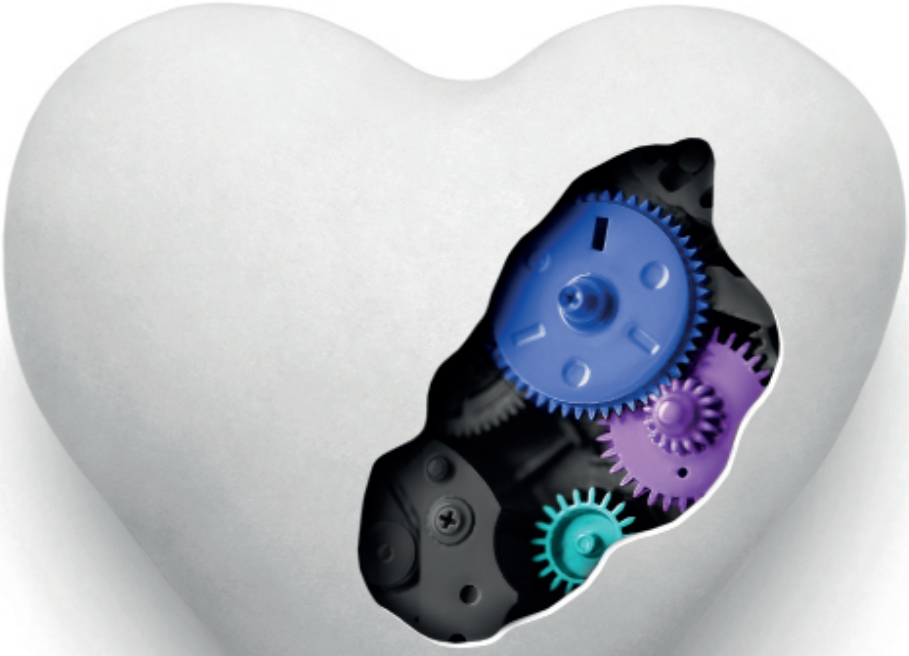
Tackling Teenage

Psychosexual functioning in adolescents with autism spectrum disorder (ASD)



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COLOFON

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´Als het niet kan zoals het moet, moet het zoals het kan.´

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Chapter 1

General Introduction

One of the most rapid and important changes in adolescence is the development of psychosexual functioning. Psychosexual functioning can be divided into three interrelated domains: sexual selfhood (i.e. intrapersonal functioning, such as self-esteem, self-perceived competence, and knowledge), sexual socialization (i.e. interpersonal functioning, such as interaction with peers, family, and media), and sexual/intimate behavior (Dewinter, Vermeiren, Vanwesenbeeck, & van Nieuwenhuizen, 2013; Tolman & McClelland, 2011). Even though psychosexual development takes off during adolescence, research into psychosexual functioning of adolescents with Autism Spectrum Disorder (ASD) has remained limited, particularly in cognitively able individuals with ASD and in comparison to typically developing (TD) individuals (for reviews see: Dewinter et al., 2013; Hancock, Stokes, & Mesibov, 2017; Kellaher, 2015). This despite the fact that the difficulties that characterize ASD may make psychosexual functioning particularly challenging. Those diagnosed with ASD have difficulties in social communication, and display restricted, repetitive behavior and interests (DSM-5; American Psychiatric Association, 2013). Particularly, difficulties in these areas can become gradually more problematic when reaching adolescence (Murphy & Young, 2005), as adequate social skills, social ´know-how´(social cognition), and adaptation to change are important in optimal psychosexual functioning (Collins, Welsh, & Furman, 2009; Maniglio, 2012; t Hart-Kerkhoffs et al., 2009). Most of the research into psychosexual functioning in individuals with ASD has focused on the atypical or problematic aspects of psychosexual functioning, particularly sexual behavior, rather than the positive elements, or how psychosexual functioning of adolescents with ASD differs from typically developing (TD) adolescents (for reviews see: Dewinter et al., 2013; Kellaher, 2015). Therefore, in the current thesis, we set out to investigate if ASD is related to difficulties in psychosexual functioning and if psychosexual functioning is different in adolescents with ASD compared to TD adolescents. In addition, we aimed to examine whether training could lead to improvements in psychosexual functioning. Before describing the specific aims of this thesis at the end of this chapter in more detail, I will first provide some background information.

Adolescence and typical psychosexual functioning

Adolescence is considered a transition period, marked by physical, mental and social changes and challenges (Dahl, 2004), aimed to prepare for the roles and responsibilities of adulthood, while taking the vulnerabilities and resources from childhood as the starting point to face these new challenges (Crockett & Petersen, 1993). Adolescence requires different, and sometimes new, skills and knowledge to successfully navigate the challenges (Dahl, 2004; Santrock, 2005). Particularly psychosexual functioning is a major developmental challenge of adolescence, triggered by the physical and social maturation and hormonal changes at the beginning of puberty (Fortenberry, 2013).

Much of the early research on psychosexual functioning in TD adolescents focused primarily on negative aspects, for example experimenting with boundaries, teenage pregnancies and sexually transmitted infections (Tolman & McClelland, 2011). With time however, psychosexual development was increasingly viewed as a normative element of adolescence, meaning a normal (accepted) and expected aspect of adolescent development. This normative approach on psychosexuality also reflects the stance of the World Health Organization, who defined sexual and reproductive health as more than just the absence of problems but also presence of positive experiences (Collumbien, Busza, Cleland, & Campbell, 2012). This also led to research into more positive aspects, for example sexual discovery and adaptation to new social demands.

In psychosexual functioning two elements are important to function optimally; psychosexual knowledge and psychosexual skills/behaviors. Both of these influence one another, a cyclical process of social learning (Bushwick, 2001). Psychosexual knowledge, or the lack thereof, may lead to behaviors and skills (Kirby, 2008; Ryan, Franzetta, & Manlove, 2007). For example, a lack of or incorrect psychosexual knowledge poses the risk of leading to inappropriate sexual behaviors (Collins et al., 2004). At the same time, psychosexual skills and behavior can also lead to more knowledge. For example, social interaction with peers at a young age, allows for informal learning experiences which enable for more complex social (or romantic) interactions later life. Especially during adolescence many social changes occurs (Pettifor et al., 2013), therefore complex social skills, including significant interest in others, managing peer-relations and peer-pressure, and adapting behaviour to often implicit or subtle rules of social interaction, become increasingly important (Collins et al., 2009). Interaction with friends also allows for learning and practicing opportunities for social and intimate relationships, thus allowing for more fine-tuning of social and intimate skills, but also more exposure to psychosexual learning opportunities to increase and improve knowledge.

Psychosexual functioning and ASD

After Autism Spectrum Disorder (ASD) was first included in the Diagnostic and Statistical Manual of Mental Disorders in 1980 as ‘infantile autism’ (DSM-III; American Psychiatric Association, 1980), psychosexuality was often not considered a relevant topic for individuals with ASD by their caregivers. Individuals with ASD were considered asexual or not ready for psychosexuality as their socio-emotional development lagged behind, thus psychosexual functioning was not considered an important priority (Ballan, 2012). However, research has shown that individuals with ASD have needs and desires for social and intimate relationships (Bauminger & Kasari, 2000; Calder, Hill, & Pellicano, 2013; Hellemans, Roeyers, Leplae, Dewaele, & Deboutte, 2010; Hénault, 2006; Stokes, Newton, & Kaur, 2007). In addition, ASD is a disorder with difficulties that are usually lifelong and noticeable in multiple domains of functioning. Thus with the coming of age of those who receive a

childhood diagnosis of ASD, adolescence and adulthood led to new challenges and difficulties, for both themselves and their families (Seltzer et al., 2003), including psychosexual functioning.

A long-held view was that the majority of those with ASD also had cognitive impairments or an intellectual disability (i.e. IQ < 70) (Charman et al., 2011). In recent years, the conceptualization of to whom the diagnosis of ASD applies has changed, resulting in the diagnosis of individuals with average to high intelligence with ASD (i.e. IQ >70) (Lai, Lombardo, & Baron-Cohen, 2014). Although with the introduction of the DSM-5 (American Psychiatric Association, 2013) worries existed about reduced sensitivity for cognitively able individuals, several studies have shown that the majority of the cognitively able individuals meet the criteria for ASD according to the DSM-5 (Mazefsky, McPartland, Gastgeb, & Minshew, 2013; Volkmar & McPartland, 2014). In addition, intelligence has also been related to psychosexual functioning in previous studies. For example, individuals with intellectual disabilities have been found to have less sexual knowledge as well as less sexual experience (McCabe, 1999). Research into the psychosexual functioning of individuals with ASD with an average to high intelligence (IQ >70) is therefore important, as some of the historical convictions and data regarding psychosexual functioning might not apply to all of those currently receiving an ASD diagnosis.

There are two main theoretical frameworks why particularly individuals with ASD may encounter difficulties with psychosexual functioning: a biological explanation and a psychosocial explanation. The biological explanation includes, for example, the influences of differences in hormones or brain connectivity (Belmonte et al., 2004; Geier & Geier, 2015; Muscatello & Corbett, 2018). Some studies have found that possibly there are biological differences related to psychosexual functioning in individuals with ASD, such as different hormonal exposures prenatally, as well as different functional development of the brain (Murphy et al., 2017) and delayed onset of menarche in girls with ASD (Knickmeyer, Wheelwright, Hoekstra, & Baron-Cohen, 2006). On the contrary, there is also research which shows that in fact pubertal timing in adolescents with ASD is similar to TD adolescents (May, Pang, O'Connell, & Williams, 2017). Research into biological differences and how these may lead to psychosexual differences is still emerging. The psychosocial explanation focuses on for example the effects of social experiences and interpretation thereof, possibilities to meet and interact with others, and limited flexibility on psychosexual functioning in individuals with ASD (Ballan & Freyer, 2017; Brown-Lavoie, Viecili, & Weiss, 2014; Jobe & Williams White, 2007), but also on fewer opportunities for formal and informal sexual health education (Hancock et al., 2017). As psychosexual knowledge and skills are important in optimal psychosexual functioning in TD individuals, it seems probable that individuals with ASD, who struggle with social and communication problems, will have less optimal psychosexual functioning. Particularly, it seems that at the very least adolescents with ASD follow a different

path in achieving psychosexual well-being (Hancock et al., 2017), making healthy psychosexual development especially challenging for individuals with autistic traits (Bailey, Palferman, Heavey, & Le Couteur, 1998; Bolton et al., 1994). As it is unclear how exactly the biological and social elements influence psychosexual functioning, it seems a biopsychosocial model, including multiple influences, is probably most helpful in trying to explain any differences in psychosexual functioning in adolescents with ASD compared to TD adolescents.

Similar to the development of research in TD adolescents, the initial focus of research into psychosexual functioning were particularly the inappropriate and problematic aspects of psychosexual functioning that adolescents with ASD may encounter (for a review see Dewinter et al., 2013). Often is was found that individuals with ASD have limited psychosexual knowledge, limited psychosexual skills and show inappropriate behaviors. Several studies have shown that adolescents with ASD have less knowledge regarding sexuality than their TD peers (e.g. Brown-Lavoie et al., 2014; Hellemans, Colson, Verbraeken, Vermeiren, & Deboutte, 2007; Stokes & Kaur, 2005). Both professionals and parents reported problems and worries such as limited awareness of personal and public boundaries (e.g. Ballan, 2012; Hellemans et al., 2007; Stokes et al., 2007). TD adolescents generally acquire sufficient information from both formal (e.g. Sex-Ed programs in schools) and informal sources (e.g. parents and peers; i.e. through social learning). However, adolescents with ASD receive less formal and informal opportunities to learn about sexuality (Hancock et al., 2017). Both professionals and parents indicate difficulties with providing formal sexual education (Hancock et al., 2017; Holmes, Himle, & Strassberg, 2015). In addition, due to a limited amount of peer relations (Orsmond, Krauss, & Seltzer, 2004) and lower social competence (Stokes et al., 2007; Williamson, Craig, & Slinger, 2008), adolescents with ASD may less frequently have informal social learning opportunities with peers. Also, adolescents with ASD may be less able to learn from informal sources, due to for example difficulties with implicit learning (Hudson, Nijboer, & Jellema, 2012), as compared to TD adolescents (Brown-Lavoie et al., 2014; Stokes et al., 2007; Sullivan & Caterino, 2008). With regard to acquiring the appropriate knowledge, the informal non-social sources (e.g. media) that adolescents with ASD use significantly more than those without ASD (Brown-Lavoie et al., 2014), may provide incorrect or over-romanticized information which could lead to more inappropriate behavior (Collins et al., 2004). Limited knowledge on psychosexuality may, in certain cases, escalate into inappropriate behaviors, as individuals with ASD may not know how to apply knowledge in real-life (Hannah & Stagg, 2016). Difficulties which have been described in previous research are limited understanding of private versus public sexual behavior (Nichols & Blakeley-Smith, 2009) or limited ability to identify abusive behavior (Sevlever, Roth, & Gillis, 2013) and sexual victimization (Brown-Lavoie et al., 2014).

The desire for social and intimate relationships combined with limited psychosexual skills and knowledge could lead to a higher prevalence of inappropriate or problematic behaviors. Several studies found inappropriate sexualized behaviors in individuals with ASD traits, for example sexually provocative talk, openly discussing sexuality, public masturbation, stalking and sexual offenses (both as victim and as perpetrator) (Demb & Pincus, 1993; Dewinter et al., 2013; Ginevra, Nota, & Stokes, 2015; Hellemans et al., 2007; Kellaher, 2015; Realmuto & Ruble, 1999; Sevlever et al., 2013; Stokes & Kaur, 2005; Stokes et al., 2007; t Hart-Kerkhoffs et al., 2009). Possibly the problematic and inappropriate behaviors were most studied (e.g. Dewinter et al., 2013; Hellemans et al., 2007; Sevlever et al., 2013; Stokes & Kaur, 2005; t Hart-Kerkhoffs et al., 2009), as these behaviors were undoubtedly the most challenging, and thus pressing for the environment. This is also reflected in the methods of these studies, which have predominantly included parent or caregiver reports, rather than self-report.

Research that has focused on the typical aspects of psychosexual functioning in individuals with ASD also exists, although more scarcely still (Ballan & Freyer, 2017). For example, research found that individuals with ASD have similar socially accepted sexual experiences and behaviors compared to other groups (Dewinter, Vermeiren, Vanwesenbeeck, Lobbestael, & Van Nieuwenhuizen, 2014; Gilmour, Schalomon, & Smith, 2012; Hénault, 2006; Kellaher, 2015; Stokes et al., 2007).

To summarize, with the coming of age of individuals with ASD, it became clear that adolescence is a particularly challenging time for this population. Steadily research has been growing, although there are limitations to the early studies into psychosexual functioning in adolescents with ASD. Research into psychosexual functioning in adolescents with ASD has predominantly focused on the existence of difficulties in psychosexual functioning as reported by parents and caregivers. In addition, much research has focused on individual elements of psychosexual functioning (Dewinter et al., 2013; Kellaher, 2015; Tolman & McClelland, 2011), mostly sexual behavior. As psychosexual functioning is such an interrelated concept (Hancock et al., 2017), investigating only one domain or using only one informant may be underestimating the complex relations which all contribute to healthy psychosexual functioning (Epstein & Ward, 2008). Furthermore, few studies have directly compared adolescents with ASD directly to TD adolescents, leaving it unclear if the difficulties found to date are indeed particularly related to ASD or if these difficulties are similar (in type and degree) to the difficulties experienced by TD adolescents. Despite the limitations of early studies in the field of psychosexual functioning in individuals with ASD, it is important to note that these early studies are very valuable, as they paved the way and sparked the interest in this, until then, neglected area. It is valuable to expand the knowledge that has been acquired up till now on psychosexual functioning in adolescents with ASD by obtaining information from multiple informants in all domains of psychosexual functioning,

in direct comparison to TD adolescents. This can provide a more well-rounded and multi-dimensional perspective on psychosexual functioning in individuals with ASD.

Aims and outline of this thesis

The current thesis, with three sub aims, extends previous work on psychosexual functioning in adolescents with ASD. The majority of our participants in the different studies are cognitively able (majority of the participants IQ > 70, mean IQ ≈ 100, with standard deviation ≈15), which means the reader should be aware that results can only be generalized with caution to populations with cognitive difficulties.

In the first part, we investigated the longitudinal relationship between childhood autistic traits and psychosexual problems in early adolescence (Chapter 2). In a general population cohort (n = 1873; the Tracking Adolescents' Individual Lives Survey (TRAILS)) we investigated if autistic traits in childhood predicted psychosexual problems in early adolescence.

In part two, the aim was to investigate psychosexual functioning of adolescents with ASD using a newly developed comprehensive multi-informant psychosexual functioning measure (the Teen Transition Inventory; TTI) compared to TD adolescents. In Chapter 3 we describe the development and initial testing of the TTI by means of multiple informants (parent- and self-report), while comparing adolescents with ASD to TD adolescents. Chapter 4 of this thesis than extended this by investigating informant discrepancies, i.e. comparing self-report with parent-report in adolescent with ASD, while comparing these results to a matched sample of parent-child TD dyads. Chapter 5 goes more in-depth, describing if adolescents with ASD have different desires in terms of what characteristics they find important in romantic partners and friends compared to TD adolescents.

The aim of part three of this thesis was to explore if a training program aimed to decrease difficulties in psychosexual functioning in adolescents with ASD could have a positive effect on the psychosexual knowledge of adolescents with ASD (Chapter 6). In this pilot study, we investigated if receiving the Tackling Teenage Training program (Boudesteijn, Van der Vegt, Visser, Tick, & Maras, 2011) resulted in an increase of psychosexual knowledge in adolescents with ASD.

Finally the last chapter, Chapter 7, gives an overview of the thesis and overall discussion of the results in the context of current literature as well as some methodological considerations. In addition, Chapter 7 gives recommendations for future research as well as implications for clinical practice and policy in relation to the psychosexual functioning of adolescents with ASD.

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Chapter 2

The longitudinal relation between childhood autistic traits and psychosexual problems in early adolescence: The Tracking Adolescents' Individual Lives Survey study.

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Abstract

Individuals with autistic traits are considered to be prone to develop psychosexual problems due to their limited social skills and insight. This study investigated the longitudinal relation between autistic traits in childhood (T1; age 10-12) and parent-reported psychosexual problems in early adolescence (T2; age 12-15). In a general population cohort study (n = 1873; the Tracking Adolescents' Individual Lives Survey (TRAILS)), autistic traits and psychosexual problems were determined. Logistic regression analyses were used to investigate whether childhood autistic traits, in individuals displaying no psychosexual problems in childhood, predicted the presence of psychosexual problems in adolescence, while controlling for pubertal development and conduct problems. Higher levels of autistic traits at T1 significantly predicted mild psychosexual problems at T2, above and beyond pubertal development and conduct problems. Particularly two dimensions of autistic traits at T1 were significant predictors; i.e. 'reduced contact/social interest' and 'not optimally tuned to the social situation'. Children with autistic traits – especially those with limited social interest and social regulation problems – showed to have a higher risk to develop psychosexual problems, albeit mild, in early adolescence as reported by parents. Although we showed that autistic traits predict psychosexual problems, it is only one of multiple predictors.

Keywords

adolescence, autistic traits, childhood, longitudinal survey, psychosexual

Introduction

Early adolescence (ages 12 to 15) is marked by physical and psychosocial changes and challenges (Dahl, 2004), including the accelerated development of sexuality. Healthy sexual development requires a wide variety of skills and knowledge, including the awareness of social and cultural rules concerning sexuality. Social skills seem especially important in a healthy sexual development (T Hart-Kerkhoffs et al., 2009; Maniglio, 2012).

A group of adolescents that have difficulty with social skills are adolescents with autistic traits (Constantino and Todd, 2005; Stokes et al., 2007). These individuals have difficulty with social skills such as reading the signals others show and being finely tuned to other people. With autistic traits we mean individuals who have some features of autism, e.g. difficulty with communication, even though they do not meet the full diagnostic criteria for an autism spectrum disorder (ASD). Autistic features have shown to be a continuously distributed trait across the population (e.g. Constantino, 2009), where many individuals exhibit autistic traits to some extent.

During adolescence, sexual and intimate situations are progressively likely to occur, which makes complex social skills including significant interest in others, peer-relations and very finely adapted behaviour to often implicit rules increasingly important. In light of their impaired social functioning (Jobe and Williams White, 2007), the high demand on social skills makes adolescence and a healthy sexual development especially challenging for individuals with autistic traits (Bailey et al., 1998; Bolton et al., 1994). The discrepancy between the needed social skills for a healthy sexual development and shortcomings in social skills, may lead to psychosexual problems. In the current paper, we define psychosexual problems as cognitions and behaviours that fall outside the typical standards of society (Chaffin et al., 2006); entailing for instance excessive masturbation, public masturbation, and excessive interest in sexuality (Bonner et al., 1999).

A potential mechanism behind the development of psychosexual problems may be that the difficulties initiating and maintaining social relationships with others leads to little exposure to social situations and/or social clumsiness, for example because the individual with autistic traits does not initiate but also does not react to social interaction. Difficulties with adapting ones behaviour to social situations in turn may cause socially inappropriate behaviours, for example because behaviour is not adapted to the situation and/or because the individual quickly overreacts. These inappropriate behaviours can cause awkward or difficult social interactions. The limited social relationships may also lead to less learning (opportunities) on appropriate psychosexual behaviours; individuals with autism spectrum disorders obtain less of their sexual knowledge from social sources than typically developing individuals (Stokes et al., 2007; Brown-Lavoie et al., 2014). Parents of

autistic adolescents report about their child's limited knowledge and skills (e.g. distinguishing between public and private behaviour and tuning behaviour to privacy rules, Nichols and Blakeley-Smith, 2009). Even in young adults non-clinical autistic traits have been related to negative social outcomes due to social and communication impairments (Jobe and Williams White, 2007).

To our knowledge, no research has been performed on the longitudinal relation between autistic traits and psychosexual problems. Although research has shown that problems in adequate social skills in the long run result in problem behaviour and maladjustment in general (Jenson, 2010), little is known on whether the limited social skills of adolescents with autistic traits result in psychosexual problems.

Apart from the absence of longitudinal studies, only few studies have investigated the concurrent relation between autistic traits and psychosexual problems. Some studies have found a relationship between severe psychosexual problems (e.g. sexual delinquency) and diminished social competence in interpersonal relationships that appear to be similar to the behaviours which individuals with autistic traits display (T Hart-Kerkhoffs et al., 2009; Kumagami and Matsuura, 2009; Maniglio, 2012). While illustrating that individuals with severe psychosexual problems may display autistic traits, this cannot be taken to mean that individuals with autistic traits often have psychosexual problems. Studies in clinical samples with autism spectrum disorder (ASD) diagnoses found evidence for psychosexual problems. For example, Stokes and Kaur (2005) found more psychosexual problems in cognitively able autistic adolescents with poorer social skills than in those with better social skills. Also, institutionalised cognitively able adolescents with ASD showed psychosexual problems such as touching of the genitals in public and masturbating while others are present (Hellemans et al., 2007). Although individuals with autistic traits may not have identical difficulties, they may have psychosexual problems, similar to individuals with a clinical diagnosis of ASD. This needs further investigation.

