for something” was also the only contextual behavior present at a significantly higher proportion in the AS group. Coupled with the fact that expression difficulties were more prevalent as a reported trigger in AS children and that tantrums without an identifiable trigger were more frequent in the AS group, this suggests communication may play a role in tantrums of AS children. Even though the level of language has not been correlated to tantrums in descriptive studies (Dominick et al., 2007; Maskey et al., 2013; Mayes et al., 2017; Sipes et al., 2011), some intervention studies have shown that functional communication training may reduce problematic behaviors (Heath, Ganz, Parker, Burke, & Ninci, 2015).

Aggression towards people or objects was present in more than half of the children in both groups. This was more than what has previously been described, where only a quarter of children in one study were reported to have hit, pulled or pushed (Potegal & Davidson, 2003). In that study, one tantrum was analyzed for each 335 children (**for a total of 335 tantrums**), whereas in the present study, parents were asked if a particular behavior had occurred at least once during a tantrum in the last three months. Hence, this greater time period for tantrum observation could explain the increased presentation of aggression. Lastly, self-injurious behaviors were common in the AS group (33.3%), but not significantly more frequent than in the non-AS group (17.0%). It may be that our sample was underpowered to detect a small difference (Cohen r was 0.11 in our study and the sample was only powered to detect a size effect of 0.6), as self-injurious behaviors have been correlated to an autism diagnosis in other studies (Bodfish, Symons, Parker, & Lewis, 2000; Dominick et al., 2007).

4.4. Consequences of tantrums (parental response)

The three parental responses most commonly reported in the present study were: talk to reassure the child, distract the child and scold. In comparison, in Eisbach et al. (2014), verbal communication was first too, but intentionally ignoring the child came second (fifth in our study) and immobilizing the child came in third (seventh in our study). Parents of autistic preschoolers were more likely to give their children what they wanted, suggesting a communication function of tantrums or, alternatively, that parents are accustomed to "buying peace" to prevent further escalation. The second hypothesis seems less plausible, because parents of autistic children did not differ significantly from parents of non-AS children in their use of other means of calming tantrums. Also, parents in the non-AS group tended to use more time-outs, possibly meaning that they perceived the tantrums of their child as more willful and less related to their child’s difficulties (but this difference did not reach significance).

4.5. Limitation

There are several limitations to the current study. Our questionnaire, intended to collect qualitative information about tantrums, was developed for this specific study, yet has not been validated against other scales like the Achenbach child behavior checklist (Pandolfi, Magyar, & Dill, 2009). However, it has the advantage of being specifically tailored to the behavioral questions under

investigation. In addition, questionnaires relying on the informer's memory may be subject to distortions of events in the distant past. A second source of information (i.e. daycare workers) could have reduced this potential bias. Our sample size, although larger than other studies in this field, especially in behavioral interventions targeting challenging behaviors (Heyvaert, Saenen, Campbell, Maes, & Onghena, 2014), was adequately powered to compare only the overall frequency of tantrums in the two groups. Other analyses must be considered exploratory, as the study was not powered enough for multiple analyses. Our control group, children initially referred for a possible autism diagnosis that were then excluded after a specialized assessment, may have biased findings in favor of the null hypothesis, since the two groups probably share more similarities than would two groups of children with clinical conditions chosen in a more independent way. Also, only a poor proxy of intellectual development (age at first steps) was used because standardized intellectual testing is difficult to administer to preschoolers (Akshoomoff, 2006; Courchesne, Girard, Jacques, & Soulieres, 2018) and may underestimate the intelligence of autistic individuals (Nader, Courchesne, Dawson, & Soulieres, 2016). Also, cognitive testing at this early age is not a strong predictor of future intelligence (Clark, Barbaro, & Dissanayake, 2017; Flanagan et al., 2015; Lord & Schopler, 1989; Turner, Stone, Pozdol, & Coonrod, 2006). The test-retest reliability of the questionnaire will be tested in a second control group of neurotypical children and is not available yet.

4.6. Implications

This is the first comparative study to examine triggering factors, behavioral characteristics and parental response in a large group of autistic individuals compared to a clinical group. Temper tantrums of autistic children were strikingly similar to those of children who did not receive that diagnosis in terms of frequency and profile. Tantrums only differed significantly in some respects; autistic children had more tantrums triggered by expression difficulties and without identifiable trigger to parents. They had demands that were more frequent during tantrums and their parents gave them what they were asking for more frequently compared to non-autistic control children. These results point towards a communication function of tantrums, even though other studies did not find such a link (Dominick et al., 2007; Maskey et al., 2013; Mayes et al., 2017; Sipes et al., 2011). Lastly, there was no difference in perceived severity and overall tantrum frequency between the two groups with other diagnoses.

Conflict of interests

The authors declare that they have no conflict of interests.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.rasd.2019.03.003.

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