Taken together, the studies available have indicated a cross-sectional association between autistic traits and psychosexual problems. However, previous studies did not explore the longitudinal relation between autistic traits in childhood and psychosexual problems in early adolescence. Such research is necessary to clarify whether autistic traits are predictive of the development of psychosexual problems. The current study therefore investigated the potential relation between childhood autistic traits and psychosexual problems in adolescence in a large general population sample by means of a commonly used parent-reported questionnaire (see measures). We hypothesised that higher levels of autistic traits in childhood were related to parent-reported psychosexual problems in adolescence. We additionally examined whether a) particular dimensions of autistic traits were related to psychosexual problems, b) the change in the level of autistic traits from childhood to adolescence was associated with psychosexual problems in

adolescence, and c) putative covariates (i.e. pubertal development, intelligence and conduct problems) influenced the relation between autistic traits in childhood and psychosexual problems in adolescence.

Methods

Sample

This study used data from the Tracking Adolescents' Individual Lives Survey (TRAILS), an on-going longitudinal cohort study of Dutch youth focused on the development of mental ill-health and health from childhood to adulthood which started in 2000 (for the design of this study see: de Winter et al., 2005; Huisman et al., 2008). The study was approved by the Dutch national ethical committee; the 'Centrale Commissie Mensgebonden Onderzoek'. To consider the longitudinal relation between autistic traits and psychosexual problems, we used data from the first assessment wave (T1, ages 10-12 years, *M* = 11.11, *SD* = .55) and the second assessment wave (T2, ages 12-15 years, *M* = 13.55, *SD* = .53). Average time between the two measurements was 2.46 years (*SD* = 0.45, range 1.39 to 4.01). As a sample, 1687 adolescents from the originally 2230 adolescents who participated in the TRAILS study met our inclusion and exclusion criteria.

Although 2230 adolescents took part in TRAILS at T1, 379 (16.9%) adolescents were excluded from the current analyses due to missing data on either the Children's Social Behaviour Questionnaire (CSBQ; used for measurement of autistic traits, see measures) at T1 (N = 62), or on the Child Behavior Checklist (CBCL; used for measurement of psychosexual problems, see measures) at T1 (N = 131) or at T2 (N = 186). There were no significant differences between the two groups (missing data versus no missing data) on gender ($c^2(1, N = 2230) = 1.11$, $p = .29$). However there were small but significant differences in pubertal development; those with missing data were more advanced (*M* = 1.97, *SD* = .86; $t(2114) = 2.67$, $p < 0.01$) than those without missing data (*M* = 1.85, *SD* = .73); and age; where those with missing data were significantly older (*M* = 11.16, *SD* =.56; $t(2230) = 1.99$, $p < 0.05$) than those without missing data (*M* = 11.10, *SD* = .55). Also there was a moderate difference regarding total Intelligence Quotient (IQ) which was significantly lower in those with missing data (*M* = 90.42, *SD* = 15.63) than in those without missing data (*M* = 97.82, *SD* = 14.78; ($t(2221) = -6.57$, $p < 0.001$).

It is important to note that, as the current study was intended to investigate the predictive value of autistic traits at T1 on psychosexual problems at T2, all children who already showed psychosexual problems at T1 (N = 164 = 7.35%) were excluded from the analyses (CBCL; used for measurement of psychosexual problems, see measures). Total IQ was significantly lower in the group with psychosexual problems at T1 (*M* = 94.61, *SD* = 14.48) than in the group without psychosexual problems at T1 (*M* = 98.03, *SD* = 14.81; $t (2048) = -2.85$, $p < 0.01$). Gender also significantly differed between these two groups (group with psychosexual problems at T1 = 69% male;

group without psychosexual problems at T1 = 48% male; (c^2(1, N = 2054) = 27.07, p < 0.001). There were no significant differences regarding pubertal development (t (1993) = -0.82, p = 0.41) or age (t (2054) = -0.17, p = 0.86).

Exclusion resulted in a final sample of N = 1687 (75.7% of 2230), of which 53% (n = 889) was female. The mean age was 11.10 years (SD = 0.55) at T1, and 13.54 years (SD = 0.52) at T2.

Measures

Psychosexual problems at T2. The 'Sex Problems scale' of the parent-report CBCL (Achenbach, 1991; Letourneau et al., 2004) was used to determine the occurrence of psychosexual problems. The Sex Problems scale, as described in the CBCL manual (Achenbach, 1991) as well as in the Dutch CBCL manual (Verhulst et al., 1996), has been identified by means of principal component analysis. The manual describes that internal consistency (by means of Cronbach's alpha) in the Dutch norm-sample is moderate (α = .39) which is similar to the internal consistency we found in our sample (α = .35). This moderate internal consistency may in part be explained by the low prevalence rate of the items and the somewhat diverse problems, and in part by the relatively few items (Achenbach, 1991). Research that included the CBCL Sex Problems scale for the purpose of measuring psychosexual problems by means of parent report has nonetheless supported the content & concurrent validity of this scale (Friedrich et al., 1992; Friedrich, 2003; Letourneau et al., 2004; Letourneau et al., 2008) as well as the discriminant validity (Bonner et al., 1999; Pithers et al., 1998). Friedrich et al. (1992) for example investigated the association between the CBCL Sex Problems scale and the more extensive Child Sexual Behavior Inventory (CSBI); they found that both measures were better than chance level to distinguish between sexually abused children and a normative sample and although the sensitivity of the CSBI was slightly better, no significant difference was found regarding specificity. Two studies found that children with sexual problem behaviour (i.e. children exhibiting sexual behaviours which were repetitive, unresponsive to adult intervention and supervision, equivalent to adult criminal violations, pervasive, occurring across time and situations, or developmentally unexpected sexual acts) scored significantly higher on the CBCL Sex Problems scale than children without such problems (Pithers et al., 1998; Bonner et al., 1999). Two more recent studies by Letourneau and colleagues (2004; 2008) divided individuals into groups with and without psychosexual problems based on the CBCL Sex Problems scale. The intervention study showed that the individuals with psychosexual problems improved significantly more with regard to internalizing and externalizing problems as compared to individuals without psychosexual problems (Letourneau et al., 2008).

Parents rate each item on the CBCL on a 3-point scale (0 = not true, 1 = somewhat or sometimes true, 2 = very true or often true). It was decided to use parent-

reports, as the reliability of self-report in individuals with autistic traits has been questioned (e.g. Cederlund et al., 2010), we expected the adolescents would also underestimate psychosexual problems. The CBCL - Sex Problems scale consists of items regarding exposing behaviour, sexual problems, thinking of sex too much and playing with own genitals in public. In the current study, psychosexual problems were dichotomized, where if parents scored at least a '1' on the items of the Sex Problems scale, their child was considered to have psychosexual problems (scoring 1 = psychosexual problems or 0 = no psychosexual problems), similar to the outcome measure used by Letourneau et al. (2008). This dichotomous variable was based on the scores on the following four items: 'plays with own sex parts in public', 'plays with own sex parts too much', 'sexual problems', and 'thinks about sex too much'.

Autistic traits at T1 and T2. The Dutch parent-report CSBQ (Hartman et al., 2007) was used to assess the level of autistic traits. The measure was developed to quantify both the various problem dimensions on which children with autistic traits differ as well as to include the milder as well as the more severe autistic behaviours in one instrument. Parents rate their children on 49 items, using a three-point scale (0 = not true, 1 = somewhat or sometimes true, 2 = very true or often true). The CSBQ has six empirically derived dimensional subscales: 'orientation problems in time, place, or activity' (e.g. has trouble doing two things at once; and sees no danger), 'not optimally tuned to the social situation' (e.g. keeps pushing a topic to get his/her way; and makes a problem out of little things), 'difficulties in understanding social information' (e.g. tells stories inconsistently; and takes things literally), 'reduced contact and social interest' (e.g. makes little eye contact; and has little or no need for contact with others), 'fear of and resistance to changes' (e.g. panics in new situations; and resists changes) and 'stereotyped behaviours' (e.g. rocks body; and smells objects). These scales are combined into a total score. For all of the analyses, the mean score of the total or subscale scores were used. The CSBQ has shown good psychometric properties (e.g. Hartman et al., 2006). The internal consistency (Cronbach's α) in our sample of the total scale was good (α = .91 for 49 items).This also held for the subscales: Subscale 1 ''reduced contact and social interest'' (α = .72); Subscale 2 ''not optimally tuned to the social situation'' (α = .85); Subscale 3 ''orientation problems in time, place, or activity'' (α = .77); Subscale 4 ''difficulties in understanding social information'' (α = .73); Subscale 5 ''stereotyped behavior'' (α = .66); and Subscale 6 ''fear of and resistance to changes' (α = .73). In our sample, the range of the total mean-score at T1 was 0 – 1.29 (M = 0.24, SD = .21). On the total CSBQ T1 score, 22% of our sample fell within the 'high-very high' range based on population norms. At T2 the range of the total mean-score was 0 – 1.27 (M = 0.20, SD = .20).

Pubertal development at T1. Physical maturation is a good predictor of sexual activity (Flannery et al., 1993; Halpern et al., 1993). Autistic traits have also been related to pubertal development (Whitehouse et al., 2011). Therefore pubertal

development was regarded as a putative covariate. The participants' pubertal development was measured using parent-reported Tanner stages (Tanner, 1962). This is a staging system which uses the five standard Tanner stages of pubertal development (Marshall and Tanner, 1970; Marshall and Tanner, 1969) in the form of schematic drawings of secondary sexual characteristics (i.e. pubic hair growth, breast growth in females, and penis growth in males). The parent (usually the mother) was provided with gender-appropriate sketches, and asked which of the sketches 'looked most like their child'. These ratings have been widely used and have demonstrated good reliability and validity (Dorn et al., 1990). Mean Pubertal development at T1 was 1.86 (range 1-5).

IQ at T1. IQ was also regarded a putative covariate, as it may be related to both psychosexual problems (Seto and Lalumiere, 2010) and autistic traits (Hoekstra et al., 2010). IQ was estimated based on the Vocabulary and Block Design subtests (Sattler, 1992) of the Revised Wechsler Intelligence Scales for Children (WISC-R; van Haassen et al., 1986; Wechsler, 1974). IQ estimates ranged between 45 and 149, with a mean of 98.12 (*SD* = 14.80).

Conduct problems at T1. As conduct problems have been related to autistic traits (e.g. Totsika et al., 2011; Geluk et al., 2012) as well as psychosexual problems (e.g. Fergusson et al., 2005; T Hart-Kerkhoffs et al., 2009; Wu et al., 2010) it was also considered as a putative covariate. Conduct problems were assessed by means of the CBCL (Achenbach, 1991) DSM-oriented Conduct Problems scale. This scale consists of 12 items (rated on a 3-point scale 0 = not true, 1 = somewhat or sometimes true, 2 = very true or often true) related to conduct disorder. The internal consistency of the conduct problems scale has been established as good in previous literature (e.g. Nakamura et al., 2009; Verhulst and Van der Ende, 2013) and was also was good in the current sample (α = .78).

Statistical analyses

First, we compared the group with psychosexual problems at T2 to the group without psychosexual problems at T2 with regards to their mean scores on the main predictors and putative covariates (i.e. pubertal development, IQ, and conduct problems) by means of independent t-tests. To check for a significant difference in the distribution of gender in the two groups, we ran a chi square test. Any significant differences on the putative covariates (i.e. pubertal development, IQ, and CBCL Conduct problems) between the groups with and without psychosexual problems at T2 resulted in the inclusion of these variables as covariates in the subsequent logistic regression analyses. Furthermore we explored the item-endorsement frequencies of psychosexual problems at T2. In addition, we assessed what percentage of cases scored high to very high on the CSBQ in each group (with or without sexuality problems). In this subsample we also explored the item-endorsement frequencies of psychosexual problems at T2.

Second, the main analyses consisted of two logistic regressions, which were to investigate the longitudinal relation between autistic traits and psychosexual problems, while controlling for covariates. Model one used the mean total score on the CSBQ at T1 as main predictor and psychosexual problems at T2 as the outcome. Model two used the separate mean scores on the six subscales of the CSBQ at T1 to predict psychosexual problems at T2. The second logistic regression analysis was performed in order to investigate whether specific autistic traits and/or associated features predicted psychosexual problems.

Third, as autistic traits may also change over time (e.g. Gotham et al., 2012; Holmboe et al., 2013; Woolfenden et al., 2012), we investigated if the change in the level of autistic traits from T1 to T2 was related to having psychosexual problems at T2. For this purpose, we computed a difference score (T2 CSBQ – T1 CSBQ) and included this variable as the predictor in an additional logistic regression model together with the relevant covariates.

Results

Preliminary data inspection

For descriptive purposes we ran a comparison (see Table 1) between the group with psychosexual problems at T2 and the group without psychosexual problems at T2. In both groups, we only included individuals who were free from psychosexual problems at T1. The results show that the group with psychosexual problems at T2 score significantly higher on the total mean score as well as on the subscales mean scores of the CSBQ. With respect to the putative covariates; the groups only differed significantly in their pubertal development ($p = 0.05$) and conduct problems ($p < 0.01$).

Table 1 also shows that mainly the items 'plays with own sex parts too much' and 'thinks about sex too much' were endorsed by parents. Psychosexual problems showed a skewed distribution with most children displaying no psychosexual problems, supporting the decision to dichotomise psychosexual problems at T2 (scoring 1 = having psychosexual problems or 0 = not having psychosexual problems).

Furthermore, in the group without psychosexual problems 20% of the adolescents scored in the high-very high range of the CSBQ. This compares to 42% of adolescents in the group with psychosexual problems. Conversely, in the sample with high to very-high scores on the CSBQ ($n = 348$) approximately 8% ($n = 27$) showed psychosexual problems at T2 (proportion per item: plays with own sex parts in public: $n = 1$ (4%); plays with own sex parts too much: $n = 4$ (15%); sexual problems: $n = 4$ (15%); thinks about sex too much: $n = 23 = (85\%)$), illustrating that psychosexual problems are more prevalent in individuals with relatively high levels of autistic traits.

Table 1 Comparison of group without (N=1620) and with (N=67) psychosexual problems at T2[a].

Variables	Without psychosexual problems (N=1620)		With psychosexual problems (N=67)		Sig.
	n	Mean (SD)	*n*	Mean (SD)	*p*
T1 mean Total score CSBQ	1620	0.23 (0.20)	67	0.39 (0.27)	<0.001*
T1 'Not optimally tuned' scale (CSBQ)	1620	0.41 (0.36)	67	0.66 (0.47)	<0.001*
T1 'Reduced soc. Interest' scale (CSBQ)	1620	0.12 (0.17)	67	0.25 (0.27)	<0.001*
T1 'Orientation problems' scale (CSBQ)	1620	0.19 (0.28)	67	0.30 (0.38)	=0.02*
T1 'Difficulties in understanding' scale (CSBQ)	1620	0.30 (0.32)	67	0.48 (0.38)	<0.001*
T1 'Stereotyped behavior' scale (CSBQ)	1620	0.11 (0.20)	67	0.20 (0.28)	<0.01*
T1 'Fear of change' scale (CSBQ)	1620	0.17 (0.34)	67	0.32 (0.50)	=0.01*
T2 mean Total score CSBQ	1611	0.19 (0.19)	67	0.40 (0.32)	<0.001*
T2 'Not optimally tuned' scale (CSBQ)	1612	0.32 (0.33)	67	0.64 (0.47)	<0.001*
T2 'Reduced soc. Interest' scale (CSBQ)	1613	0.14 (0.21)	67	0.30 (0.34)	<0.001*
T2 'Orientation problems' scale (CSBQ)	1613	0.14 (0.22)	67	0.31 (0.39)	<0.001*
T2 'Difficulties in understanding' scale (CSBQ)	1613	0.30 (0.32)	67	0.52 (0.44)	<0.001*
T2 'Stereotyped behavior' scale (CSBQ)	1612	0.07 (0.15)	67	0.17 (0.28)	<0.01*
T2 'Fear of change' scale (CSBQ)	1608	0.13 (0.30)	67	0.37 (0.46)	<0.001*
T1 Pubertal development	1587	1.84 (0.74)	65	2.03 (0.81)	=0.05*
T1 IQ	1619	98.85 (14.47)	66	99.70 (15.93)	=0.64
T1 Conduct problems	1620	0.12 (0.14)	67	0.19 (0.18)	<0.01*
T1 Gender	1620	46.9% male	67	56.7% male	=0.12
T2 Sex Problems scale item - Plays with own sex parts in public	1617	0% (n=0)	66	3% (n=2)	
T2 Sex Problems scale item – Plays with own sex parts too much	1615	0% (n=0)	66	21.2% (n=14)	
T2 Sex Problems scale item – Sexual problems	1616	0% (n=0)	66	7.6% (n=5)	
T2 Sex Problems scale item - Thinks about sex too much	1616	0% (n=0)	67	79.1% (n=53)	

[a] T2 = second assessment wave. Comparison of the main predictor CSBQ total score and subscales and putative covariates (physical development, intelligence, and gender), as well as item-endorsement on the Sex Problems scale items of the Child Behavior Checklist

SD: Standard deviation; CSBQ: Children's Social Behaviour Questionnaire. * is significant difference.

Associations between T1 autistic traits and T2 psychosexual problems

As shown in Table 2, when adding the covariates (i.e. pubertal development and CBCL Conduct problems) as predictors in the logistic regression, there was a significant effect of CSBQ T1 total score. In analyses with the CSBQ subscales, the subscales 'Reduced social interest' and 'Not optimally tuned' had a significant effect on psychosexual problems after controlling for the covariates.

Table 2 Results of the logistic regression models 1 and 2 predicting psychosexual problems including covariates.[a]

Model 1[b]			
	OR[d]	**95% CI**	***p***
T1 CSBQ Total score	10.62	[3.37, 33.50]	<.00
T1 Tanner stages	1.41	[1.02, 1.94]	.04
T1 Conduct problems (CBCL scale)	2.08	[.40, 10.96]	.39
Model 2[c]			
	OR[d]	**95% CI**	***p***
T1 'Reduced social interest' scale (CSBQ)	3.84	[1.13, 12.99]	.03
T1 'Not optimally tuned' scale (CSBQ)	2.29	[1.01, 5.20]	.05*
T1 'Orientation problems' scale (CSBQ)	0.44	[.15, 1.29]	.13
T1 'Difficulties in understanding' scale (CSBQ)	1.32	[.55, 3.18]	.53
T1 'Stereotyped behavior' scale (CSBQ)	1.97	[.69, 5.62]	.21
T1 'Fear of change' scale (CSBQ)	1.37	[.74, 2.52]	.31
T1 Tanner stages	1.44	[1.05, 1.99]	.03
T1 Conduct problems (CBCL scale)	2.58	[.44, 15.22]	.29

[a] The results presented are excluding children with psychosexual problems at T1. Model 1 includes the mean total score on the CSBQ as well as the Tanner stages and IQ; Model 2 includes the mean subscale scores on the CSBQ as well as the Tanner stages and IQ.

CSBQ: Children's Social Behaviour Questionnaire; CBCL: Child Behavior Checklist; OR: odds ratio, CI: confidence interval.

[b] Nagelkerke $R^2 = 0.07$

[c] Nagelkerke $R^2 = 0.09$

[d] The odds ratios represent the *OR* per unit of mean score.

* exact *p* value is .048

Associations between autistic traits over time and T2 psychosexual problems

The change in the level of autistic traits over time (i.e. the difference score of T2 CSBQ – T1 CSBQ) also significantly predicted psychosexual problems at T2 (O.R. = 6.41, confidence interval (CI) = (1.63 – 25.16), $p < .01$) while controlling for the effects of the covariates (i.e. pubertal development and conduct problems) (see

Table 3). Noticeably, the adolescents with psychosexual problems at T2 had a higher mean score at both T1 and T2 on the CSBQ (see Table 1). The model with the difference scores on the subscales of the CSBQ showed that only the scale 'Orientation problems' has a significant effect on psychosexual problems, above and beyond pubertal development and conduct problems (see Table 3).

Table 3 Results of the logistic regression models 1 and 2 with difference score predicting psychosexual problems including covariates.[a]

Model 1[b]			
	OR[d]	**95% CI**	***p***
T2 - T1 CSBQ Total score	6.40	[1.63, 25.13]	<.01
T1 Tanner stages	1.34	[.97, 1.84]	.07
T1 Conduct problems scale(CBCL)	19.26	[5.11, 72.60]	<.001
Model 2[c]			
	OR[d]	**95% CI**	***p***
T2 - T1 'Reduced social interest' scale (CSBQ)	0.79	[.20, 3.04]	.73
T2 - T1 'Not optimally tuned' scale (CSBQ)	2.05	[.75, 5.60]	.16
T2 - T1 'Orientation problems' scale (CSBQ)	4.37	[1.28, 14.87]	.02
T2 - T1 'Difficulties in understanding' scale (CSBQ)	0.98	[.39, 2.48]	.96
T2 - T1 'Stereotyped behavior' scale (CSBQ)	0.57	[.16, 2.06]	.40
T2 - T1 'Fear of change' scale (CSBQ)	1.12	[.53, 2.37]	.77
T1 Tanner stages	1.32	[.96, 1.81]	.09
T1 Conduct problems scale(CBCL)	24.28	[6.14, 95.96]	<.001

[a] The results presented are excluding children with psychosexual problems at T1. Model 1 includes the mean total score on the CSBQ as well as the Tanner stages and IQ; Model 2 includes the mean subscale scores on the CSBQ as well as the Tanner stages and IQ.
CSBQ: Children's Social Behaviour Questionnaire; CBCL: Child Behavior Checklist; OR: odds ratio, CI: confidence interval.
[b] Nagelkerke $R^2 = 0.05$
[c] Nagelkerke $R^2 = 0.07$
[d] The odds ratios represent the *OR* per unit of mean score.

Discussion

The purpose of this study was to investigate whether autistic traits in childhood predicted the occurrence of psychosexual problems in early adolescence. Our study revealed a positive longitudinal association between childhood autistic traits and parent-reported psychosexual problems in early adolescence. The results show that autistic traits in childhood, above and beyond pubertal development and conduct problems, predict psychosexual problems in early adolescence. In the

group with psychosexual problems in adolescence, many more adolescents scored high to very high levels of autistic traits in childhood compared to those without problems sexuality. In particular, limited social interest and problems in adapting ones behaviour were related to thinking too much about sex and playing with own sex parts too much. Especially those adolescents with a lack of motivation to initiate and reciprocate social contact, overreacting, and/or a lack of regulation of emotions and behaviours in social situations, were more vulnerable to develop psychosexual problems. In addition, psychosexual problems at T2 were associated with the change in the level of autistic traits from T1 to T2. As shown in Table 1, adolescents with psychosexual problems at T2 already showed higher levels of autistic traits at T1 than those without psychosexual problems at T2, and there was a slight increase in the level of autistic traits in the individuals with psychosexual problems at T2 whereas the adolescents without psychosexual problems at T2 were characterized by a decrease in the level of autistic traits from T1 to T2. Our results thus support the notion that autistic traits are associated with psychosexual problems (Ballan, 2012). It should be noted however that although it was shown that autistic traits are a significant predictor of psychosexual problems, they are only one of multiple predictors of problems in the sexual development.

Psychosexual problems may be the result of the fact that individuals with autistic traits have more difficulties with figuring out unwritten social rules (Hénault, 2006) or less knowledge on social boundaries (i.e. privacy) (Nichols and Blakeley-Smith, 2009; Stokes and Kaur, 2005). The difficulties that individuals with autism spectrum disorders have with deriving the appropriate rules and norms from a situation or context complicates the adaptation of their behaviour (if they do not understand or know the rules, they cannot adapt to these rules either). Individuals who do not meet the full diagnostic criteria for ASD seem to have comparable difficulties. Seeing as the knowledge or the ability of the child to keep behaviours and cognitions private may be limited (Stokes and Kaur, 2005), we speculate that the problems most often reported by the parents in our sample, 'plays with own sex parts too much' and 'thinks about sex too much', may be result of these difficulties with privacy.

Another putative mechanism explaining the relation we found between autistic traits and psychosexual problems may be that the social impairments and limited social interest and the tuning problems make it unlikely for adolescents with autistic traits to be involved in peer groups and thus to learn from social sources (Stokes et al., 2007; Brown-Lavoie et al., 2014). In such peer groups they would have valuable learning opportunities regarding sexuality and social (Sullivan and Caterino, 2008). Therefore a lack of such involvement may ultimately limit the knowledge and skills of the adolescent with autistic traits, potentially resulting in psychosexual problems.

In our sample mostly mild aspects of psychosexual problems were endorsed (e.g. thinking too much about sex and plays with own sex part too much) which are

not alarming behaviours or cognitions for adolescents. In addition, the judgement 'too much' is a subjective one, which may lead to differences in the reporting of problems due to a difference in attitudes of the parents. In our large sample, only 67 parents (3.6%) reported these psychosexual problems in adolescence. This may indicate that there is a problem of socially inappropriate behaviour or cognitions rather than variation in openness of the parents concerning sexuality. However, the higher scores could equally be due to other reasons (i.e. scoring tendencies of the parents), therefore further validation of the CBCL Sex Problems scale is needed. Although the reported psychosexual problems are relatively mild, this group might be at-risk to develop more severe forms of psychosexual problems, especially in combination with other additional risk factors. There is evidence that adolescents with escalated psychosexual problems (i.e. sexual delinquency) have autistic traits (T Hart-Kerkhoffs et al., 2009; Maniglio, 2012). Although the likelihood of committing actual sexual offences is predicted by multiple factors (Maniglio, 2012), autistic traits may be one of these many predictors.

Although clearly not all adolescents with autistic traits will develop psychosexual problems, as a group, these adolescents are at-risk. Because of the risk and potential problems, it is important to timely assess indicators of psychosexual problems, to be able to provide appropriate support as soon as necessary. Support for individuals at-risk of developing psychosexual problems might be provided in the form of socio-sexual trainings (e.g. Visser et al., 2012). Such a socio-sexual training explicitly teaches children with autistic traits to understand how to develop and maintain social relations and what appropriately tuned behaviour entails. Such a training may increase the likelihood of a healthy sexual development and potentially prevent or minimize the risk of developing psychosexual problems and the potential escalation of psychosexual problems (Wieckowski et al., 1998; T Hart-Kerkhoffs et al., 2009).

Conclusions from our study are mainly applicable to a general population with average IQ, as our sample showed a normal range of intelligence (IQ: M = 98.1, SD = 14.8). Due to missing data, adolescents with lower IQs were excluded from our sample. However the differences between the adolescents with and without missing data were still within one standard deviation (IQ in group with missing data, M = 90.42, SD = 15.63; those without missing data, M = 97.82, SD = 14.78; (t(2221) = -6.57, $p < 0.001$). The same applies to our selection of individuals who did not have psychosexual problems in childhood (group with psychosexual problems at T1, *mean IQ* = 94.35, SD = 14.28; group without psychosexual problems at T1, mean IQ = 98.12, SD = 14.79; t (2031) = -3.11, $p < 0.01$). The exclusion of those with psychosexual problems at T1 (whom had a significantly lower IQ than those without psychosexual problems at T1), suggests there may be a relationship between psychosexual problems and IQ. Therefore the individuals who were excluded due to missing data, who also had significantly lower IQ scores, may be a group with more psychosexual problems. The inclusion of individuals with a normal range of

intelligence limits the generalizability of the current findings to clinical samples with lower IQ scores. Future research could investigate the relationship in a sample with lower IQ scores. However, our data do support the view that irrespective of cognitive abilities, autistic traits may be related to psychosexual problems (Nichols and Blakeley-Smith, 2009).

There are a few limitations to our studies. First, only a limited range of psychosexual problems was covered. Although the validity and reliability of the CBCL Sex Problems scale has been examined in previous research (e.g. Letourneau et al., 2008; Bonner et al., 1999), this scale needs further psychometric research. Moreover, this measure is not exhaustive, since other problematic sexual behaviours, such as touching others inappropriately, as well as frustrations of the adolescent and concerns of parents were not assessed. In future research, it would therefore be valuable to investigate psychosexual problems in relation to autistic problems using a more extensive measure. Second, as the reliability of self-report in adolescents with autistic traits is questioned (e.g. Cederlund et al., 2010), we assessed psychosexual problems by means of parent-report. However the usage of parent-report may lead to a biased result, in particular, the scale is based on parental report regarding 4 items which have a subjective element ('too much'). If we speculate, potentially parents of adolescents with autistic traits report psychosexual problems more often, as they may be more aware of the psychosexual problems. A possible explanation may be that the parent-child relationship in adolescence in a child with autistic traits may be less private, as the parent is more involved in day to day care of their child, than in parent-child relationships where the child is typically developing. Therefore it would be valuable to pursue this line of research including measures from multiple informants. Third, our results are based on data from a general population sample, and our findings thus pertain to mild variation in autistic problems. Future research should assess whether indeed autistic traits in a clinical sample would predict future psychosexual problems, and thus generalize across all levels of severity.

Taken together, the results of this study highlight the importance of assessing autistic traits in childhood, as children with relatively high levels may be at-risk to develop psychosexual problems. Especially when considering that adult sexual outcome is rooted in adolescence (Tolman and McClelland, 2011). That said, we want to emphasize that displaying autistic traits, although a significant predictor of psychosexual problems, is only one of multiple predictors of psychosexual problems. Yet, the current results showed that the (change in) level of autistic traits significantly predicted psychosexual problems in adolescence above and beyond the effects of (pubertal stage and conduct problems). In this field, we are only beginning to learn how autistic traits contribute to differences in socio-sexual learning, development and behaviour.

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Declaration of conflicting interests
Professor F.C. Verhulst M.D., Ph.D. is a contributing author to the Achenbach System of Empirically Based Assessment (ASEBA) from which he receives remuneration. The other authors declare no conflict of interest.

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Chapter 3

Psychosexual functioning of cognitively-able adolescents with autism spectrum disorder compared to typically developing peers: The development and testing of the Teen Transition Inventory- a self-and parent report questionnaire on psychosexual functioning.

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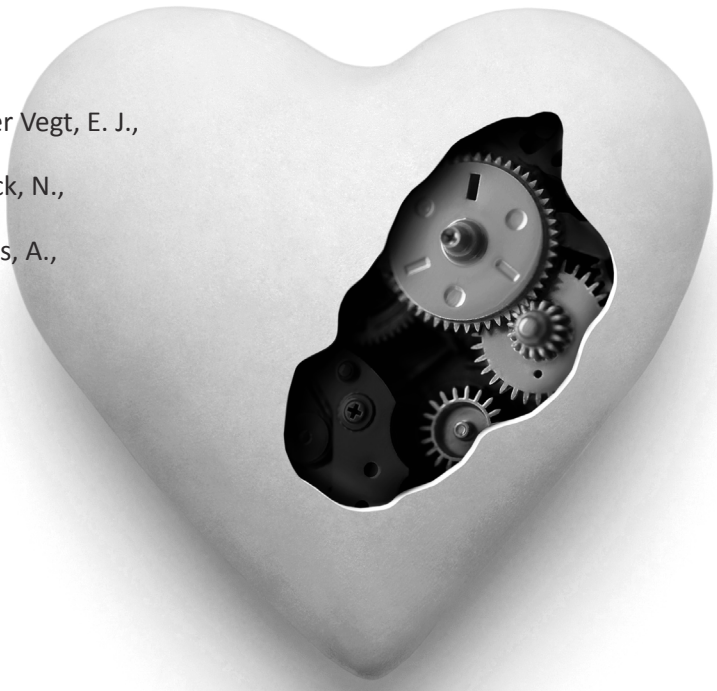

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Abstract

To gain further insight into psychosexual functioning, including behaviors, intrapersonal and interpersonal aspects, in adolescents with Autism Spectrum Disorder (ASD), comprehensive, multi-informant measures are needed. This study describes (1) the development of a new measure of psychosexual functioning in both parent- and self-reports (Teen Transition Inventory; TTI) covering all three domains of psychosexual functioning (i.e. psychosexual socialization, psychosexual selfhood, and sexual/intimate behavior). And (2) the initial testing of this instrument, comparing adolescents with ASD (*n*=79 parent-report; *n*=58 self-report) to Typically Developing (TD) adolescents (*n*=131 parent-report; *n*=91 self-report) while taking into account gender as a covariate. Results from both informants indicate more difficulties regarding psychosexual socialization and psychosexual selfhood in the ASD group. With regard to sexual/intimate behavior, only parents reported significantly more problems in adolescents with ASD.

Keywords

Psychosexual, Autism spectrum disorder, Adolescence, Comprehensive measure, Typically developing

In the past few years, psychosexual functioning in adolescents with ASD has become an increasingly studied topic of research (e.g. Dewinter, Vermeiren, Vanwesenbeeck, Lobbestael, & Van Nieuwenhuizen, 2014; Dewinter, Vermeiren, Vanwesenbeeck, & Van Nieuwenhuizen, 2015; Ginevra, Nota, & Stokes, 2015; Gougeon, 2010; Kellaher, 2015; Mehzabin & Stokes, 2011). Psychosexual functioning covers not only sexual behaviors, but also interpersonal (i.e. psychosexual socialization; for example relationships) and intrapersonal (i.e. psychosexual selfhood) dimensions (Dewinter, Vermeiren, Vanwesenbeeck, & van Nieuwenhuizen, 2013). Although not necessary, the interpersonal and intrapersonal elements may be the basis for a healthy overall psychosexual functioning (O'Sullivan, Cheng, Harris, & Brooks-Gunn, 2007). For example, having a crush, or developing a relationship with someone and having sexual desires, may be the foundation for the development of partnered sexual behavior (Hearn, O'Sullivan, & Dudley, 2003), although this has not be studied in individuals with ASD. Much research into psychosexual functioning in individuals with ASD has focused on problematic aspects, using primarily parent or clinician report. For example; autistic traits have been related to excessively thinking about sex, public masturbation, stalking and sexual offenses (i.e. both as victim and as perpetrator) (e.g. Dekker, Hartman, et al., 2014; Dewinter et al., 2013; Hellemans, Colson, Verbraeken, Vermeiren, & Deboutte, 2007; Sevlever, Roth, & Gillis, 2013; Stokes & Kaur, 2005; t Hart-Kerkhoffs et al., 2009). However, there is also research into psychosexual functioning in individuals with ASD which has focused on the typical aspects, using mostly self-report. This research has shown that individuals with ASD have sexual needs and desires, are interested in romantic relationships and have similar socially accepted experiences and behaviors compared to other groups (Dewinter et al., 2014; Gilmour, Schalomon, & Smith, 2012; Hénault, 2006; Kellaher, 2015; Stokes, Newton, & Kaur, 2007). It is valuable to expand the acquired knowledge on psychosexual functioning in adolescents with ASD and obtain information from multiple informants in all domains of psychosexual functioning. This can provide a more well-rounded and multi-dimensional perspective on psychosexual functioning in individuals with ASD.

Psychosexual functioning can be divided into three domains: psychosexual socialization (interpersonal), psychosexual selfhood (intrapersonal), and sexual/intimate behavior (Dewinter et al., 2013; Tolman & McClelland, 2011). Psychosexual socialization includes the interaction with social contexts (e.g. peers, parents, siblings, and media) in which individuals learn about and experience relationships and sexuality. Psychosexual selfhood relates to the intrapersonal functioning including self-esteem, self-perceived competence, and knowledge. Sexual/intimate behavior includes a continuum of sexualized behaviors and experiences, ranging from typical, age-appropriate behaviors to atypical, inappropriate or even illegitimate behaviors. Unfortunately, in the current literature on individuals with ASD, most of the studies on (psycho)sexual socialization have primarily used parent or caregiver report, psychosexual selfhood is generally understudied, and when

self-report was used the focus was solely on sexual behavior (Dewinter et al., 2013; Fenton, Johnson, McManus, & Erens, 2001).

The usage of either self-report or other-report may be related to issues of assumed insight and knowledge regarding the topic of research and/or the capacity to report reliably on the topic. At least in Typically Developing (TD) individuals (Fenton et al., 2001), typical and socially accepted aspects of psychosexual functioning are often considered fairly private. Therefore, others are thought to not be optimal informants about these topics, which may have led to primarily using self-report. The limited use of self-report in the other domains in the current literature on psychosexual functioning in ASD (see for reviews Byers, Nichols, & Voyer, 2013; Dewinter et al., 2013; Gougeon, 2010) may be because the reliability and validity of self-report in individuals with ASD has been questioned (Cederlund, Hagberg, & Gillberg, 2010; Urbano, Hartmann, Deutsch, Polychronopoulos, & Dorbin, 2013). Most likely the use of clinician or parent report stems from the assumption that individuals with ASD have little insight into the problematic aspects. However, even with regard to overt topics, such as behavior, a recent study of Dewinter et al. (2015) showed that parents and adolescents do not report identically, implying that the type of informant may influence the results and thus the conclusions. To conclude, parents or clinicians may be better to report on some issues requiring difficult social insight. However, adding self-report also provides meaningful information, namely the adolescents own perspective on their psychosexual functioning (i.e. psychosexual socialization and psychosexual selfhood) and their private experiences (i.e. sexual/intimate behaviors) (Lerner, Calhoun, Mikami, & De Los Reyes, 2012). When it comes to psychosexual functioning in individuals with ASD, the use of multiple informants seems valuable to get a more complete picture as well as insight into how the informant is experiencing psychosexual functioning.

Besides the limited use of multiple informants, few studies have directly compared the psychosexual functioning of adolescents with ASD to a TD control group. This has limited the ability to compare psychosexual functioning in the two groups and investigate the influence of ASD on psychosexual functioning. A comprehensive measure designed for multiple informants which gives insights into the functioning on all three domains of psychosexual functioning used in both an ASD and TD group, would provide data to compare the two groups, thus giving insight into the potential differences and difficulties related to ASD.

As psychosexual functioning is a complex, multifaceted concept (World Health Organization, 2006), this in turn has complicated the development of a questionnaire which covers all domains and is suitable for multiple informants. Many currently existing questionnaires only cover one domain of psychosexual functioning or are not suitable for multiple informants. Therefore, in an attempt to add to the growing body of research on psychosexual functioning in adolescents with ASD,

we developed the Teen Transition Inventory (TTI; for a detailed description see Measurements) for the purpose of this study. In the development of this tool, we adopted the broad definition of psychosexual functioning described before, covering the three domains: psychosexual socialization, psychosexual selfhood, and sexual/intimate behavior (Dewinter et al., 2013; Tolman & McClelland, 2011). Items regarding the first domain, i.e. psychosexual socialization, inquire for example into the skills related to social and intimate contact, openness regarding intimacy and dealing with boundaries. This domain distinguishes between more basic social skills (e.g. Friendship Skills and Social Acceptance) that form a prerequisite for more complex intimate social skills (e.g. Romantic skills). Existing questionnaires on social qualities of individuals with ASD, e.g. the Social Responsiveness Scale (Constantino & Gruber, 2007) focus mainly on known autistic difficulties in social relations. In the TTI the focus is more on typical basic and complex intimate social skills that are the basis for healthy psychosexual functioning. Items regarding the second domain, psychosexual selfhood, seek to get information for example about sexual preference, body image, the level of self-esteem, desires, self-perception, and psychosexual knowledge. Questions in the third domain, sexual/intimate behavior, entail the behavioral repertoire that people have with regard to sexuality both online and offline, covering appropriate and inappropriate sexualized behavior (including the amount and type of behaviors), and the age of onset. Moreover, we developed the TTI in both a self-report and a parent-report version. However, in line with previous research, some items are only posed in the TTI of one informant, as we expected the other informant to not be able to reliably answer some items (for example items regarding appropriately dealing with boundaries was only asked to parents and general self-esteem was only part of the self-report TTI).

In the current paper we describe the development of the TTI. Which was specifically developed for the purpose of this study, to allow us to compare all aspects of psychosexual functioning of cognitively-able adolescents with ASD to TD adolescents. In addition, the initial testing of the TTI is discussed, involving (1) the pilot testing of the internal consistency of the theoretically constructed scales regarding psychosexual functioning, and (2) examining whether the scales and items of the TTI distinguish between cognitively-able adolescents with ASD versus their TD peers. Based on previous literature, we hypothesized that cognitively-able adolescents with ASD compared to their TD peers have less psychosexual socialization (e.g. less social acceptance and less adequately dealing with boundaries), poorer psychosexual selfhood (e.g. poorer body image, less confidence, less perceived social competence, lower self-esteem and less knowledge despite equal social, romantic and sexual desires), and display more inappropriate sexualized behaviors, but have similar experiences with appropriate sexual/intimate behaviors (e.g. Brown-Lavoie, Viecili, & Weiss, 2014; Dewinter et al., 2014; Kasari, Locke, Gulsrud, & Rotheram-Fuller, 2011; Nichols & Blakeley-Smith, 2009; Stokes et al., 2007). Given the fact that previous studies only used one informant (i.e. either parent or self-

report), we were particularly interested to see whether these hypotheses would be confirmed using both parent- and self-report.

Method

Sample & procedure

Between 2011 and 2012, data for this study were collected from an ASD group and a TD group:

The ASD group (*n* = 79) was selected from a larger clinical sample from the outpatient's Department of Child and Adolescent Psychiatry/psychology of the Erasmus MC - Sophia in Rotterdam, the Netherlands who were participating in a follow-up study. In the initial study between July 2002 and September 2004, 503 children were referred for psychiatric evaluation. Of the 503 referrals, 234 children were eligible to be included in the follow-up study approximately 7 years later due to their social and/or communication problems during the first study (Louwerse et al., 2015). Of the 234 children, 104 (42.3%) children had a best-estimate ASD diagnosis, which was based on the ADI-R and ADOS (see ASD diagnostic procedure below) and thus received the TTI to participate in this part of the study. 79 (76.0%) parents of the 104 individuals with a best-estimate ASD diagnosis returned the Teen Transition Inventory (TTI) parent-report. The parents who did return the TTI did not significantly differ from the group of parents who did not return the TTI with regard to the adolescent's age ($t(102) = 1.50$, $p = .14$), intelligence ($t(75) = -.39$, $p = .70$) or gender ($c^2(1, n = 104) = 0.61$, $p = .44$). Of the 79 individuals with parent-report, we received 58 (73.4%) self-report TTI's. The group without self-report data did not differ significantly from the group with self-report data on age ($t(77) = .68$, $p = .50$), intelligence ($t(59) = -1.43$, $p = .16$), or gender ($c^2(1, n = 79) = 0.46$, $p = .50$), nor on any of the parent-reported psychosexual scales (for a full description of the scales see measurements: Teen Transition Inventory). The mean age of the adolescents with ASD (*n* = 79) was 16.79 years (range 13-21, *SD* = 2.05) and the majority was male (86%). Please see Table 1 for all descriptive characteristics of the ASD group.

The TD sample was drawn from a Dutch general population study (*n* = 1710) (Evans et al., 2012; Louwerse et al., 2013; Tick, Van der Ende, & Verhulst, 2008) from which 326 individuals were eligible to participate as they were between 12 and 21 years old (Evans et al., 2012). Of the 326 adolescent and their parents who were contacted, 153 (47%) returned the parent-report and 113 (35%) the self-report. To ensure the TD group would be without autistic traits, we additionally excluded individuals if they had elevated autistic traits (*n* = 22) as assessed with the Autism Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001). The final number of included participants; i.e. those who returned the TTI and without autistic traits on the AQ, was 131 (40% of the originally selected adolescents and 86% of those who returned the TTI). Of the 131 participants with parent-report, 91 (= 69.5%) self-report TTIs were returned. Those without self-report data did not differ significantly from the group with self-report data on intelligence ($t(118) = -.66$, $p = 0.51$), or

gender ($c^2(1, n = 131) = 1.96, p = .16$) and on seven of the nine parent-reported psychosexual scales (see Measurements: Teen Transition Inventory). However the group with self-report data was significantly younger ($M = 16.12$, $SD = 1.47$) than the group without self-report data ($M = 16.73$, $SD = 1.77$; $t(129) = 2.03$, $p = .04$). In addition, the group with self-report data had higher parent-reported family openness regarding sexuality ($M = 1.22$, $SD = .42$) than those without self-report ($M = .98$, $SD = .40$; $t(126) = -3.04$, $p < .01$) and less parent-reported sexual experiences ($M = .48$, $SD = .37$) than those without self-report ($M = .64$, $SD = .36$; $t(120) = 2.15$, $p = .03$). The mean age of the TD sample ($n = 131$) was 16.31 years (range 13-20, $SD = 1.59$) and 46% of the sample was male. Table 1 provides descriptive information on the TD group.

To assure we were able to make a viable comparison regarding psychosexual functioning between the ASD and TD group, we ascertained whether the groups differed in characteristics such as age, intelligence, physical development and gender, to potentially control for these variables in the main analyses (for further details, please see section Statistical analyses). The results of these comparisons are displayed in Table 1. The study was approved by the Medical Ethical Review Committee of the Erasmus MC. All parents and adolescents gave informed consent.

ASD diagnostic procedure

To obtain a best-estimate clinical diagnosis of ASD, the Autism Diagnostic Interview Revised (ADI-R; Rutter, Le Couteur, & Lord, 2003) was performed with parents, and the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) was administered to the adolescents. The ADI-R and ADOS were administered by examiners who had completed the research-training and had achieved sufficient reliability for administration and coding. Based on age and language capability, module 4 of the ADOS was primarily used, although for 6 participants the ADOS module 3 was used. Both examiners reviewed DSM-IV-TR criteria of ASD (i.e. Pervasive Developmental Disorder) and together obtained a consensus diagnosis (Falkmer, Anderson, Falkmer, & Horlin, 2013). Although 32% of the ASD cases (n=23) did not meet the diagnostic cut-off of the ADOS, these cases received a best-estimate clinical diagnosis based also on the information obtained during the ADI-R.

Table 1 Characteristics of participants

	ASD				TD				
	N (%[a])	*Mean*	*SD*	*Range*	*N (%[a])*	*Mean*	*SD*	*Range*	*p*
Parent-report TTI	79 (100%)				131 (100%)				
Self-report TTI	58 (73.4%)				91 (69.5%)				
Male	68 (86.1 %)				60 (45.8 %)				<.001
Age		16.79	2.05	13 – 21		16.31	1.59	13-20	.08
Intelligence		98.56	17.88	54 – 135		100.00	15.00	64 – 152	.57
Tanner stage		4.32	.94	1 – 5		4.42	.72	2 – 5	.41
ADI-R Diagnostic	78* (99%)	36.80	11.59	4 – 59					
ADI-R Current	75*[†] (95%)	24.72	8.10	10-44					
ADOS CSS	72 (91%)	5.88	2.39	1– 10					

* one did not participate with ADI-R interview

ASD Autism Spectrum Disorder; *TD* Typically Developing; *TTI* Teen Transition Inventory; *ADI-R* Autism Diagnostic Interview – Revised; *ADOS CSS* Autism Diagnostic Observation Schedule Calibrated Severity Score.

[†] Two participants were non-verbal, and for one participants only the diagnostic score was available due to a clinical evaluation process at another facility.

[a] Percentages are based on sample size of parent-report.

Measures

Teen Transition Inventory – measurement development

General description of the Teen Transition Inventory

The Teen Transition Inventory (TTI) was primarily developed for the purpose of this study, which was to get a better insight in the psychosexual functioning (i.e. psychosexual socialization, psychosexual selfhood and sexual/intimate behavior) of adolescents with ASD compared to TD adolescents. The TTI is based and expanded upon previous research in the field of psychosexual functioning in individuals with ASD (see below). As psychosexuality may be experienced as a rather delicate topic, and is probably related to more general aspects of social and physical development, it was decided to structure the TTI in such a way (i.e. build in subheadings) that it starts with less intimate questions on more general adolescent transition issues (such as the experience of the transition to secondary school and building new friendships, physical development, and leisure activities), followed by the more personal questions on psychosexual functioning (i.e. the bulk of the questionnaire, such as building romantic relationships). As such, more intimate questions regarding intimate relations build on similar questions regarding friendship relations. In the section 'Psychosexual functioning in the Teen Transition Inventory' a more in-depth description of the psychosexual domains of the TTI is provided.

The TTI is aimed at individuals between the ages of 12 and 21 years old. To obtain multiple perspectives, the TTI consists of a parent-report version and a self-report version. The parent-report TTI and self-report TTI have considerable overlap in items and thus scales (see Table 2). However, the parent-report TTI includes additional items and scales on topics that parents were considered to be better able to adequately judge (e.g. their child's psychosexual knowledge and the extent to which their child deals appropriately with boundaries) and thus reliably report on. The self-report TTI includes additional items and scales compared to the parent-report TTI regarding very private and subjective matters (e.g. age of onset of sexual/intimate behavior and self-perceived social competence). In total, the parent-report TTI consists of 148 items and the self-report TTI of 205 items. All scorings of the items are based on information of the last six months to the current state of the adolescent. Most of the items of the TTI are scored on a 3-point scale of 'Not at all true'; 'Somewhat or Sometimes true' and 'Definitely or Often true', with the exception of a minority of items (e.g. age of onset and behaviors that can only either be displayed or not, i.e. yes/no answering format). Both the parent-report and self-report take approximately 1 hour to complete. The TTI is available upon request (in Dutch, English, Greek and Spanish).

Development of the Teen Transition Inventory

The TTI was developed by a team of researchers and clinicians of Erasmus MC – Sophia and Yulius with input from adolescents with ASD and their parents. The researchers who were involved the development of the TTI, had previous research experience with the assessment of adolescents with ASD and their caregivers. The clinicians involved in the development of the TTI were psychologists, sexologists and psychiatrists, who had specific clinical experience with adolescents with ASD and psychosexual concerns. As a first step, based on the earlier literature on sexuality in individuals with ASD as well as gaps noticed in this research, an initial list of questions, their scoring options, and clustering was constructed by the researchers: i.e. covering the topics of psychosexual socialization, psychosexual selfhood and sexual/intimate behavior (based on Gougeon, 2010; Hellemans et al., 2007; Hellemans, Roeyers, Leplae, Dewaele, & Deboutte, 2010; Hénault, 2006; Koller, 2000; Locke, Ishijima, Kasari, & London, 2010; Nichols & Blakeley-Smith, 2009; Realmuto & Ruble, 1999; Stokes & Kaur, 2005; Stokes et al., 2007; Sullivan & Caterino, 2008; t Hart-Kerkhoffs et al., 2009; Tolman & McClelland, 2011). In the second step, these items, options and their clustering were reviewed by the clinicians, who suggested some changes in the wording (particularly with regard to taking the wording too literal, which some individuals with ASD do; e.g.Dennis, Lazenby, & Lockyer, 2001; Martin & McDonald, 2004), and also suggested the addition of items; i.e. questions regarding inappropriate love interests (e.g. a teacher, therapist or group-leader). After the suggested changes were made, in a third step this revised version of the TTI was piloted during a pilot study to include the input of 12-18 year old adolescents with ASD and their parents, who also participated in a study on the

effects of a psychosexual intervention (Tackling Teenage). Participants (*N* = 30) were asked to fill out the TTI and provide it with their written feedback, including open-ended alternative answering options as well as an open page on which participants could provide their suggestions. Also, oral feedback was welcomed, in case preferred. The use of the TTI in the pilot study was undertaken to specifically evaluate the TTI for use among adolescents with ASD and their parents, to ensure that the questions were relevant, clear and understandable for individuals with ASD and their parents. In addition, the pilot allowed us to examine whether the content, covering rather private topics, was experienced as too personal which could lead to people not filling out questions. The pilot ensured that this was not the case, since all participants returned the TTI fully answered. The feedback uncovered that the content of the TTI was experienced as asking quite personal information, and some found it difficult to think of answers as they never consciously thought about these issues before. Yet no feedback was given that topics should be excluded for the reason of being too personal or that other topics should be included. Remaining feedback varied from suggesting changes in the answering options (i.e. hair growth can never be done, thus the answer option was changed from 'finished' to 'full-grown') to suggesting shortening of the introductory texts on the topics of the TTI. The feedback of the clients and their parents was used to further improve the TTI. As a final step, the researchers optimized the initial TTI scales based on the state-of-the art literature.

Psychosexual functioning in the Teen Transition Inventory

Psychosexual functioning (i.e. psychosexual socialization, psychosexual selfhood and sexual/intimate behavior) is covered by a total of 81 items in the parent-report TTI and 123 items in the self-report TTI. Table 2 illustrates the scale structure of the TTI divided per domain of psychosexual functioning, and provides examples of items for each subscale (a sample of the TTI is provided in appendix 1a+b). As shown, 48 of the items of the parent-report are clustered into 9 scales, with the remaining 33 items used as 'stand-alone' items. Of the self-report 69 of the items are clustered into 12 scales, with the remaining 54 items left as 'stand-alone' dichotomous variables. 'Stand-alone' items reflect the presence or absence of particular behaviors, experiences or qualities that could not be meaningfully clustered into scales (e.g. My child has been in love with a celebrity; I think it is important that my best friend is funny) and were therefore used dichotomously. Any stand-alone item scored on a 3-point scale, was first dichotomized before further analyses. The categories 'Somewhat or sometimes true' and 'Definitely or often true' were then collapsed into one category and coded as 1 whereas the category 'Not at all true' was coded as 0.

Based on the existing literature and on expert opinion, the scales were formed using items that reflect a particular underlying construct (e.g. Dewinter et al., 2013; Realmuto & Ruble, 1999; Tolman & McClelland, 2011; Urbano et al., 2013). Scale

scores are computed by calculating the mean score of all the items on the scale that were filled out, where a minimum of 60% of the items in the scale have to be filled out. Thus, the scale scores reflect the mean score of the items on the scale, either of the parent or the adolescent. Most scale scores range between 0 and 2 except the scales in the sexual/intimate behavior domain (i.e. 'Amount of sexual/intimate behavior'; 'Amount of inappropriate sexualized behavior' and 'Online sexual activity') which range between 0 and 1. As behaviors and experiences are considered to either have or have not occurred, most items on the scale were dichotomous, and thus all items on these scales were used as dichotomous items to compute the mean scale score.

Table 2 Teen Transition Inventory (TTI) domain and topical structure

Psychosexual functioning domains	**Topic**	**Parent-report TTI**	**Self-report TTI**
Sexual socialization	Friendship skills	Scale of 5 items, e.g. child is good at making friends	Scale of 5 items, e.g. I am good at making friends
	Social acceptance by peers	Scale of 3 items, e.g. child is part of a group of friends	Scale of 6 items, e.g. I am part of a group of friends.
	Perceived romantic skills	Not assessed in parent-report TTI	Scale of 3 items, e.g. When I'm in love with someone, I do not know what to do
	Personal openness about intimacy	Not assessed in parent-report TTI	Scale of 3 items, e.g. I discuss my feelings and/or questions about intimacy/sexuality with my parents
	Family openness about intimacy	Scale of 4 items, e.g. in our family we discuss sexuality	Not assessed in self-report TTI
	Adequately dealing with boundaries	Scale of 8 items, e.g. child is able to recognize other people's boundaries regarding social relationships in general.	Not assessed in self-report TTI
Sexual selfhood	Sexual preference	*N* = 4 separate items , e.g. I notice a sexual preference in my child; my child has dated a girl; my child has been in love with a boy. The latter recoded to heterosexual love interest; homosexual love interest; heterosexual dating experience; homosexual dating experience.	N = 2 separate items, e.g. I have been in love with a girl; I have dated a boy. Recoded to heterosexual love interest; homosexual love interest; heterosexual dating experience; homosexual dating experience.
	Body image	Scale of 3 items, e.g. child is satisfied with his/her body.	Scale of 7 items, e.g. I am satisfied with the way I look.

	Perceived social competence	*N* = 2 separate items , e.g. my child is uncomfortable when he/she is around a group of teenagers	Scale of 12 items, e.g. Around other people I lose my confidence
	Social desires	*N* = 1 separate items , e.g. My child has a need for a best friend.	*N* = 10 separate items , e.g. I think it is important my best friend is funny.
	Romantic desires	Not assessed in parent-report TTI	*N* = 9 separate items , e.g. I think it is important a (future) partner is funny.
	Amount of sexual desires	Not assessed in parent-report TTI	Scale of 6 items, e.g. I want to French kiss; I want to have intercourse; I fantasize sometimes about being intimate?
	Self-esteem	Not assessed in parent-report TTI	Scale of 12 items, e.g. I am happy with myself as a person.
	Psychosexual knowledge	Scale of 9 items, e.g. child knows what precautions to take to avoid pregnancy	Not assessed in self-report TTI
Sexual behavior	Amount of sexual behavior	Scale of 3 items, e.g. my child has had intercourse.	Scale of 5 items, e.g. I have had intercourse.
	Types of intimate or sexual behavior and experiences	*N* = 24 separate items, e.g. My child has been in love with a celebrity; When in love my child does not know how to make contact with that person; my child has difficulty being touched by family members or well-known acquaintances.	*N* = 26 separate items, e.g.I have been in love with a fictional character; the first time I have contact with the person I am in love with, I tell that person I am in love with him/her; I have had a very unpleasant intimate experience; Do you have a specific physical limitation or any physical problems at the moment which make intimate relations or sexuality more difficult?
	Amount of inappropriate sexualized behavior	Scale of 6 items, e.g. my child touches people in places where the other does not want to be touched; Did your child ever masturbate at inappropriate times, in inappropriate ways or places.	Scale of 3 items, e.g. I keep contacting someone, even though that person has indicated he/she does not want any contact with me; I touch people in places where the other does not want to be touched.
	Online sexual activity	Scale of 3 items, e.g. my child visits websites that give information about sex.	Scale of 7 items, e.g. I visit websites that give information about sex.
	Age of onset	Not assessed in parent-report TTI	*N* = 5 separate items, e.g. how old where you the first time you had intercourse.

TTI Teen Transition Inventory.

Putative covariates

Previous studies have related age, gender, intelligence and physical development (i.e. Tanner stages) to psychosexual functioning and to ASD (e.g. Baron-Cohen & Wheelwright, 2003; Beier & Ackerman, 2003; Flannery, Rowe, & Gulley, 1993; Halpern, Udry, Campbell, & Suchindran, 1993; Mandy et al., 2012; Shandra & Chowdhury, 2012; Stokes et al., 2007; Vickerstaff, Heriot, Wong, Lopes, & Dossetor, 2007; Whitehouse, Maybery, Hickey, & Sloboda, 2011). Therefore, it was important to assess these variables.

As measures for intelligence we used abbreviated versions of the Wechsler intelligence scales. In the ASD sample the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999) was used. The full 4 score of the WASI (i.e. using all of the 4 subtests) was used as a total IQ score. In the TD sample, two subtests of the Wechsler Intelligence Scale for Children were used, namely vocabulary and block design (WISC; Wechsler, 2004). On both subtests a score of 10 reflects average intelligence. A total IQ score was calculated for the TD sample by computing the mean scores, transforming this into z-scores, and then transforming the z-score to a total IQ score with 100 as a mean and 15 as the standard deviation.

The Tanner stages are a staging system which uses schematic drawings of secondary sexual characteristics divided into five standard stages (W. A. Marshall & Tanner, 1969, 1970). In our study we used the parent-rated Tanner stages. The primary caregiver, in our study mostly the biological mother (86%), indicated on the gender appropriate sketches which stage resembled the physical appearance of her child most. The ratings have shown good reliability and validity and have been used widely (Dorn, Susman, Nottelmann, Inoff-Germain, & Chrousos, 1990).

Statistical Analyses

Sample characteristics

For descriptive purposes, we computed means and standard deviations on age, intelligence, and parent-reported Tanner stages and the frequency of gender for the group with ASD and the TD group. For the ASD group, we also computed descriptive scores on the ADI-R (Rutter et al., 2003) and the severity score on the ADOS (Lord et al., 2000), to provide an indication of the ASD severity in our sample. To investigate which of the putative covariates should be included in the main analyses, we examined whether our groups differed on these variables. For age, IQ and tanner stages this was done by means of independent-samples t tests, gender was compared by means of chi square analyses. In addition, we computed correlations between the potential covariates and all scales of the TTI. An association of the potential covariate with group status (ASD versus TD) as well as an outcome measure resulted in the inclusion of this variable as a covariate in the main analyses (i.e. group comparisons).

The primary aims of the current paper were to describe the development of the TTI and to compare psychosexual functioning of adolescents with ASD to TD adolescents. For this purpose, we firstly examined the internal consistency of the scales and correlations between scales, and secondly explored the differences between adolescents with ASD and TD adolescents with regard to psychosexual functioning using the TTI.

Measurement development: Internal consistency
The internal consistency of the scales of the TTI, which were theoretically constructed based upon the available literature and clinical experience of the team developing the TTI, were checked by means of Cronbach's alpha. The Cronbach's alphas were calculated separately for the ASD sample and for the TD sample. Items on the scales were checked to have an item-rest correlation of at least .3 in at least one of the samples, which indicates that the item measures the same underlying construct (Field, 2013). Items that did not meet this criteria were subsequently either retained or removed from the scale based on their content validity and the effect on the Cronbach's alpha of the scale. If the deletion of an item let to an improvement of 0.1 or more in the Cronbach's alpha's in both samples the item was removed from the scale.

Measurement development: Correlations between scales
We also ran correlations between the various scales of both self-report and parent-report. Any perfect or near to perfect correlations (>±.90) were considered for data reduction purposes. If the correlation in combination with content seemed to reflect that the scales measured the same construct, this could indicate a scale could be excluded. In addition, the correlations provide insight in how the different domains of psychosexual functioning interrelate and show the associations between self-report and parent-report .

ASD vs. TD: Group comparisons
Group comparisons regarding psychosexual functioning were made using analyses of variance adjusted for any relevant covariate (ANCOVA; i.e. for scale scores) or logistic regression analyses (i.e. for categorical separate item scores). For continuous outcomes, e.g. scores on the scales and age variables, group membership (ASD or TD) was the between-subjects factor. For the categorical outcomes, i.e. the dichotomous separate items, we investigated differences between ASD and TD again including any relevant covariate as predictors. Items which showed a significant difference between the ASD sample and the TD sample were subsequently analyzed for frequencies, to investigate which percentage of the groups had that experience. Since we ran multiple tests to investigate similarities and differences in psychosexual functioning between the adolescents with ASD versus TD adolescents, we used the Bonferroni correction for multiple testing in the group comparison analyses. In the parent-reported data we ran 42 analyses (9 on the scales and 33 on the dichotomous

separate items), therefore the appropriate p-value to control for Type I errors is .0012 (is .05/42). In the self-reported data we ran 65 tests (12 on the scales and 54 on the dichotomous separate items), therefore the appropriate p-value after the Bonferroni correction is .0008 (is .05/66).

Results

Sample characteristics

The main characteristics of the ASD and TD samples are shown in Table 1. Only gender significantly differed between the group with ASD and the TD group, in which the ASD sample had significantly more males than the TD sample. Correlations between the scales of the TTI and potential covariates per group showed that some of the potential covariates were significantly related to some of the scales (see Table 3 and Table 4). However, since gender was the only variable related to both group status and outcome measures, only this variable was included as a covariate in all the main analyses.

Table 3 Correlations between covariates and scales in the ASD group

	Self-report												Parent-report								
	Socialization				Selfhood					Behavior			Socialization				Selfhood		Behavior		
	FS	SA	RS	PO	BI	SE	SC	RC	SD	SB	ISB	OS	FS	SA	FO	AB	BI	PK	SB	ISB	OS
Gender	-.21	-.42†	-.06	-.16	-.09	-.37†	-.36†	-.05	-.23	.07	-.00	-.03	-.13	-.24*	-.09	-.24*	-.08	-.13	-.00	.27*	-.14
Age (parent)	-.15	-.11	-.23	-.01	.05	-.13	-.36†	-.10	.07	.17	-.01	.14	.10	.03	-.08	.22	-.01	.17	.14	-.20	.15
Age (self)	-.16	-.14	-20	-.04	.09	-.13	-.35†	-.10	.06	.14	-.01	.12	.05	.12	-.17	.04	-.03	-.08	.01	-.17	.13
IQ	.22	.20	.20	.05	.07	.17	.42†	.38	.40*	.26	.02	.08	-.00	-.03	.13	.32*	.12	.61*	.23	-.11	.11
Tanner (parent)	.08	-.05	-.27	-.16	.30*	-.07	-.13	.37*	.27	.17	.04	.18	.27*	.21	.13	.26*	.27*	.35†	.32†	-.25*	.17
Tanner (self)	-.00	.14	-.27	-.03	.32*	-.04	-.06	.12	.33*	.29*	.05	.18	.22	.29*	.24	.06	.40†	.30*	.40†	-.12	.28*

ASD autism spectrum disorder; *FS* friendship skills; *SA* social acceptance; *RS* romantic skills; *PO* personal openness; *FO* family openness; *AB* adequate boundaries; *BI* body image; *SE* self-esteem; *SC* perceived social competence; *RC* romantic confidence; *SD* amount of sexual desire; PK psychosexual knowledge; *SB* amount of sexual behavior; *ISB* amount inappropriate sexualized behavior; *OS* online sexual activity

* = <.05

† = <.01

Table 4 Correlations between covariates and scales in the TD group

	Self-report												Parent-report								
	Socialization				Selfhood					Behavior			Socialization				Selfhood		Behavior		
	FS	SA	RS	PO	BI	SE	SC	RC	SD	SB	ISB	OS	FS	SA	FO	AB	BI	PK	SB	ISB	OS
Gender (0=male)	.16	-.03	.03	.26*	-.20	-.26*	-.06	.06	-.25	-.01	.05	-.24*	.20*	.01	.15	.01	-.19*	.01	-.04	-.11	-.34*
Age (parent)	-.03	.07	.02	.24*	.01	.01	.08	.20	.41†	.46†	.07	.12	.03	.11	.05	.24†	.02	.12	.50†	.12	.19*
Age (self)	-.12	.04	.00	.12	.05	.01	.03	.21	.41†	.47†	.05	.06	.01	.10	.03	.24*	-.10	.05	.29†	.04	.08
IQ	-.15	-.05	.25*	-.26*	-.03	-.20	-.17	-.42†	.05	-.20	-.05	.21	-.03	.04	-.09	-.05	.09	-.06	-.11	-.01	.15
Tanner (parent)	.03	.05	.08	.05	-.15	-.11	.00	.12	.04	.22*	.11	.06	.14	.11	.16	.25†	.04	.11	.34†	.04	.10
Tanner (self)	.13	-.05	-.05	.02	.00	.07	.11	.23	.22	.22*	.07	.15	.16	.12	.08	.23*	.01	.05	.32†	-.07	-.03

Note. TD = Typically developing. *FS* friendship skills; *SA* social acceptance; *RS* romantic skills; *PO* personal openness; *FO* family openness; *AB* adequate boundaries; *BI* body image; *SE* self-esteem; *SC* perceived social competence; *RC* romantic confidence; *SD* amount of sexual desire; PK psychosexual knowledge; *SB* amount of sexual behavior; *ISB* amount inappropriate sexualized behavior; *OS* online sexual activity

† = <.01

* = <.05

Measurement development: Internal consistency

One of the goals of the current study was to pilot test the internal consistency of the TTI scales (see Table 5). For each scale the internal consistency was calculated and the item-rest correlations were checked to see if any item on any scale was below 0.3 in both samples. Based on the number of items in each scale, and the number of participants, five of the nine parent-scales and ten of the twelve adolescent-scales showed good (i.e. >=.7) internal consistency in at least one of our samples (see Table 5 for the respective Cronbach's alphas; Field, 2013; Kline, 1999; Ponterotto & Ruckdeschel, 2007). In addition, three of nine parent-scales showed moderate (> .55) internal consistency (Kline, 1999; Ponterotto & Ruckdeschel, 2007). Only two scales showed low (i.e. < .5). internal consistency. One in both parent-report and self-report (i.e. Amount of inappropriate sexualized behavior) and one only in self-report (Personal openness about intimacy).

Table 5 Cronbach's alphas of the psychosexual scales of the TTI

	Parent-report		Self-report	
Name scale	ASD	TD	ASD	TD
Friendship skills	.79	.57	.74	.52
Social acceptance by peers	.67	.74	.82	.78
Romantic skills	*n.a.*	*n.a.*	.82	.80
Personal openness about intimacy	*n.a.*	*n.a.*	.37	.51
Family openness about intimacy	.73	.75	*n.a.*	*n.a.*
Adequate boundaries	.89	.75	*n.a.*	*n.a.*
Body image	.60	.60	.62	.74
Self-esteem	*n.a.*	*n.a*	.70	.70
Perceived social competence	*n.a.*	*n.a.*	.75	.73
Romantic confidence	*n.a.*	*n.a.*	.72	.63
Amount of sexual desire	*n.a.*	*n.a.*	.89	.86
Psychosexual knowledge	.93	.91	*n.a.*	*n.a.*
Amount of sexual behavior	.57	.57	.81	.82
Amount of inappropriate sexualized behavior	.42	.36	.26	-.10
Online sexual activity	.66	.58	.66	.76

ASD autism spectrum disorder; *TD* typically developing; *TTI* Teen Transition Inventory

n.a. not applicable, i.e. scale only exists in either the parent-report or the self-report version of the TTI

Based on the analyses to check the Cronbach's alpha, 15 items (six items on parent-report scales and nine items in the self-report scales) showed an item-rest correlation below .3 in both samples. Please see specifications in appendix 2. Although an item-rest correlation below 0.3 may indicate that the item does not belong to the scale, all off the items were retained on their respective scales for two reasons. Firstly, removal of the items resulted in minimal improvements of the Cronbach's alpha (less than 0.1 in both samples), or even decreased the Cronbach's alpha. Secondly, as this pilot study is the first using the TTI and the Cronbach's alpha is dependent on sample size and characteristics, removing the items based on these first results in the current sample seems too premature. Current sample sizes are insufficient to run confirmatory factor analyses, which would have been a better way to study the reliability of the questionnaire. Further research with the TTI is on its way to improve its psychometric underpinnings.

Measurement development: Correlations between scales

Correlations between the scale-scores of both informants (self-report and parent-report) showed a wide variety of correlational strength (see Table 6). Most of the correlations are non-significant (*n* = 69.3%) and represent negligible (.00 to ±.10) or small correlations (.10 to ±.0.30). Of the correlations that do reach significance (*n*=117), the majority (*n*=59= 50.4%) can be qualified as medium effect (>±.30) and 24 correlation (20.5%) have large effect (>±.50) (Field, 2013). None of the correlations were perfect or near perfect (>±.90). Thus, there were no correlations which merited data reduction. The correlations were mostly in the expected directions and between scales that were expected to be closely related (e.g. Social Acceptance and Friendship Skills), both within informant and between informants. Only one scale stood out in this respect, i.e. the Romantic Skills scale, which unexpectedly correlated negatively with the majority of the scales on the TTI (both self-report and parent-report). Correlations between informants showed that, in both the ASD and TD group, on all but the scale of Inappropriate Sexualized Behavior the correlations were significant.

Table 6 Correlation matrix between the scales of the TTI

		Self-report												Parent-report								
		Socialization				Selfhood					Behavior			Socialization				Selfhood		Behavior		
		FS	SA	RS	PO	BI	SE	SC	RC	SD	SB	ISB	OS	FS	SA	FO	AB	BI	PK	SB	ISB	OS
Self-report	F.S.		.48†	-.32†	.33†	.17	.26*	.51†	.39†	.02	.15	.11	-.11	.39†	.24*	.16	-.06	-.02	.05	.22*	.15	.13
	S.A.	.54†		-.34†	.19	.31†	.43†	.56†	.33†	.13	.09	-.06	-.23	.39†	.57†	.05	.30†	.12	-.02	.12	.00	-.04
	R.S	-.39†	-.21		-.29†	-.27*	-.33†	-.53†	-.57†	.06	-.29†	-.09	.04	-.15	-.04	-.25*	-.12	-.11	.01	-.38	-.03	-.03
	P.O.	.00	.08	.20		.05	.10	.23*	.32†	.20	.24*	.08	.09	.14	.13	.11	-.01	-.05	.12	.24*	.12	.11
	B.I.	.25	.26	-.05	-.05		.65†	.48†	.40†	.02	-.04	-.11	-.04	-.01	.20	.05	.19	.35†	-.06	-.06	.16	.16
	S.E.	.32*	.58†	.01	-.00	.50†		.66†	.54†	.15	.12	.02	.01	.02	.16	.06	.02	.22†	-.05	.12	.17	.20
	S.C.	.54†	.48†	-.12	.04	.48†	.63†		.82†	.11	.21*	.07	-.10	.21*	.27*	.16	.10	.18	.00	.31†	.19	.09
	R.C.	.33*	.21	-.23	.19	.46†	.37*	.82†		.29*	.33†	.06	.03	.11	.17	.16	.03	.21	-.02	.33†	.13	.07
	S.D.	.24	.18	-.20	.10	.00	-.01	.23	.34		.52†	.23	.50†	.03	.22	-.08	.14	.18	-.10	.36†	-.17	.38†
	S.B.	.20	.23	-.23	.12	.10	.08	.29*	.43†	.65†		.29†	.36†	.29†	.26*	.10	.19	-.03	.12	.77†	.04	.20
	I.S.B.	-.21	.23	.17	.25	.00	.06	.05	.18	.18	.10		.05	-.04	-.02	.07	-.13	-.05	.06	.29†	.05	.14
	O.S.	.19	.20	-.07	.15	.05	.07	.00	-.02	.45†	.34*	.01		-.04	-.07	.06	-.04	.15	.04	.17	.10	.33†
Parent-report	F.S.	.47†	.35*	-.22	.13	.24	.15	.24	.28	.33*	.23	-.16	-.06		.57†	.19*	.20*	.14	.01	.26†	-.06	-.26†
	S.A.	.27	.46†	-.07	.17	.20	.25	.25	.18	.49†	.30*	.11	.14	.65†		.08	.21*	.33†	.07	.18	-.05	-.05
	F.O.	-.17	-.06	.18	.23	.05	.08	.07	.14	.00	.08	.05	.24	.11	.10		.16	.19*	.18*	.09	.03	-.02
	A.B.	-.12	.03	.19	.26	-.26	-.20	-.20	-.04	.14	.03	-.01	.00	.44	.25	.21		.09	.09	.14	-.34†	-.11
	B.I.	.17	.25	-.12	.36†	.33†	.18	.17	.33*	.04	.13	-.04	.18	.37†	.32†	.40†	.11		.10	.13	-.06	.05
	P.K.	.20	-.04	-.02	.17	.05	-.14	.26	.36*	.54†	.30†	-.01	.18	.33†	.18	.26*	.62†	.14		.05	.09	.03
	S.B.	.21	.14	-.26	-.04	.10	.10	.31*	.40*	.44†	.73†	.04	.14	.23	.29*	.13	.16	.27*	.39†		.06	.20*
	I.S.B.	.10	-.16	.05	-.01	-.10	-.06	.08	.01	-.05	-.04	-.04	-.10	-.13	-.10	-.08	-.53†	.03	-.44†	.01		.30†
	O.S.	.14	.07	-.14	.00	-.07	-.03	.13	.01	.27	.29*	-.05	.47†	-.04	.10	.24*	.15	.14	.39†	.40†	-.06	

Note. Below the diagonal are correlations in Autism Spectrum Disorder group ; above the diagonal are correlations in the Typically Developing group.

FS friendship skills; *SA* social acceptance; *RS* romantic skills; *PO* personal openness; *FO* family openness; *AB* adequate boundaries; *BI* body image; *SE* self-esteem; *SC* perceived social competence; *RC* romantic confidence; *SD* amount of sexual desire; PK psychosexual knowledge; *SB* amount of sexual behavior; *ISB* amount inappropriate sexualized behavior; *OS* online sexual activity

* = <.05

† = <.01

ASD vs. TD: Group comparisons

Psychosexual socialization

Table 7 shows the results regarding the domain psychosexual socialization. Significant differences, based on both self-report and parent-report, between adolescents with ASD and TD adolescents are found on three of the scales (i.e. 'Friendship skills', 'Social acceptance by peers' and 'Adequately dealing with boundaries'). Adolescents with ASD have more problems with peers than the TD adolescents. The other scales (i.e. 'Romantic skills, 'Family openness about intimacy' and 'Personal openness about intimacy') showed no significant group differences.

Psychosexual selfhood

Due to the large number of separate items in the psychosexual selfhood domain (n = 7 in the parent-report and n = 21 in the self-report), only those items which significantly differed between the two groups are reported in Table 8. Significant differences between the adolescents with ASD and their TD peers were found with regard to the scales 'Sexual knowledge', 'Self-esteem' and 'Perceived social competence' (the latter both on the self-report and parent-report). Only parents reported a significant difference on the scale 'Body image'. No significant differences were found with regard to 'Romantic confidence', 'Social desires', 'Romantic desires' and 'Sexual preference' (i.e. hetero- or homosexual love interests).

Table 7 Results of the domain Sexual Socialization measured with TTI

	Parent-report							*Self-report*						
	ASD		*TD*					*ASD*		*TD*				
	N_{total}	*M (SD)*	N_{total}	*M (SD)*	*F*	η_p^2	*p*	N_{total}	*M (SD)*	N_{total}	*M (SD)*	*F*	η_p^2	*p*
Friendship skills scale	76	.96 (.58)	128	1.71 (.33)	112.59	.36	<.001*	56	1.29 (.53)	88	1.68 (.29)	26.70	.16	<.001*
Social acceptance by peers scale	76	.74 (.61)	128	1.61 (.47)	120.70	.38	<.001*	55	1.19 (.48)	91	1.58 (.36)	35.48	.20	<.001*
Perceived romantic competence scale		n.a.		n.a.	n.a	n.a	n.a	46	.88 (.65)	81	.78 (.61)	.58	.01	.45
Personal openness about intimacy scale		n.a.		n.a.	n.a	n.a	n.a	55	.44 (.38)	89	.61 (.48)	1.79	.01	.18
Family openness about intimacy scale	78	1.20 (.47)	128	1.14 (.43)	1.43	.01	.23	n.a.		n.a.		n.a	n.a	n.a
Adequately dealing with boundaries scale	71	1.27 (.51)	125	1.91 (.18)	152.67	.44	<.001*	n.a.		n.a.		n.a	n.a	n.a

TTI Teen Transition Inventory; *ASD* autism spectrum disorders; *TD* typically developing; η_p^2 – partial eta squared, *CI* confidence interval; *n.a.* not applicable, not a scale in that version of the TTI, thus no analyses. Each model is adjusted for the effect of gender

*Significant after Bonferroni correction

Table 8 Results of the domain Sexual Selfhood measured with TTI

	Parent-report							*Self-report*						
	ASD		*TD*					*ASD*		*TD*				
Scales	N_{total}	*M (SD)*	N_{total}	*M (SD)*	*F*	η_p^2	*p*	N_{total}	*M (SD)*	N_{total}	*M (SD)*	*F*	η_p^2	*p*
Body image scale	76	1.06 (.49)	129	1.40 (.42)	32.60	.14	<.001*	56	1.39 (.33)	90	1.43 (.38)	2.38	.02	.13
Perceived social competence scale		n.a		n.a	n.a.	n.a.	n.a.	55	1.24 (.36)	91	1.56 (.32)	31.98	.18	<.001*
Amount of sexual desires scale		n.a		n.a	n.a.	n.a.	n.a.	43	.87 (.60)	63	.83 (.59)	.70	.01	.41
Self-esteem scale		n.a.		n.a.	n.a.	n.a.	n.a.	55	1.36 (.29)	90	1.51 (.26)	19.41	.12	<.001*
Psychosexual knowledge scale	78	1.79 (.47)	128	2.04 (.21)	24.95	.11	<.001*	n.a.		n.a.	n.a.	n.a.	n.a.	

	ASD		TD					ASD		TD				
Separate items	N_{total}	%	N_{total}	%	*OR*	95% CI	*p*	N_{total}	%	N_{total}	%	*OR*	95% CI	*p*
My child feels uncomfortable around a group of teenagers.	76	72.4	128	34.4	7.37	[3.58-15.20]	<.001*	n.a.		n.a.		n.a.	n.a.	n.a.
My child feels confident when hanging out with peers.	75	69.3	127	93.7	.14	[.05-.37]	<.001*	n.a.		n.a.		n.a.	n.a.	n.a.

TTI Teen Transition Inventory; *ASD* autism spectrum disorders; *TD* typically developing; η_p^2 – partial eta squared, *CI* confidence interval; *n.a.* not applicable

not applicable, not a scale/item in that version of the TTI, thus no analyses. Each model is adjusted for the effect of gender

*Significant after Bonferroni correction

Sexual/intimate behavior

The results regarding Sexual/intimate behavior are shown in Table 9. Again, only items which significantly differed between the ASD group and the TD group were reported in Table 9. When considering self-report, no significant differences were reported; indicating that according to self-report adolescents with ASD functioned similarly in the domain of Sexual/intimate behavior as their TD peers. However, significant differences between the adolescents with ASD and their TD peers were found when considering the parent-reported scales 'Amount of sexual/intimate behavior' and 'Amount of inappropriate sexualized behavior'. These results indicated less experience with typical sexual/intimate behaviors (e.g. French-kissing), and more inappropriate sexualized behaviors in the adolescents with ASD. In addition, parents reported significant differences in some types of sexual/ intimate behaviors, particularly related to allowing and seeking physical contact with family-members or well-known acquaintances, and taking initiative to seek physical contact with less known acquaintances/strangers. No significant differences were found with regard to age of onset for sexual/intimate behaviors (self-report only), online sexual activity, a variety of types of sexual/intimate behavior (see Table 2 for examples) and the length of the current relationship or age of the current partner (both parent and self-report) .

Table 9 Results of the domain Sexual behavior measured with TTI

	Parent-report							*Self-report*						
	ASD		*TD*					*ASD*		*TD*				
Scales	N_{total}	*M (SD)*	N_{total}	*M (SD)*	*F*	η_p^2	*p*	N_{total}	*M (SD)*	N_{total}	*M (SD)*	*F*	η_p^2	*p*
Amount of sexual/ intimate behaviour scale[a]	74	.35 (.32)	122	.53 (.37)	10.78	.05	.0012*	50	.37 (.33)	88	.53 (.37)	4.86	.04	.03
Amount of inappropriate sexualized behaviour scale[a]	78	.23 (.23)	128	.05 (.11)	49.28	.20	<.001*	55	.04 (.13)	91	.04 (.12)	.03	.00	.85
Online sexual activity scale[a]	72	.34 (.36)	123	.22 (.28)	1.19	.01	.28	57	.15 (.19)	91	.09 (.15)	1.43	.01	.24
	ASD		TD					ASD		TD				
Separate items	N_{total}	%	N_{total}	%	*OR*	95% CI	*p*	N_{total}	%	N_{total}	%	*OR*	95% CI	*p*
Difficulty being touched by family	77	75.3	129	32.6	6.32	[3.17-12.61]	<.001*	56	35.7	91	13.2	3.97	[1.58-9.97]	.003
Child takes initiative to touch family members	78	65.4	127	93.7	.10	[.04-.27]	<.001*	n.a.		n.a.		n.a.	n.a.	n.a.
Child takes initiative to touch less known acquaintances/strangers	78	30.8	127	58.3	.34	[.18-.64]	<.001*	n.a.		n.a.		n.a.	n.a.	n.a.

TTI Teen Transition Inventory; *ASD* autism spectrum disorders; *TD* typically developing; η_p^2 – partial eta squared, *CI* confidence interval; *n.a.* not applicable

not applicable, not a scale/item in that version of the TTI, thus no analyses. Each model is adjusted for the effect of gender

*Significant after Bonferroni correction

In our main analyses only gender qualified to be taken into account as a covariate. Although none of the other covariates merited to be taken into account in our analyses, for good measure we additionally ran all the analyses in all three domains including all covariates (i.e. gender, age, IQ and Tanner stages). These analyses yielded very similar results.

Discussion

Research on psychosexual functioning in individuals with ASD is steadily growing, uncovering more and more information. However, much research has been done with only one informant, not covering all domains of psychosexual functioning or without including a TD control group. Therefore, the current paper aimed to describe the development of comprehensive measure of psychosexual functioning, the TTI, and the initial testing of the TTI. The measure was developed for the purpose of this study, i.e. to compare psychosexual functioning of adolescents with ASD to TD adolescents. Subsequently, we tested the internal consistency of the scales on the TTI and tested whether the TTI distinguished between adolescents with ASD and TD adolescents.

Measurement development

The TTI covers all three domains of psychosexual functioning (i.e. psychosexual socialization, psychosexual selfhood, and sexual/intimate behavior) and uses multiple informants. By creating a parent-report and self-report version of the TTI, we were able to get both the perspective of the caregiver as well as the adolescent, which, to our knowledge, was not yet combined in previous studies, highlighting the significance of the current report. During the development of the TTI we took into account results from previous research and attempted to combine constructs into a questionnaire covering all 3 domains of psychosexual functioning, while also making the questionnaire suitable for multiple informants. Of the 9 parent-report and 12 self-report psychosexual scales of the TTI, that were theoretically constructed, most (89% of the parent-report and 83% of the self-report) showed moderate to good internal consistency (Kline, 1999; Ponterotto & Ruckdeschel, 2007). Two scales (i.e. 'Amount of inappropriate sexualized behavior' and 'Personal Openness about intimacy') had low internal consistency. The scale 'Amount of inappropriate sexualized behavior' measures behavior which is fairly uncommon and thus has a low variance. This may have led to a low internal consistency, which is in line with previous research (e.g. Ginevra et al., 2015; Stokes & Kaur, 2005). The other scale ('Personal openness about intimacy') measures 1 concept, but the questions cover different aspects of that concept (i.e. feeling comfortable in discussion versus initiating discussion versus discussion in different social groups), which could have led to a lower internal consistency. Correlations showed that there are significant correlations between the several domains of psychosexual functioning, underlining the interrelatedness of its aspects. Often when discussing sexuality, most attention is devoted to the domain of sexual/intimate behavior. However, based on the

correlation analyses and previous studies, the domains of psychosexual socialization and psychosexual selfhood are important elements of psychosexual functioning, probably forming the basis on which partnered sexualized/intimate behaviors can be built. The significant correlations between informants imply that at least to some extent informants agree, although no result yielded a perfect correlation. Further research on informant agreement is warranted.

ASD versus TD

The final aim of this study was to explore differences in psychosexual functioning (i.e. psychosexual socialization, psychosexual selfhood, and sexual/intimate behavior) between adolescents with ASD and TD adolescents. We found significant differences in all domains of psychosexual functioning (i.e. psychosexual socialization, psychosexual selfhood and sexual/intimate behavior) between adolescents with ASD and TD adolescents. Our results showed that in the domain of psychosexual socialization and psychosexual selfhood differences were found both on self-report and parent-report, however in the domain of sexual/intimate behavior, differences were only found when using parent-report. This suggests that, particularly in the domain of sexual/intimate behavior, the results of studies regarding psychosexual functioning may depend on which informant is chosen. Below we discuss our findings per domain of psychosexual functioning in more detail in light of the existing literature.

Psychosexual socialization

According to both parent- and self-report, adolescents with ASD had significantly less friendship skills, and were significantly less accepted by their peers than TD adolescents. The reduced friendship skills and peer relations are in line with previous research regarding social skills (e.g. Mack et al., 2010), which indicated that having ASD is a unique contributing factor to peer relationship problems. Difficulties in this area may become increasingly problematic when reaching adolescence (Murphy & Young, 2005), as peer relationships become increasingly important (La Greca & Harrison, 2005) and complex (Laugeson, Frankel, Gantman, Dillon, & Mogil, 2012). The difficulties with intimacy as well as rejection by peers which adolescents with ASD reported may lead to loneliness, social anxiety and depression (Eussen, 2015; La Greca & Harrison, 2005) as well as frustration (Hellemans et al., 2010) which have been related to problems such as anxiety and sexual delinquency (Marshall, 2010). In addition, due to the problems with peers that the adolescents with ASD and their parents reported, adolescents with ASD may be less able, or less frequently in the position to learn from their peers or other informal social sources (Brown-Lavoie et al., 2014; Stokes et al., 2007; Sullivan & Caterino, 2008). This in turn may lead to other problems in psychosexual functioning, which is supported by the correlations we found between the three domains of psychosexual functioning.

For example more peer problems is directly correlated with more problems in social competence and romantic confidence, which in turn are directly related to sexual/ intimate behavior. These results suggest that targeting more general social skills could be a prerequisite for optimal psychosexual functioning, and thus an improtant target when providing psychosexual guidance or training.

According to parents, adolescents with ASD were also poorer in adequately dealing with boundaries, of both others and oneself. In TD adolescents, experimenting with boundaries is a risk factor to become either the victim or a perpetrator of inappropriate and unwanted sexual/intimate behavior (de Bruijn, Burrie, & van Wel, 2006). Although several studies have looked into inappropriate behaviors or victimization of individuals with ASD, few have investigated the link of being able to deal with boundaries to such behaviors and experiences. In individuals with ASD, the problems with boundaries may be less related to 'typical' experimentation but rather a problem to recognize and respect boundaries.

The parents of adolescents with ASD reported similar family openness about psychosexual topics compared to the parents of TD adolescents. Similar to our results, Stokes et al. (2007) found that in cognitively able individuals with ASD (aged 13 to 36 years old) do not significantly differ in learning about social or romantic relationships from their parents in comparison to TD adolescents. Conversely, other research found that parents of children with ASD reported to not find the discussion of sexual or intimate topics relevant, or to be apprehensive to communicate about sexuality topics due to worries, e.g. fear that the child might develop fixation on the topic (Ballan, 2012). However, the study of Ballan (2012) was in a group of children with ASD, aged between 6 and 13 years old, whereas our study involved adolescents between the ages of 13 and 21. Potentially when the children with ASD age into adolescence, the parents become more comfortable discussing the topic of sexuality and find it more appropriate. Also, our study took place in a different country with probably different cultural values regarding sexuality. The effect of parent-child communication on risk behaviors in TD samples is mixed (e.g. Clark & Shields, 1997; Somers & Paulson, 2000), indicating no relation with risk behaviors, and other research indicating reduced or delayed sexual behavior, including sexual risk behaviors (Somers & Paulson, 2000) and less delinquency (Clark & Shields, 1997). These differences in findings of the effect of communication regarding psychosexual topics may be related to the content discussed by the various sources for example the expectations of the parents (Holmes, Himle, & Strassberg, 2015) and/or the other learning opportunities individuals have.

In our study, adolescents with ASD reported similar personal openness about psychosexual topics as their TD peers. However, in the previously described study of Stokes et al. (2007) it was found that individuals with ASD make significantly fewer use of their peers and friends for information than their TD peers. Possibly due to

problems with peers, as found in several studies including our own, adolescents with ASD may experience less opportunity to learn from friends and peers (Brown-Lavoie, et al., 2014; Stokes, et al., 2007; Sullivan & Caterino, 2008).

As parent and peer communication regarding sexuality differs in terms of content and message (Epstein & Ward, 2008), different sources may also lead to different results with regard to psychosexual functioning. As our results show similar personal and family openness, but at the same time also difficulties in the various domains of psychosexual functioning, this may mean there is another explanation. Possibly it is not the *quantity* but rather the *content* of the communication which determines whether or not difficulties in psychosexual functioning arise.

Psychosexual selfhood

No significant differences were found with regard to sexual preference. There is both research which supports this (Kellaher, 2015) as well as research which found significant differences in sexual preference (Byers et al., 2013). In the study of Byers et al. (2013), adults were used as opposed to adolescents, and participants were directly asked if they identified with a specific sexual orientation. One potential reason for the contradicting finding may be that we did not directly ask the adolescents what their sexual preference was, but rather asked if they had ever been in love with a boy, and if they had ever been in love with a girl, and afterwards based on the adolescents gender recoded this to reflect hetero or homosexual love interests. Our method of assessment of sexual preference reduces the difficulties that individuals may have with the associations of the predefined labels of sexual preference. Yet, we should also note that differences in gender distributions across studies may also explain differences in findings. In the current study, only 14% of the ASD sample was female. Thus, more research is needed to elucidate gender-specific differences in psychosexual functioning in the context of ASD.

In addition, no significant differences were found with regard to social, romantic and amount of sexual desires. This is also in line with previous research (Dewinter et al., 2014; Gilmour et al., 2012; Hénault, 2006).

Parents reported a significant differences with regard to the body image of their child, although the adolescents themselves did not report this. Interestingly, little research into body image in individuals with ASD has been conducted. Often it is thought that individuals with ASD may be less influenced by social conventions, as they may be less sensitive to social disapproval (e.g. Ray, Marks, & Bray-Garretson, 2004), which would imply a body image less influenced by social conventions. Potentially, the discrepancy in our study between parent-report and self-report can be attributed to this phenomena; the adolescents themselves are less bothered by social conventions and thus report similar satisfaction with their physical appearance as TD adolescents, whereas parents may be more aware of the discrepancy of the

physical appearance of their child with the social conventions, thus reporting a poorer body image. Contrary to our study, Hénault (2006) found that individuals with Asperger syndrome reported a poor body image compared to the general population, implying they are aware of their looks and care about how they look. More research is needed to clarify the body image of individuals with ASD.

Adolescents with ASD and their parents reported lower perceived social competence. This is in line with previous research of Williamson, Craig, and Slinger (2008) as well as the work of Stokes et al. (2007) who found low social competence in adolescents with ASD. Higher perceived social competence is in TD individuals related to spending more time with someone of the other sex (Zimmer-Gembeck & Gallaty, 2006). Possibly the lower social competence in adolescents with ASD may also influence the time spend with peers of the other sex, thus limiting romantic and sexual opportunities as well as learning opportunities. Possibly, overall psychosexual functioning in adolescents with ASD could be improved if support is targeted also at the more general social skills.

Surprisingly, the two groups did not differ in their romantic confidence. Some studies have underlined that greater romantic confidence is expected in those with greater social competence (e.g. Giordano, Longmore, & Manning, 2006), as they may have more experience and thus more comfort with navigating relationships (e.g. experience with making up with a friend could improve confidence in romantic relationships). More research is needed to investigate romantic confidence in adolescents with ASD compared to TD adolescents.

According to parent-report, adolescents with ASD had significantly less psychosexual knowledge (e.g. regarding reproductive health) than TD adolescents. Lack of psychosexual knowledge has the risk of leading to inappropriate sexualized behaviors (Collins et al., 2004). For example the lack of insight in public or private behaviors (Nichols & Blakeley-Smith, 2009) or being unable to identify abusive behavior (Sevlever et al., 2013). Specifically in individuals with ASD the level of actual knowledge was found to be a risk factor for sexual victimization (Brown-Lavoie et al., 2014). Our correlations show a direct significant relationship between psychosexual knowledge, inappropriate sexualized behavior and difficulties with adequately dealing with boundaries in the ASD group. Although correlations do not provide causal information, this may imply that the improvement of knowledge could lead to improvements in both dealing with boundaries and less inappropriate behavior. One explanation for the limited psychosexual knowledge in the adolescents with ASD may be their particular learning skills; as implicit learning of social cues is weakened in adolescents with ASD (Hudson, Nijboer, & Jellema, 2012). Therefore, adolescents with ASD often need to be explicitly taught about psychosexual topics (Gougeon, 2010; Hatton & Tector, 2010; Sullivan & Caterino, 2008). Furthermore, although currently a gradual shift in emphasis and form of sex

education at schools is taking place, often sexual education still mainly focuses on the mechanical parts of sexuality rather than the psychosexual aspects. This is probably because in TD adolescents, much knowledge on psychosexual topics is often learned naturally, without explicit teaching, through peers (Andrew, Patel, & Ramakrishna, 2003; Brown-Lavoie et al., 2014; Stokes et al., 2007). In addition, informal non-social sources (e.g. media and internet) which individuals with ASD use more often (Brown-Lavoie et al., 2014), may provide an incorrect, overly romantic picture of psychosexual functioning or distorted viewpoint through pornography, which could lead to incorrect or limited actual psychosexual knowledge. Therefore it would be valuable to increase the psychosexual knowledge of individuals with ASD, in an attempt to improve the other elements of psychosexual functioning.

Sexual/intimate behavior

In this domain, parents reported significant differences, while adolescents self-reports did not reveal such group differences with regard to both appropriate sexual behavior and inappropriate sexualized behavior. This finding underlines the usefulness of using multiple informants with regard to psychosexual functioning in individuals with ASD.

Parents of adolescents with ASD reported less sexual behavior of their child than the parents of the TD adolescents. The adolescents themselves did not report a significant difference, although they report a similar trend. Both parents and the adolescents indicate that adolescents with ASD have shown approximately one-third of the sexual behaviors and the TD adolescents about half of the sexual behaviors. The non-significant difference found in self-report is in line with other research using self-report, which has found that sexual behavior does not differ between adolescents with ASD and those without ASD (Dewinter et al., 2014). Research in adults using self-report has found that particularly partnered behavior is less common than solitary sexual behavior (i.e. masturbation) when reporting about the last month (Byers et al., 2013), but did not compare this to TD adults. The fact that the adolescents with ASD report slightly higher score on the scale of sexual behaviors than their parents, may be because most sexual behavior is displayed in private (Dewinter et al., 2014) and thus parents may be less aware. In addition, parents of adolescents with ASD may assume that the behavior is non-existent in line with the idea previously explained that parents of individuals with ASD view their children as a-sexual or the topic of sexuality not relevant (Ballan, 2012). At the same time, parents of TD adolescents may assume their child does have the experience based on their age rather than factual knowledge. Therefore particularly when investigating psychosexual behavior it is essential to use multiple informants, as different informants may lead to different results and conclusions.

Parents also reported that adolescents with ASD exhibited significantly more inappropriate sexualized behaviors than their TD peers. However it must be noted that the scale of 'Inappropriate sexualized behavior' had low internal consistency, most likely due to the low rates of occurrence of the inappropriate behaviors in our sample. Therefore, the results should be interpreted in this light, showing that many of the adolescents with ASD in our sample showed very little to no inappropriate behavior, albeit significantly more than TD adolescents. As has been underlined by previous research, for example that of Demb and Pincus (1993), Ginevra et al. (2015), Hellemans et al. (2007), Kellaher (2015) and Stokes et al. (2007), a diverse range of inappropriate behaviors (e.g. sexually provocative talk, openly discussing sexuality, as well as public masturbation) is reported in adolescents with ASD, regardless of cognitive capacities. Many of these studies however reflect only case-studies or small samples (for a discussion see Kellaher, 2015). Our study using a much larger sample of cognitively able adolescents with ASD thus increases our understanding that in fact inappropriate behavior is significantly more likely to occur in individuals with ASD. Even if the behaviors do not escalate to sexual offending, adolescents with ASD who display inappropriate behaviors such as stalking, are at risk for negative outcomes such as criminalization of their behaviors (Stokes et al., 2007) regardless of the intent of their behavior. The findings regarding inappropriate behavior also underlines the importance of using multiple informants.

When looking at stand-alone items, only parents reported difficulties with intimacy with family members and well-known acquaintances both in receiving and initiating it. Such difficulties may complicate the development of intimate and romantic relationships (Tarnai & Wolfe, 2008). Although the adolescents themselves do not report these problems, intimacy problems with family may be related to later intimacy problems. Again using multiple informants is important to uncover a better insight in the psychosexual functioning of adolescents with ASD.

Limitations and methodological considerations

Some caution is required when interpreting our results. As the TTI is newly developed, more research should be carried out to investigate the reliability and validity of the inventory. Due to our sample size, we could not perform (confirmatory) factor analyses for the scales as we were underpowered (due to the ratio of items vs. participants). This means that the scales were developed based on the literature and expert opinion, and we used statistical analyses to check the Cronbach's alpha of the scales, which showed that most scales met the criteria for internal consistency. However, some items did not correlate in both samples above the 0.3 limit with the rest of the items on the particular scale (Field, 2013), suggesting the scales may be better if these items were removed. Studies with larger samples are on their way to further investigate which items should be removed from the scales. As the TTI is a fairly long measure, it could benefit from item reduction to improve its usability. One way to do this would be to remove the opening questions on general puberty issues

and focus it to a psychosexual functioning scale. Also, validation of the TTI against other domain-specific measures is needed. A reliable and validated inventory of psychosexual functioning may improve the comparability and replicability of data and the research performed into this topic. In addition, the results represent a mostly cognitively able group of adolescents with ASD, as the majority of our ASD sample had an IQ within the normal range (scores between 85-115). Potentially these cognitively able adolescents may be more aware of their possible difficulties in psychosexual functioning (e.g. social interaction), as particularly cognitively able adolescents with ASD may be aware of their shortcomings in comparison less cognitively able adolescents with ASD (e.g. Locke et al., 2010). Therefore our results may be less applicable to adolescents whom are less cognitively able. Although our pilot indicated that all adolescents were able to read and answer the questionnaire on their own, the reading level of the TTI should be further investigated, especially, when considering using it with less cognitively able participants. Moreover, in the ASD sample, 14 % (n=11) was female, while in the TD sample, this was 54% (n=71). Although gender was taken into consideration as a covariate in all analyses, clearly, more research is needed to disentangle important gender differences in psychosexual functioning in the context of ASD. Lastly, besides the differences in psychosexual functioning that we found between adolescents with ASD and their TD peers, there were also several 0-findings (for example in the domain sexual/intimate behavior: e.g. age of onset). However, as we used the Bonferroni correction for multiple testing, which is rather conservative and causes some loss of power (increasing chances of Type II error) (Narum, 2006), this may mean that in fact some 0-findings are not 0-findings. Therefore, we encourage future research to investigate psychosexual functioning in larger samples to increase power to examine the factor structure of the TTI and replicate our positive as well as 0 findings.

Strengths

Our study also has three notable strengths. First, we attempted to develop a comprehensive measure including all three domains of psychosexual functioning (i.e. psychosexual socialization, psychosexual selfhood and sexual/intimate behavior). By including all three domains in our inventory we were able to get a more well-rounded view of the level of psychosexual functioning of adolescents with ASD, going beyond only information on a behavioral level. This is particularly important as the interpersonal and intrapersonal domains may form the basis of the behavioral domain. Second, by including a TD comparison group and their parents we were able to directly compare the groups in their psychosexual functioning. Third, as we used both parent-report and self-report we were able to get both perspectives on several aspects of psychosexual functioning of the adolescents. Our results showed that parents and the adolescents themselves did not perceive their psychosexual functioning completely the same, particularly in the domain of sexual behavior (e.g. inappropriate sexualized behavior) and in the domain psychosexual selfhood (i.e. body image). Parents of adolescents with ASD reported significantly

more inappropriate sexualized behaviors and a more negative body image than the parents of the TD adolescents, while self-reports did not show significant differences. There are several possible explanations for this difference in parent and self-report: Possibly, parents pathologize the behaviors of their children more, or the child has less self-reflection decreasing the reliability of their self-report. Although parent and self-report showed significant correlations, more research is needed on informant-agreement. Previous research should be considered in the light of which informant was used, as results may differ depending on the informant.

Overall conclusions and implications
Our findings reflect less favorable psychosexual functioning in adolescents with ASD, although the TTI clearly does require more rigorous investigation to both assess its quality and in order to revise the instrument. As could be expected, as social impairments are a hallmark of ASD, adolescents with ASD showed less psychosexual socialization (e.g. on social acceptance, friendship skills and adequately dealing with boundaries) and poorer psychosexual selfhood than their TD peers (i.e. less self-esteem, less social competence and less psychosexual knowledge), both on self-report and parent-report. In the domain of sexual/intimate behavior only significant differences were found on the parent-report, implying less typical and more inappropriate sexualized behaviors as reported by the parents. The interpersonal (socialization) and intrapersonal (selfhood) domains, which significantly correlate with one another, may form a basis for healthy overall psychosexual functioning. Thus difficulties in these domains may underlie difficulties in the behavioral domain. This could explain why earlier studies focused primarily on problematic or inappropriate behaviors, as these were most likely the most pressing and problematic for the environment (e.g. Dewinter et al., 2013; Hellemans et al., 2007; Sevlever et al., 2013; Stokes & Kaur, 2005; t Hart-Kerkhoffs et al., 2009). In addition, informants differ in their report of psychosexual functioning, implying the value of using multiple informants. Future research into psychosexual functioning should include multiple informants to aim to get the full picture as well as investigate the factors which may be related to discrepancies between informants.

Regardless of the exact interplay of the elements of psychosexual functioning, the poorer psychosexual functioning of adolescents with ASD may make them more vulnerable also other domains. For example, the poorer psychosexual socialization (e.g. the difficulties with peer relationships) and psychosexual selfhood (e.g. limited self-esteem and limited knowledge) may lead to frustration and loneliness; possibly making adolescents with ASD more vulnerable than their peers (e.g. Brown-Lavoie et al., 2014; de Bruijn et al., 2006; Vickerstaff et al., 2007). Psychosexual training programs may decrease this vulnerability (Kirby, Laris, & Rolleri, 2007) and improve psychosexual functioning, for example by increasing psychosexual knowledge (Dekker, van der Vegt, et al., 2014). Future research may provide more insight by investigating the interplay between the different domains of

psychosexual functioning. This could perhaps shed more light on the differences in psychosexual functioning between individuals with ASD and TD individuals, for example the sources and content of sexual education and their effect on behavior or the effect of self-esteem on social relationships, which potentially could lead to appropriate support in the relevant areas. Also future research could look at how problems in psychosexual functioning in individuals with ASD potentially relates to other domains of their lives. If proper support is provided to improve psychosexual functioning hopefully this could lead to improvements in all aspects of psychosexual functioning and potentially other domains to which it is related.

Many of the psychosexual difficulties that individuals with ASD show may also lead to more extreme difficulties throughout their lives (i.e. sexual victimization or delinquency) (Dennison & Leclerc, 2011; Geluk et al., 2012; Markham et al., 2010; Sevlever et al., 2013; Steiger, Allemand, Robins, & Fend, 2014; Trzesniewski et al., 2006). However as the concept is so interrelated investigating only one element may be understating the intricate relations which all contribute to healthy psychosexual functioning (Epstein & Ward, 2008). Interventions aimed to improve psychosexual functioning in adolescents with ASD may therefore not only be important to improve psychosexual functioning, but also to decrease the risk of the potential victimization and delinquency.

Although more research is required to determine the quality of the TTI, the differences we found between adolescents with ASD and TD adolescents may support the validity of the TTI as a tool when assessing psychosexual functioning and identifying potential difficulties or problem areas which may need more counseling or help when working with adolescents with ASD. As the literature on psychosexual functioning in adolescents with ASD is still developing and steadily growing, we hope the present study contributes to the understanding of psychosexual functioning in adolescents with ASD and potential difficulties they face. In turn this may contribute to research regarding how to improve psychosexual functioning in adolescents with ASD. Our results indicate that adolescents with ASD have a less favorable psychosexual functioning than TD adolescents in all domains (i.e. psychosexual socialization, psychosexual selfhood and sexual/intimate behavior). Future research could elaborate on our findings to investigate which differences are most prudent to eliminate or minimize and which depend mostly on the informant; to decrease the risks adolescents with ASD have in psychosexual functioning, both with regard to victimization as well as sexual delinquency. Such insights may guide the creation and adaptation of psychosexual training programs aimed to improve psychosexual functioning.

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Author contribution
LPD was responsible for data collection, data analysis, interpretation of the results, and drafted the manuscript. EvdV, JvdE, NT, AL, AM and FCV participated in the design of the study, the interpretation of the data and manuscript development. KGL participated in the design of the study, data analysis, interpretation of the results, manuscript development and supervised the overall study. All authors read and approved the final version of the manuscript.

Compliance with Ethical Standards
Conflict of interest
Kirstin Greaves-Lord is second author on the Dutch ADOS-2 manual, for which Yulius receives remuneration. Frank Verhulst is head of the department of Child and Adolescent Psychiatry at Erasmus MC, which publishes ASEBA materials and from which he receives remuneration.

Ethical Statement
At wave 1, parents of the participating children signed informed consent forms prior to participation in the study. At wave 2, both parents and adolescents signed the informed consent forms. This study was approved by the local Medical Ethics Committee (MEC-2008-388).

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Appendix 1a: Sample of the TTI-adolescent version

YOU & LOVE

Below is a list of items that describe adolescents. All these items concern issues on how you are now or have been in the last 6 months. Please answer *very or often true* if this expression is appropriate to your situation. Please answer *somewhat or sometimes true* if this expression is somewhat or sometimes true to your situation. If the expression is not at all appropriate to your situation, please answer *not at all true*.

		Not at all true	Somewhat or Sometimes true	Very or Often true
1.	I have been in love with someone. (If you choose not at all skip all questions up until question 24 and start with question 25 on page 14)	○	○	○
2.	I have been in love with a peer.	○	○	○
3.	I have been in love with someone who I know through the Internet.	○	○	○
4.	I have been in love with a celebrity (= an existing person).	○	○	○
5.	I have been in love with a fictional character from TV or a computer game (= a fictional person).	○	○	○
6.	I have been in love with a teacher or mentor or group-leader.	○	○	○
7.	I have been in love with someone else, namely: _____ _____	○	○	○
8.	I have been in love with a boy/man.	○	○	○
9.	I have been in love with a girl/woman.	○	○	○
10.	I have been in love with someone a lot younger than I was (5 years or more).	○	○	○
11.	I have been in love with someone a lot older than I was (5 years or more).	○	○	○
12.	I have been in love with someone although that person was not in love with me.	○	○	○
13.	I have been in love with someone and that person was also in love with me.	○	○	○

YOU & LOVE

	Not at all true	Somewhat or Sometimes true	Very or Often true
14. When I am in love with someone, I feel confident.	○	○	○
15. When I am in love with someone, I do not know what to do.	○	○	○
16. When I am in love with someone, I do not know what to say.	○	○	○
17. When I am in love with someone, I do not know how to make contact with that person.	○	○	○
18. When I am in love with someone, I contact that person using the internet (MSN/ Facebook/email/social networks).	○	○	○
19. When I am in love with someone, I start a conversation with that person.	○	○	○
20. When I am in love with someone, I do something else to come into contact with him or her, namely: _____ _____ _____	○	○	○
21. The first time I have contact with the person I am in love with, I ask for contact information (= phone number, email address, MSN, Facebook etc).	○	○	○
22. The first time I have contact with the person I am in love with, I ask if he or she wants to meet up with me.	○	○	○
23. The first time I have contact with the person I am in love with, I tell that person I am in love with him or her.	○	○	○
24. The first time I have contact with the person I am in love with, I ask him or her to be my boyfriend/girlfriend.	○	○	○
25. I keep contacting someone, even though that person has indicated he/she does not want any contact with me.	○	○	○

SEXUALITY

During puberty many teenagers are curious about intimacy. Some teenagers will have their experiences with intimacy.

4. This question consists of 3 subparts; carefully read the instructions below before you answer the question.

I) Of the actions named below, please answer if you have ever done that and if you have done it, how old you were when you first did it.
II) After completing part I, please answer if you have done it in the past 6 months.
III) If you have never done it, we ask if you to please answer if you would want to do it.

	I) Ever			**II) Past six months**			**III) Would you want to do it**		
	No	Yes	Age 1st time:	Never	Sometimes	Often	Not at all	A little	Very much
Masturbating	O	O	____	O	O	O	O	O	O
French kissing	O	O	____	O	O	O	O	O	O
Touching and caressing	O	O	____	O	O	O	O	O	O
Fingering by or of someone / giving or receiving a hand-job	O	O	____	O	O	O	O	O	O
Intercourse (making love, sex)	O	O	____	O	O	O	O	O	O
Something else, namely:_____	O	O	____	O	O	O	O	O	O

		Not at all true	Somewhat or Sometimes true	Very or Often true
5.	When I am physically intimate with another person (for example making out, cuddling or sex) I am good at pointing out what I do and do not find pleasant.	○	○	○
6.	I fantasize sometimes about being physically intimate with someone (for example French kissing, cuddling or sex).	○	○	○
7.	I have had a very unpleasant intimate experience (for example French kissing, cuddling or sex).	○	○	○
8.	I find it pleasant to be physically intimate with another person (for example French kissing, cuddling or sex).	○	○	○
9.	I feel confident when I am physically intimate (for example French kissing, cuddling or sex) with someone.	○	○	○
10.	I do not know how to masturbate (having sex with yourself, touching your private parts/caressing).	○	○	○

11. Do you have a specific physical limitation or at the moment have any physical problems (for example infections or injuries on the genitals) that make having intimate relations or sexuality more difficult?

○ No

○ Yes, such as: _____

YOU & THE INTERNET

Below is a list of items that describe adolescents. All these items concern issues on how you are now or have been in the last 6 months. Please answer *very or often true* if this expression is appropriate to your situation. Please answer *somewhat or sometimes true* if this expression is somewhat or sometimes true to your situation. If the expression is not at all appropriate to your situation, please answer *not at all true*.

		Not at all true	Somewhat or Sometimes true	Very or Often true
1.	I make use of the Internet.	○	○	○
2.	I have contact on the Internet with people whom I know from my immediate surroundings (for example, chatting, and social networks).	○	○	○
3.	I have contact on the Internet with people who I do NOT know before I first contacted them using the Internet (for example, chatting, and social networks).	○	○	○
4.	I have contact with people using a webcam.	○	○	○
5.	I visit websites that give information about sex.	○	○	○
6.	I visit websites with sexual imagery or movies (=porno).	○	○	○
7.	I have set a date with someone I met on the Internet.	○	○	○
8.	I have had sex with someone I met on the Internet.	○	○	○
9.	I have shown myself naked via the webcam.	○	○	○
10.	Another person has shown himself/herself naked via the webcam to me.	○	○	○
11.	I have had sex with someone via the Internet (=cybersex).	○	○	○

Appendix 1b Sample of the TTI parent version

YOUR CHILD & SEXUAL EDUCATION

1. Has your child already had sexual education or training on the topic of puberty/ friendship/intimacy/sexuality?

○ No
○ Yes > where/from whom did your child receive sexual education? You are allowed to give more than one answer.

- ○ By his parents/caregivers
- ○ By his teacher at school
- ○ By his friends/peers
- ○ By the media and/or the internet
- ○ At a special training, namely _____ __ _____
- ○ Other, namely: _____ _____

FAMILY

Every family has their own habits and ways of doing things. In the one family there is more openness about the naked body or discussing sexuality than there is in other families. The following questions centre around the habits of your family.

Below is a list of items. Each item concerns how your child is now or has been in the last 6 months. Please answer Very or often true if this expression is appropriate to your child's situation. Please answer somewhat or sometimes true if this expression is somewhat or sometimes true to your child's situation. If the expression is not at all appropriate to your child's situation, please answer not at all true.

		Not at all true	Somewhat or Sometimes true	Very or Often true
2.	Within our family we discuss sexuality	○	○	○
3.	We/I as parent(s) are comfortable talking about sexuality with the child for whom we are filling out the questionnaire.	○	○	○
4.	My child takes the initiative to talk about sexuality with me/us.	○	○	○
5.	We/I as parent(s) take the initiative to talk about sexuality.	○	○	○

KNOWLEDGE

Some teenagers have a limited knowledge about physical development and sexuality, other teenagers know a lot about it. The following questions are focused on the knowledge your child has about these subjects.

		Not at all true	Somewhat or Sometimes true	Very or Often true
2.	My child has knowledge about the physical changes that occur during puberty.	○	○	○
3.	My child is able to name his/her body parts.	○	○	○
4.	My child knows the correct meaning of the sexual terminology he/she uses.	○	○	○
5.	My child has knowledge about the different types of sexual preference that exist (hetero-, homo-, bisexual).	○	○	○
6.	My child knows how a woman can become pregnant.	○	○	○
7.	My child knows what precautions to take to prevent pregnancy.	○	○	○
8.	My child knows how babies are conceived.	○	○	○
9.	My child knows people have intercourse and how they do that.	○	○	○
10.	My child knows what precautions to take to prevent getting a venereal disease/sexually transmitted disease (STD).	○	○	○

YOUR CHILD & INTIMACY

Intimacy

Physical contact is commonly made during friendly contact. Some teenagers have trouble with this, for example with being touched and touching others.

Below is a list of items. Each item concerns how your child is now or has been in the last 6 months. Please answer Very or often true if this expression is appropriate to your child's situation. Please answer somewhat or sometimes true if this expression is somewhat or sometimes true to your child's situation. If the expression is not at all appropriate to your child's situation, please answer not at all true.

	Not at all true	Somewhat or Sometimes true	Very or Often true
1. My child takes initiative to touch other family members or well-known acquaintances.	○	○	○
2. My child has difficulty with being touched by other family members or well-known acquaintances.	○	○	○
3. My child takes the initiative to touch less known acquaintances/strangers.	○	○	○
4. My child has difficulty with being touched by acquaintances/strangers.	○	○	○
5. My child touches others where they do not like to be touched.	○	○	○

If your child never does this continue on page 23 with question 8. If your child does do this, please fill out question 6 and 7 as well.

	Not at all true	Somewhat or Sometimes true	Very or Often true
6. My child realizes it when he/she is touching people inappropriately.	○	○	○

7. Who does your child touch inappropriately?

○ Family members/acquaintances
○ Friends
○ Strangers
○ Other, such as: _____

		Not at all true	Somewhat or Sometimes true	Very or Often true
8.	My child follows the social rules that are accepted in the different situations that centre around nudity (for example changing with the curtains drawn).	○	○	○
9.	My child poses questions or makes remarks about intimate topics that are socially inappropriate (for example asking (too) personal questions or making personal remarks at inappropriate times).	○	○	○
10.	My child is able to set his/her boundaries regarding social relationships in general.	○	○	○
11.	My child is able to recognize other people's boundaries regarding social relationships in general. (This means your child is able to recognize another person's non-verbal-hints)	○	○	○
12.	My child responds adequately to other people's boundaries regarding social relationships in general. (Your child adjusts his/her behavior depending on what the other person indicates)	○	○	○
13.	I worry about the defensibility of my child regarding social relationships in general.	○	○	○

Appendix 2 'item-rest correlations below .3'

Fifteen items (six items on parent-report scales and nine items in the self-report scales) showed an item-rest correlation below .3 in both samples: 1 item on the scale 'Body image' (self-report); 1 item on the scale 'Personal openness about intimacy' (self-report); 3 items on the scale 'Self-esteem'(self-report); 1 item on the scale 'Amount of sexual behavior' (both parent-report and self-report); several items on the scale 'Amount of inappropriate sexualized behavior'(parent-report = 4 items and self-report = 3 items); and 1 item on the scale 'Online sexual activity' (parent-report) had an item-rest correlation below .3 (detailed information available upon request).

Eight of the 15 items with a low item-rest correlation are part of the two scales which showed low internal consistency (i.e. ´Amount of inappropriate sexualized behavior´ and 'Personal Openness about intimacy'). With regard to the ´Amount of inappropriate sexualized behavior´ scale, this scale showed low internal consistency on both parent-report and self-report in both groups (ASD and TD), and in the TD self-report even a negative Cronbach's alpha. Although the low alpha's of the 'Amount of inappropriate sexualized behavior' would generally be worrisome, the behaviors reported on in this scale range from rather moderate to extremely inappropriate behaviors (see Table 2 for example questions) thus it can be expected that the more extreme behaviors are sparsely endorsed by our non-criminal groups. Similar findings with regard to sexual behavior have been found in other studies; i.e. the studies of Ginevra et al. (2015) and of Stokes and Kaur (2005). Specifically, in the parent-report scale, the item endorsement of the 4 items with low item-rest correlation range from 0% (i.e. inappropriate masturbation) to 8.1% (i.e. inappropriately taking care of personal hygiene surrounding either menstruation or ejaculation) in the TD group. In the ASD group the endorsement was somewhat higher, ranging from 2.1% (i.e. inappropriate masturbation) to 46.9% (i.e. inappropriately taking care of personal hygiene surrounding either menstruation or ejaculation). This explains why the Cronbach's alpha was also better in the ASD group. The 3 items on the self-report scale of ´Amount of inappropriate sexualized behavior´ were sparsely endorsed in both the TD group (ranges from 2.2% to 6.6%) and the ASD group (ranges from 3.6 to 7.1%). The low internal consistency on the Openness scale may be because the items on this scale measure different aspects of openness (i.e. communication regarding sexuality with different people), potentially thereby decreasing the Cronbach's alpha.

The remaining 7 items were checked on their content validity and effect on the Cronbach's alpha. All items suited the scale they are part of based on content, but may not have correlated optimally with the other items in the scale as they measure (slightly) different aspects of the construct measured with the full scale. For example, the item in sexual behavior with an item-rest correlation below 0.3 in both samples asked about masturbation behavior, which is a solo-sexual activity, whilst the other items covering sexual behavior are at least partnered sexual activities.

Chapter 6

Improving Psychosexual Knowledge in Adolescents with Autism Spectrum Disorder:
Pilot of the Tackling Teenage Training Program.

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Abstract

Previous studies have shown that psychosexual functioning in adolescents with autism spectrum disorder (ASD) is hampered and emphasize the need for a specialized training program tailored to their needs. Therefore, an individual training program was developed; the Tackling Teenage Training (TTT) program. The current pilot study systematically evaluated whether psychosexual knowledge increased after taking part in the TTT program, using a pre- and post-training design in 30 adolescents with ASD (77% male, mean age=14.80 years, mean intelligence=96.96). Psychosexual knowledge increased significantly (pre-training total score: *M*=25.74, *SD*=6.20; post-training total score: *M*=33.52 (*SD*=2.78); F(1, 29)=65.20, p<.001). The TTT program may be useful to improve psychosexual knowledge and functioning in adolescents with ASD, yet these findings are preliminary, and a more elaborate controlled trial is needed.

Due to the main characteristics of autism spectrum disorder (ASD), namely impairments in social interaction and communication as well as restricted, repetitive and stereotyped behaviors (APA 2013), individuals with ASD run into a variety of difficulties in daily life. The discrepancy between their physical development and their socio-emotional development, may increasingly lead to difficulties as individuals with ASD mature (Kuo et al. 2011; Anderson et al. 2011; Sullivan and Caterino 2008), especially with regard to psychosexual functioning (Gougeon 2010). Psychosexual functioning is a multi-facet concept covering not merely sexual behaviors (i.e. behaviors and experiences with sexuality), but also sexual selfhood (i.e. the internal functioning of people, including for example sexual knowledge and self-esteem) and sexual socialization (i.e. the context in which psychosexual development takes place, such as friends, family and the internet) (Dewinter et al. 2013; Tolman and McClelland 2011). Many professionals as well as parents report problems and worries in relation to psychosexual functioning of adolescents with ASD, such as limited awareness of personal and public boundaries (e.g. Ballan 2012; Hellemans et al. 2007; Stokes et al. 2007). The problems in psychosexual functioning may originate from limited knowledge and skills with respect to appropriate psychosexual functioning (Stokes et al. 2007; Sullivan and Caterino 2008; Stokes and Kaur 2005).

A putative reason for the difficulty in psychosexual functioning, has been suggested to be the result of the implicit rules in particular contexts that often accompany sexual situations (Hénault 2006). As implicit learning of social cues is weakened in adolescents with ASD (Hudson et al. 2012), these adolescents usually need explicit information to acquire the appropriate knowledge and skills, also regarding sexual functioning (Gougeon 2010).

Previous studies suggest that guidance and education on psychosexual functioning for adolescents with ASD may help in stimulating healthy psychosexual functioning (Gougeon 2010; Hénault 2006). The need to develop an appropriate training program on psychosexual functioning, that is tailored to the needs of individuals with ASD, has been emphasized by several authors (e.g. Gougeon 2010; Hellemans et al. 2007). However, to our knowledge, to date, no evidence-based individual training program on psychosexual functioning exists specifically tailored to the needs and difficulties of adolescents with ASD which offers guidance with tackling the particular difficulties that adolescents with ASD may run into.

For this purpose, we developed an individual training program; the Tackling Teenage Training (TTT) program (Boudesteijn et al. 2012). This training program consists of 18 individual sessions in which a variety of psychosexual topics are discussed (i.e. psycho-education) alternated with exercises (e.g. behavioral rehearsal; see Method section for full description) and is specifically tailored to the needs of cognitively able adolescents with ASD. The TTT program aims to improve all domains of psychosexual

functioning (i.e. sexual behavior, sexual selfhood, and sexual socialization), with a particular focus on obtaining theoretical as well as practical knowledge (e.g. explicit explanation of often implicit rules and practicing conversational skills).

Healthy psychosexual functioning requires specific knowledge and skills in all domains (i.e. sexual behavior, sexual selfhood, and sexual socialization); for example regarding personal hygiene, developing and maintaining relationships, recognizing and acknowledging personal boundaries (both of self and others), and intimacy and sexual activity with or without partners (T Hart-Kerkhoffs et al. 2009; Hénault 2006; Maniglio 2012). Research has shown that sex education programs which positively impact sexual behavior in typically developing individuals incorporate increasing sexual knowledge (Kirby et al. 2007; Ryan et al. 2007; Rock et al. 2005). Psychosexual knowledge may therefore be important both with regard to making informed decisions, i.e. for example regarding reproduction, intimate behaviors and understanding boundaries (e.g. Urbano et al. 2013) as well as to promote healthy psychosexual behavior, such as the use of a condom (e.g. Rock et al. 2005). Therefore a specialized training program such as the TTT program (Boudesteijn et al. 2012) may be a valuable first step in increasing psychosexual knowledge to improve psychosexual functioning in adolescents with ASD.

Several studies have shown that adolescents with ASD have less knowledge regarding sexuality than typically developing (TD) peers (e.g. Hellemans et al. 2007; Stokes and Kaur 2005). Although some studies have found average psychosexual knowledge levels in individuals with ASD whom are cognitively able (Byers et al. 2013), such differences may be explained to the diverse operationalization of psychosexual knowledge, ranging from simple theoretical vocabulary knowledge (e.g. what is a 'wet dream') to broader psychosexual knowledge, such as knowledge on developing relationships (see Dewinter et al. 2013 for a comprehensive review). A recent study by Brown-Lavoie et al. (2014) using a measure on theoretical sexual knowledge (e.g. reproductive health, sexually transmitted infections, and condom use) found that individuals with ASD had significantly less perceived and less actual knowledge than controls without ASD. In addition, even with adequate theoretical knowledge, adolescents do not always transfer this knowledge into daily functioning (Hellemans et al. 2007). Potentially not only theoretical (e.g. definitions of sexual terminology) but also broader practical psychosexual knowledge and insights (e.g. how to appropriately deal with a psychosexual situations, such as personal hygiene or communication about sexual topics) is important in exhibiting the appropriate skills and psychosexual functioning. Limited knowledge on psychosexual topics in adolescents with ASD may, in certain cases, escalate into inappropriate behaviors; due to for instance limited understanding of private versus public sexual behavior (Nichols and Blakeley-Smith 2009) or even dangerous situations; for instance due to the limited ability to identify abusive behavior (Sevlever et al. 2013).

Therefore, the aim of the current pilot study was to investigate a) whether psychosexual knowledge significantly increased after taking part in the TTT program by means of a pre-training and post-training design. Subsequently, we explored b) which aspects of psychosexual knowledge particularly seemed to increase and c) whether particular characteristics of the participants were related to improved psychosexual knowledge. The final aim was to d) explore whether parents perceived that their child applied the acquired knowledge in everyday life (i.e. transfer of knowledge to adaptation of behavior).

Methods

Participants & procedure

Participants were 30 11-19 year old adolescents with ASD (*M* = 14.80 years, *SD* = 2.07; 77% male). Data were collected between April 2010 and May 2012. The adolescents were in treatment at Yulius; a large expert mental health care organization providing care in the South-West of the Netherlands, which is, among other expertise, specialized in children, adolescents and (young) adults with ASD. Participants were in treatment either at the inpatient or outpatient clinic, and were referred to the Tackling Teenage Training (TTT) program by their clinical practitioner. Referrals were made either because problems in psychosexual functioning had already occurred (i.e. intervention purposes) or because the clinician foresaw future issues regarding the psychosexual functioning of the adolescent (i.e. prevention purposes). All participants gave informed consent. The pilot study was approved by a Dutch mental health ethics committee (METIGG; NL36421.097.11).

As the TTT program was developed for cognitively able adolescents with ASD, the inclusion criteria were; a total IQ score of 75 or higher, age between 11 and 19 years old and a clinical diagnosis of ASD. Based on their Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) axis 1 classification, adolescents were classified as ASD if they fulfilled the criteria for a classification of Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS), Asperger's syndrome (AS) or Autistic Disorder (AD). The inclusion criteria were set as the training program was specifically tailored to the needs of cognitively able adolescents with ASD.

A group of 40 adolescents was eligible to start the training program and to participate in the systematic evaluation. Of 30 adolescents, we had complete data. The incomplete data of the remaining nine adolescents was due to two reasons. First, during the course of the training program, 7 adolescents (17.5%) dropped out and did not finish the training program due to personal circumstances or practical reasons (e.g. moving to a different location or scheduling of appointments was not feasible). In addition, 3 adolescents (5%) did finish the training program, but did not complete the psychosexual knowledge test at both time points. The group without

complete data did not differ significantly from the group with complete data on their knowledge test score at T1 ($t(38) = 1.87$, $p = .07$), age ($t(38) = -.73$, $p = .47$), intelligence $t(31) = .93$, $p = .36$), or gender ($c^2(1, N = 38) = 0.45$, Fisher's exact test $p = .66$). For a detailed description of our sample we refer to Table 1, which shows the sample characteristics.

To investigate whether the TTT program increased psychosexual knowledge in our sample, we used a pre-test, post-test design. We obtained data by means of a psychosexual knowledge test (described in measures) at pre-training and post-training. On average, the training program is completed in approximately 6 months (i.e. 18 weekly sessions), although this may vary. Pre-training data were collected during an intake session one week before the TTT program. Post-training data were collected during an evaluative session, one week after finishing the final session of the TTT program.

Prior to the intake session (i.e. pre-training data collection) and the start of the training program, the adolescents and parents were invited for an introduction meeting. During the introduction meeting, the purpose of the systematic evaluation, the time-investment, the aspects of the systematic evaluation as well as the content of the training program were discussed.

At the intake session, the adolescent filled out the psychosexual knowledge test. The adolescents were able to ask questions for clarification, but did not receive feedback on his/her answers on the psychosexual knowledge test, to avoid a learning effect which could influence the measurement at the post-training time-point. A week after the last session of the TTT program, at the evaluative session, the adolescent filled out the post-training psychosexual knowledge test. The parents filled out an evaluation form in which they indicated if they perceived their child to be able to apply the knowledge, acquired in the training program, in everyday life.

From the start of the TTT program, the adolescent generally had a weekly individual session of 1 hour, in which one topic of the 18 sessions training program was covered (see Tackling Teenage Training program section for more detailed information). The training program was provided by trained and certified trainers of the TTT program, of which there were 5 at the time of the systematic evaluation. The certified trainers received a two day train-the-trainer course and participated in interdisciplinary meetings every three months. Each adolescent was assigned to one trainer for the duration of the entire TTT program. After each session the trainer rated motivation, resistance and difficulty of the session for the adolescent. In our sample pre-training and post-training measurements were on average 7 months apart ($M = 6.8$, $SD = 1.76$; range 3 – 11 months).

The Tackling Teenage Training program
The Tackling Teenage Training (TTT) program was designed to offer guidance and support with tackling the difficulties that adolescents with ASD may encounter regarding psychosexual functioning, by increasing their knowledge and skills on this topic (Boudesteijn et al. 2012). The TTT program is an individual training program, consisting of 18 sessions covering the following topics; discussing puberty (i.e. how and with whom, session 1), appearances (session 2), first impressions (session 3), physical and emotional developments in puberty (session 4, 5 and 6), how to become friends and maintain a friendship (session 8), falling in love and dating (session 9, 11 and 18), sexuality and sex (e.g. sexual orientation, masturbation, and (safe) intercourse; sessions 7, 10, 12, 13), pregnancy (session 14) , setting and respecting boundaries (sessions 15 and 16) and internet use (session 17) are all discussed and practiced in a structured manner with the adolescent in one-on-one training sessions (Boudesteijn et al. 2012).

All sessions are structured in the following way: the adolescent receives information regarding different subtopics of the session (i.e. psycho-education), alternated with exercises (e.g. behavioral rehearsals, and knowledge and insight quizzes). The sessions, provide the adolescent with a leaflet with the information and exercises of the session, supported with clear life-like illustrations as well as a training kit which includes materials such as a model penis (designed for educational purposes) and condoms. This so that the theoretical knowledge can be supported with practical demonstrations and explicit skills training using concrete materials. At the end of each session, the adolescent receives a take-home assignment in which the topic of that session can be discussed/practiced outside of the context of the training program, e.g. a small interview with one of the parents on the topic of the session, or arranging a get-together with a friend. After each session, parents are informed through e-mail about the topic of the session (i.e. psycho-education) and the take-home assignment of the child. In addition, particularities (i.e. strengths and difficulties of the child) of the specific session are communicated to parents. This feedback to the parents is provided with the permission of the adolescents and is intended to enhance generalization, by preparing the parents for any questions or remarks. Both the take-home assignments and the communication with the parents are intended to foster an environment in which the adolescent can feel comfortable to discuss or practice appropriate skills (i.e. conversational) regarding psychosexual topics to enhance generalization. The TTT program manual (Boudesteijn et al. 2012) is available upon request in Dutch, English, Greek and Spanish.

Materials
Psychosexual knowledge test. To assess psychosexual knowledge, and possible lack thereof, we used a psychosexual knowledge test of 37 items. This test is an adapted version of an existing Dutch high school biology test regarding sexual knowledge for adolescents between the ages of 13-15 years old, who are attending pre-

vocational education (in Dutch 'VMBO') (Hendriks and Meijs 2005). The questions of the psychosexual knowledge test vary from understanding the meaning of sexual terminology (e.g. *What does 'orgasm' mean?*), to knowledge on functionality of sex organs (e.g. *What happens when someone ejaculates?),* to safety related topics in sexuality (e.g. *Which statement regarding condom use is correct?*), to more applied psychosexual knowledge topics (e.g. *Why is it important to make eye contact during social interactions?*) (see appendix A for the full psychosexual knowledge test). The psychosexual knowledge test consists of 35 multiple choice questions and 2 open-ended questions in which 4 male reproduction body-parts and 6 female reproduction body-parts have to be named correctly. Each question is rated as being either correct or incorrect, which leads to a score of one point per question. The total score on the psychosexual knowledge test represents the total number of correct answers, ranging from 0 to 37. Thus the higher the total score, the more correct psychosexual knowledge the adolescent has. The internal consistency of the measure at both T1 and T2 was good (Cronbach's α T1 = .87; Cronbach's α T2 = .71).

Individual characteristics. Age, gender, intelligence, ASD diagnosis and severity, level of perceived motivation for the training program and difficulty and resistance to the training program, and parental level of perceived transfer of knowledge to real-life behavior were assessed to provide a detailed description of our sample.
By means of the Autism Diagnostic Observation Schedule (ADOS; Lord et al. 2000) the ASD severity was assessed using the calibrated severity scores (Hus and Lord 2014). The ADOS was administered by examiners who had completed the research-training and had achieved sufficient reliability for administration and coding. All the adolescents received module 4 of the ADOS based on their age as well as language abilities.

Information on *intelligence* (i.e. total intelligence quotient, TIQ) was gathered by means of several standardized assessment tools, generally the Wechsler Intelligence scale for Children (WISC; Wechsler 2004).

As potentially the level of motivation for the training program, perceived difficulty with the sessions or resistance to a training program of an adolescent can influence learning (e.g. Wolters 2003) we considered these factors in the evaluation of the training program. Trainers rated motivation, resistance and difficulty of the adolescent after each session. First, motivation of the adolescent was scored on a scale from 0 to 10 (0 = no motivation at all; 10 = very motivated). Second, the trainer rated how much resistance the adolescent showed during the session, again on a scale from 0 to 10 (0 = no resistance at all; 10 = very much resistance). Last, the trainer rated how difficult that particular session was for the adolescent on a scale from 0 to 10 (0 = very easy to 10 = extremely difficult). These scores for each session were subsequently summed and then averaged to compute an index of overall motivation, resistance and difficulty. During the training program, neither

the parent nor the adolescent were informed about the scores.
Lastly, we explored the perceived transfer of knowledge to adaptation of behavior in a parent evaluation at the end of the TTT program. Parents were asked whether their child applied the acquired knowledge in everyday life, scoring this item either yes (= 1) or no (= 0).

Analyses
Firstly, we performed descriptive analyses in order to provide information about the diagnostic characteristics of the participants as well as on how the TTT program was generally perceived (i.e. mean scores of the trainer reported perceived motivation, difficulty and resistance) as well as how parents scored the transfer of knowledge to behavior.

Secondly, we calculated frequencies to investigate the percentage of correct answers per question of the psychosexual knowledge test, both pre-training and post-training.

Thirdly, to investigate whether psychosexual knowledge significantly increased from pre-training to post-training, we performed a repeated-measures ANOVA with the total score on the psychosexual knowledge test as the dependent variable.

Finally, to explore whether individual characteristics (i.e. age, gender, intelligence, ASD severity, motivation, resistance, difficulty, and perceived transfer of knowledge) were related to a change in psychosexual knowledge, we computed Pearson correlations between these variables and the change in total score from pre-training to post-training (i.e. post- minus pre-training score) on the psychosexual knowledge test. Due to the small sample size in our pilot, we did not have sufficient power to include the individual characteristic, which may influence the effect of the training program, in the main analyses.

Results

Sample characteristics
Table 1 shows the characteristics of our sample as well as how the TTT program was perceived, both reported by the trainer (i.e. perceived motivation, difficulty and resistance) and by parents (i.e. if the child applied the acquired psychosexual knowledge in daily life).

Table 1 Sample characteristics

		N (%)
Gender (male)		23 (77%)
PPD-NOS classification [a]		24 (80%)
Asperger's syndrome (AS) classification [a]		3 (10%)
Autistic Disorder (AD) classification [a]		3 (10%)
Perceived transfer of knowledge to adaptation of behaviour (parent-reported 'yes')		19 (86%) [b]
	***M* (*SD*)**	**[Range]**
Age	14.80 (2.08)	[11-19]
Total IQ	96.96 (10.80)	[79-120]
Calibrated severity score ADOS [c]	5.46 (2.92)	[1-10]
Motivation average [d]	7.33 (1.15)	[4.88-9.67]
Difficulty average [d]	4.37 (1.89)	[1.12-8.00]
Resistance average [d]	1.51 (1.16)	[0-4]

Note. PDD-NOS = Pervasive Developmental Disorder – Not Otherwise Specified. ADOS = Autism Diagnostic Observation Schedule. Total sample is 30 adolescents.

[a] Based on axis 1 classification of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR; APA, 2013). [b] Available for *N* = 21 (70% of total sample). [c] Available for *N* = 22 (73% of total sample); Calibrated scores as described in Hus and Lord (2014); Module 4. [d] Available for *N* = 28 (93% of total sample); Trainer reported about adolescent; 0 = not at all to 10 = very much.

Changes in psychosexual knowledge

Table 2 shows the proportion of adolescents with ASD who correctly answered a question, at pre-training and post-training. Pre-training, adolescents had the least psychosexual knowledge regarding sexual selfhood (i.e. sexual preference, naming the separate body parts of the female reproductive area and the function of the hymen). The proportion of correct answers on almost all questions increased, except on one question. The one question was answered correctly by all the adolescents on both pre-training and post-training (i.e. correct word for the primary male sexual organ; question 7). Psychosexual knowledge increased especially on three questions, indicated by an increase of at least 40% of the adolescents answering the questions correctly: two questions regarding sexual selfhood (i.e. the definition of sexual preference (question 21; increase of 56.7%) and how one discovers his/her sexual preference (question 22; increase of 46.7%)) and one question regarding sexual behavior (i.e. practical knowledge on 'foreplay' (question 31; increase of 53.3%)). On more than one third (i.e. 13 out of 37 = 35%) of the questions, after the training program all the adolescents knew the correct answer, while this proportion was 1 out of 37 (= 3%) before the training program.

Table 2 Results psychosexual knowledge test per question

Question		Pre-training	Post-training
		% correct	% correct
1.	Definition of 'puberty'	93.3	100.0
2.	Definition of 'charisma'	80.0	100.0
3.	Definition of 'physical trait related to appearance'	70.0	90.0
4.	Relation of dress code to sexual desire	70.0	76.7
5.	Purpose of making eye contact	96.7	100.0
6.	Correct word for the primary female sexual organ	90.0	100.0
7.	Correct word for the primary male sexual organ	100.0	100.0
8.	Naming the elements of the female reproductive area	29.6	50.0
9.	Naming the elements of the male reproductive area	46.4	66.7
10.	Definition of 'menstruation'	66.7	83.3
11.	Definition of 'an erection'	73.3	100.0
12.	Timing of an erection	66.7	100.0
13.	Definition of 'ejaculation'	83.3	93.3
14.	Definition of 'wet dream'	86.7	96.7
15.	Definition of 'masturbating'	66.7	90.0
16.	Synonym 'orgasm'	66.7	100.0
17.	Elements of friendship	93.3	100.0
18.	Applicability of term 'friendship'	86.7	96.7
19.	Definition of 'attraction'	66.7	80.0
20.	Elements of 'being in love'	90.0	96.7
21.	Definition of 'sexual preference'	23.3	80.0
22.	Discovering sexual preference	50.0	96.7
23.	Definition of 'heterosexual'	63.3	90.0
24.	Definition of 'coming out'	53.3	80.0
25.	Description of 'flirting'	66.7	96.7
26.	Timing of first sexual intercourse	53.3	83.3
27.	Definition of 'the pill'	86.7	100.0
28.	Usage of condom	93.3	96.7
29.	Definition of STI's	50.0	83.3
30.	Definition of 'being horny'	73.3	100.0
31.	Utility of 'foreplay'	40.0	93.3
32.	Definition of 'hymen'	33.3	70.0
33.	Definition of 'impregnation'	90.0	100.0
34.	Knowledge about unimpregnated oocyte	53.3	79.3
35.	Knowledge about unwanted pregnancy	86.7	93.3
36.	Definition of 'boundary crossing behaviour'	76.7	100.0
37.	Portrayal of sex in the media	70.0	96.7

Note. % reflects how many of the adolescents answered the question correctly. See appendix A for full psychosexual knowledge test.

The repeated measures ANOVA we performed on the total scores of the pre-training and post-training scores on the psychosexual knowledge test showed a significant increase in overall psychosexual knowledge from pre-training (*M* = 25.80,*SD* = 6.30), to post-training (*M* = 33.80, *SD* = 2.72; F(1, 29) = 65.20, p < .001).

Individual characteristics related to the changes in psychosexual knowledge
The correlations in Table 3 show that age and perceived difficulty significantly correlated with the change in total score on the psychosexual knowledge test from pre-training to post-training. Younger adolescents showed a larger increase in psychosexual knowledge (r = -.55, p < .01), and adolescents that seemed to have more difficulty with the content of the sessions as reported by the trainer showed a larger increase in psychosexual knowledge (r = .41, p =.03).

Table 3 Correlation matrix change score psychosexual knowledge test

Measure	**Correlation**	**p**
Age	-.55	<.01
Gender (male)	-.17	.37
Total IQ	-.30	.17
Calibrated severity score ADOS [a]	-.05	.83
Motivation [b]	-.03	.89
Difficulty [b]	.37	.05
Resistance [b]	.09	.66
Child manages to apply in their daily life, the psychosexual knowledge that they acquired during the Tackling Teenage Training (parent-report yes) [c]	.13	.59

Note. Pearson correlations with the change score of the psychosexual knowledge test (post-training minus pre-training score).
[a] Available for *N* = 22 (73% of total sample); Calibrated scores as described in Hus and Lord (2014); Module 4. [b] Available for *N* = 28 (93% of total sample); Trainer reported about adolescent; 0 = not at all to 10 = very much. [c] Available for *N* = 21 (70% of total sample).

Discussion

As the research literature on psychosexual functioning in ASD is steadily increasing, evidence accumulates that adolescents with ASD have specific needs for a specialized training program regarding the area of psychosexual functioning (Gougeon 2010; Hénault 2006; Hellemans et al. 2007). However, to our knowledge, there is not yet an evidence-based individual psychosexual training program available serving these particular needs. For this purpose, we developed the Tackling Teenage Training (TTT) program (Boudesteijn et al. 2012) which is a training program regarding psychosexual functioning (i.e. sexual behavior, sexual selfhood and sexual socialization) that is specifically tailored to the needs and the difficulties that cognitively able adolescents with ASD have and which offers them guidance and support in their psychosexual development. As knowledge is a predictor of healthy psychosexual behavior in typically developing individuals (Ryan et al. 2007), the main aim of the current systematic evaluation was to investigate whether knowledge regarding psychosexual functioning increased after participation in the TTT program, using a pre- post-training design. In our sample of 30 11-19 year old adolescents with ASD, overall psychosexual knowledge significantly increased from pre-training to post-training. In addition we explored if particular aspects of psychosexual knowledge increased. Particularly, psychosexual knowledge regarding sexual selfhood (i.e. sexual preference) and sexual behavior (i.e. practical knowledge regarding foreplay) increased, as each had at least 40% of the adolescents improve their knowledge on these items. When exploring which characteristics influenced the increase in knowledge, it was found that younger adolescents showed a larger increase in psychosexual knowledge, as well as the adolescents that were reported by their trainer to have more difficulty. Moreover when exploring if parents perceived a transfer of knowledge to adaptation of behavior, most parents reported to perceive a transfer of the learned psychosexual knowledge to every-day life.

Appropriate psychosexual knowledge may lead to healthier decision making regarding psychosexual behavior, thereby decreasing the risk adolescents may run. Although, to our knowledge, no study has investigated if psychosexual knowledge improves decision making regarding psychosexual behavior in adolescents with ASD, there are studies in typically developing adolescents which supports this (Ryan et al. 2007; Zimet et al. 1992; Reitman et al. 1996). Psychosexual knowledge of adolescents with ASD significantly increased after taking part in the TTT program, and may therefore improve the decisions that adolescents with ASD make regarding their psychosexual functioning. This hypothesis is speculatively supported by our finding that most parents reported that they perceived transfer of knowledge to adaptation of behavior in everyday life.

Age and trainer-reported difficulty significantly correlated with the change in total score on the psychosexual knowledge test. There was a strong negative association between age and the change in total score on the psychosexual knowledge test.

Thus, the younger the adolescent, the more psychosexual knowledge was obtained over the course of the TTT program. There was a moderate positive relationship with trainer reported average level of difficulty and the change in total score on the psychosexual knowledge test. Thus the more difficulty the trainer estimated the adolescent had with the total training program, the larger the increase in total score on the psychosexual knowledge test. This may mean that the training program might have the most optimal outcome with respect to knowledge in relatively young teenagers, potentially as they may have been less exposed to psychosexual information or did not learn as much from regular psychosexual information sources and therefore have a lower score at the start allowing more room to learn. In addition those that seem to have greater difficulties with the total training program according to their trainer, also show the most increase in psychosexual knowledge. Potentially this may be because those with the most difficulty have less knowledge at the start of the training program or they may have misinterpreted psychosexual information leading to incorrect knowledge and therefore need to acquire more knowledge or to improve previously learned incorrect knowledge. However in our pilot study, the lack of power does not allow for the more extensive analyses required to properly analyze this. Therefore more research is needed to corroborate these preliminary conclusions. A randomized controlled trial would be better suited to investigate if indeed the TTT program improves psychosexual function on top of the effects of regular learning opportunities in daily life (e.g. sexual education in schools, interaction with peers, parents, and siblings, psychosexual experiences, and information from online sources). In addition, a more extensive assessment battery could be useful to investigate which factors are related to the effectiveness of the training program, as well as if and how the transferal of knowledge to adaptation of behavior and skills in daily life takes place.

Due to the difficulties in social communication and implicit learning of adolescents with ASD as well as their limited amount of peer relations (Orsmond et al. 2004), a formal training program, may be best suited to improve their psychosexual functioning. In typically developing adolescents, most psychosexual knowledge is acquired from informal social sources, e.g. parents and peers (Stokes et al. 2007; Brown-Lavoie et al. 2014). However, adolescents with ASD may be less able – or less frequent in situations – to learn from informal social sources as compared to their typically developing peers (Sullivan and Caterino 2008; Stokes et al. 2007; Brown-Lavoie et al. 2014). Non-social sources, such as the media, which individuals with ASD use significantly more than those without ASD (Brown-Lavoie et al. 2014), may provide incorrect or over-romanticized information which could lead to more inappropriate behavior (Collins et al. 2004). Therefore a formal training program

to improve psychosexual functioning such as the TTT program, may be particularly beneficial for psychosexual functioning in adolescents with ASD. In this training program, informal social sources (e.g. parents) are also included, since parents have unique teaching opportunities within the daily lives of the adolescents. To stimulate such 'co-teaching' with the parents, after each session the trainer of the TTT program provides updates to the parents with information on the topic that was covered in the session, the homework that was assigned and strengths and difficulties that their child displayed with the topic.

The TTT program is aimed at 12-18 year old boys and girls with ASD and a total IQ of 80 or higher. However, due to differences in gender, symptom severity and intelligence within this group of adolescents with ASD, it can be valuable to customize the training program to the individual characteristics and needs of an adolescent with ASD. Therefore, trainers of the TTT program were provided with a 2 day train-the-trainer in which they were taught how to provide the training program in a standardized way, with particular suggestions on how it can be customized to the individual needs of the adolescent if necessary. As part of the standardized protocol for research it is imperative that all the sessions are covered, but given the cognitive ability and personal behaviors, experiences, contexts and particular interests of the adolescent, the order of the sessions can be altered, supplementary text and/or exercises can be included, or more time can be used to discuss a particular topic. Currently, given the personal intimate matters that the training program covers it is provided individually, but an adapted version is being created in order to provide the training program in the classroom setting so that peers and teachers can be involved in the learning process.

The current exploratory systematic evaluation has some limitations, which require caution with interpretation of the results. Firstly, the design was a non-controlled pre-training and post-training design incorporated in a care-as-usual setting, thus lacked a control group that did not undergo the training program to compare outcomes. Secondly, the sample size was relatively small and showed a large variety in diagnostic characteristics. Thirdly, our sample included very few girls. Therefore we cannot generalize our findings to females with ASD. Finally, the psychosexual knowledge test was used in exactly the same version at pre-training versus post-training assessment. The increase in knowledge may be the result of a more general learning-effect or potentially some adolescents sought out information after the pre-training assessment. Therefore our results cannot be assigned definitely to the TTT program. The current pilot study prepares and informs a more elaborate randomized controlled trial, that allows us to investigate the efficacy of the TTT program using a randomized controlled trial in a larger sample including more elaborate measures, both parent- and self-report, on psychosexual functioning (i.e. sexual behavior, sexual selfhood and sexual socialization) in everyday functioning.

Although these limitations warrant caution when interpreting these preliminary results, findings seem to indicate an increase in psychosexual knowledge after participation in the TTT program. The training program had a high coherence, and those who did drop out, did so because of circumstantial reasons. As psychosexual knowledge has been related to sexual behaviors in the general population (e.g. Somers and Paulson 2000; Ryan et al. 2007) and both knowledge and skills have been suggested to affect more general psychosexual functioning (T Hart-Kerkhoffs et al. 2009; Hénault 2006; Maniglio 2012), increasing the psychosexual knowledge of adolescents with ASD seems to be a valuable first step in preparing them to develop as sexually healthy adults. The long-term effects as well as the investigation if the training program is mostly beneficial for deviant behavior or victimization should be investigated in future research. Thus, the TTT program may be a potential tool in assisting the healthy psychosexual functioning of adolescents with ASD, although further research is needed to replicate and elaborate the current findings.

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Questionnaire – What do you already know

Date: **Code:**

You can complete this questionnaire anonymously, so you do not need to write your name on it. The trainer will not see your answers and will not discuss them with you.

Complete the following multiple choice questions.
Every question has only one correct answer, so choose the option you think is best.

1. **What is puberty?**

O the age period between ten and nineteen years old in which the body of a child develops into the body of an adult
O the age period in which teenagers behave rebellious and sassy
O I don't know

2. **What do we mean by someone's total expression?**

O invisible radiance coming from the body
O the impression someone is giving other people about himself or herself
O I don't know

Picture 1

3. **Which of the following is <u>not</u> a physical feature?**

O body posture
O clothing style
O character
O piercing
O I don't know

4. **Take a look at picture 1. When a girl wears sexy clothing like in this picture, the girl wants to have sex.**

O true
O false
O I don't know

5. **What is the purpose of making eye contact during a conversation?**

O to show to whom you are talking to and to show that you are listening to someone
O to know how often someone blinks
O eye contact doesn't have a purpose, it's not important
O I don't know

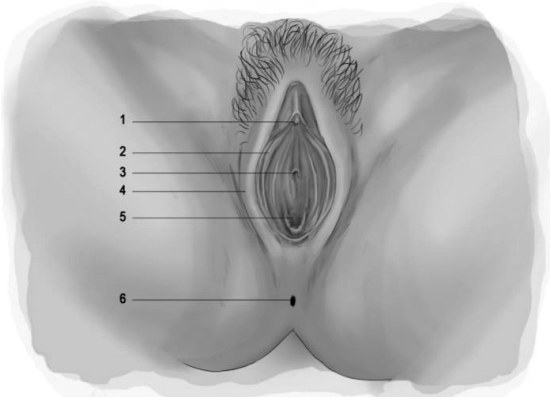
6. **How do you call the female genitals?**

O anus
O vagina
O clitoris
O I don't know

7. **How do you call the male genitals?**

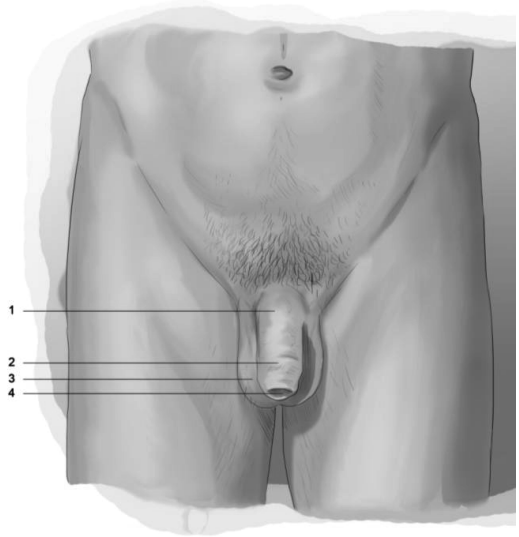
O scrotum
O anus
O penis
O I don't know

8. Take a look at this picture. How do you call the numbered body parts?



1. .....
2. .....
3. .....
4. .....
5. .....
6. .....

9. Take a look at this picture. How do you call the numbered body parts?



1. .....
2. .....
3. .....
4. .....

10. What is menstruation?

O monthly blood loss occurring in a girl or a woman
O fertilization of an egg cell
O it's the same as masturbation
O I don't know

11. What is an erection?

O an injection when you are feeling sick
O circumcised male genitals
O when the male genital becomes stiff
O I don't know

12. When can a person have an erection?

O when someone is having a circumcision because of religious beliefs
O any given moment, without a reason or during sexual arousal (excitement) or touch
O when someone finds out he has a contagious virus
O I don't know

13. What is ejaculation?

O planting seeds in fertile soil
O the release of one sperm cell
O the release of millions of sperm cells
O I don't know

14. What is a wet dream?

O when a boy wets his bed
O an ejaculation during sleep
O a nightmare after which you wake up sweating
O I don't know

15. What is masturbation?

O the same as menstruation
O the same as making love with yourself
O when a man satisfies a woman with his hands
O I don't know

16. What is another definition for orgasm?

O to come
O explosion
O gas formation
O I don't know

17. What is for most people <u>not</u> important in a friendship?

O to meet each other regularly
O to trust each other
O to wear the same clothes
O to respect each other
O I don't know

18. Which of these situations is the best example of a friendship?

O when two people regularly meet
O when two people have never met each other but have daily contact by computer
O when two people meet on vacation and the next day they undertake an activity
O when two people sit next to each other in class and talk about schoolwork
O I don't know

19. What does attraction mean?

O gravity between two bodies
O when somebody tries to make his/her appearance more attractive
O when somebody finds another person attractive
O I don't know

20. What is <u>never</u> a part of 'being in love'?

O to think about someone all the time
O a brother and sister who love each other
O tension, insecurity, blushing
O to be attracted to someone
O I don't know

21. What is the right description for 'sexual preference'?

O when you want to have sex with someone
O when you are falling in love with someone of your own or the opposite sex
O the age you prefer to have sex for the first time
O I don't know

22. There are many ways to find out about your own sexual preference. How do most people discover their preference?

O it shows itself, because you fall in love with someone
O by waiting to see who wants to have sex with you
O by having sex with different people at age of 16
O I don't know

23. When is someone heterosexual?

O when someone always falls in love with a person of the opposite sex
O when someone always falls in love with a person of the same sex
O when someone falls in love with someone of the same sex at one time and with someone of the opposite sex at another time
O I don't know

24. What does 'coming out' mean?

O to tell openly people that you are heterosexual
O to tell openly people that you are gay or bisexual
O to tell openly people what your sexual fantasies are
O I don't know

25. What is <u>not</u> a description of flirting?

O to urgently want to have sex with someone
O to use body language to let somebody know that you like or love him/her
O to send each other text messages or e-mails in which you show that you like each other
O I don't know

26. How can you tell if you are ready for sex or not?

O you can never know, you first have to try it and then you will know
O if you are older than 16, you are certainly ready for sex
O if you feel like having sex, you fantasize about it and desire to have sex with someone then you are ready to have sex
O I don't know

27. What is the Pill?

O a pill that prevents sexual transmitted diseases
O a pill that girls/women take to prevent pregnancy
O a pill you can take after unsafe sex to terminate a possible pregnancy
O I don't know

28. Which statement is <u>true</u> about condom use?
O you can use a condom several times
O a condom protects against sexually transmitted diseases and pregnancy
O it's safer to put on two condoms instead of one
O I don't know

29. Which statement is <u>false</u> about STD?
O a STD is the same as a venereal disease
O you can get a STD from masturbation
O you can get a STD by having unsafe sex
O a STD is a sexual transmitted disease
O I don't know

30. What is the meaning of 'being horny'?
O to feel like having sex, to be excited
O to feel uncomfortable
O when you lost your virginity
O I don't know

31. Why is foreplay mostly important?
O to get sexually aroused and to relax before you have sexual intercourse
O to get to know someone better before you have sexual contact
O to make sure everyone understands the rules before you play a game
O I don't know

32. What is <u>correct</u> about the hymen?
O the hymen proves that you lost your virginity
O the hymen is a small tissue at the beginning of vaginal opening
O the hymen is a membrane that closes the vagina.
O I don't know

33. What is fertilization?
O when fruits are ripe and the pits or seeds are used to plant new fruits
O when a women loses amniotic fluid while giving birth
O when the core of the sperm cell melts with the core of the ovum
O I don't know

34. What happens when an ovum is <u>not</u> fertilized?
O the ovum dissolves
O the ovum goes back to the ovary
O the ovum goes to the uterus and settles in
O I don't know

35. How can an unwanted pregnancy be terminated?
O by condom use
O by abortion or an abortion pill
O by unhealthy food or drink
O I don't know

36. What is 'deviant' behavior?

O behavior that occurs in several countries in the world
O behavior that crosses someone's personal boundaries
O I don't know

37. Which of the following statements about the media (e.g. internet, TV) is correct?

O in the media all you see is fake
O in the media people often show a different picture of reality
O in reality everything is more beautiful than in the media
O I don't know

THE END

Chapter 7

General discussion

When Autism Spectrum Disorder (ASD) was first introduced in the Diagnostic and Statistical Manual of Mental Disorders, Third Edition (DSM-III, American Psychiatric Association, 1980) it was done so as infantile autism. The diagnosis was highly associated with cognitive impairments (i.e. IQ<70) (Charman et al., 2011). Over time, the view on ASD and to whom the diagnosis applies changed, thereby leading to more adolescents and adults receiving the diagnosis, as well as those with average to high IQ's (IQ>70) (Lai, Lombardo, & Baron-Cohen, 2014). Adolescence and adulthood posed new challenges for the individuals with ASD and their caregivers (Seltzer et al., 2003). Several studies have investigated adolescent and adult outcomes and found that the majority of individuals with ASD have a poor outcome in terms of employment and independence from family and caregivers (Eaves & Ho, 2008; Howlin, 2000; Howlin, Goode, Hutton, & Rutter, 2004). However, an understudied area in terms of adolescent and adult outcome has remained psychosexual functioning (i.e. sexual selfhood, sexual socialization, and sexual behavior) (Ballan & Freyer, 2017; Dewinter, Vermeiren, Vanwesenbeeck, & van Nieuwenhuizen, 2013).

In the past two decades slowly but surely research was published on the topic of sexuality, although the informants most often used, were parent or clinician reports, rather than direct inquiry of the individuals with ASD (Dewinter, Vermeiren, Vanwesenbeeck, Lobbestael, & Van Nieuwenhuizen, 2014; Kellaher, 2015). In addition, mostly directly observable sexual behaviors – particularly inappropriate or problematic – were investigated, with few studies looking into the domains of sexual selfhood (i.e. intrapersonal) and sexual socialization (i.e. interpersonal) (Dewinter et al., 2013; Tolman & McClelland, 2011). It has been suggested that due to limited psychosexual insight, knowledge, and skills, higher prevalence of inappropriate or problematic psychosexual functioning in individuals with ASD exists (for a review see Dewinter et al., 2013). Unfortunately, much of the early research had methodological drawbacks due to, for example, small sample sizes, heterogeneous groups, the lack of a comprehensive, multi-informant measure on psychosexual functioning and often no Typically Developing (TD) control group (e.g. Dewinter et al., 2014; Kellaher, 2015). Despite these drawbacks, it is important to note that these early studies should be regarded as the pioneering work necessary to spark the research in an, until then, neglected area.

In the current thesis, I aimed to extend the work of earlier research to investigate if indeed ASD problems are longitudinally related to sexual symptoms (part 1), to investigate with multiple informants (i.e. self-and parent-report) psychosexual functioning of adolescents with ASD, using a newly developed comprehensive measure (Teen Transition Inventory), comparing to TD adolescents (part 2) and if a psychosexual training program would be valuable to increase psychosexual knowledge in adolescents with ASD (part 3). In this chapter, I will describe the main findings and methodological considerations per part of this thesis. Then I will

discuss the overall conclusions of the findings in a broader scientific, clinical and societal context. Lastly, I will give recommendations for future research and the implications for clinical practice and policy.

Part 1: Longitudinal relation between autistic traits and psychosexual problems

Main findings

Part 1 of this thesis includes a study that focused on the broader autism spectrum phenotype (BAP) and how such childhood autistic traits relate to psychosexual problems in early adolescence (Chapter 2). In this study, I investigated if in a general population cohort (n = 1873; the Tracking Adolescents' Individual Lives Survey (TRAILS) (for the design of this study see: de Winter et al., 2005; Huisman et al., 2008), autistic traits in childhood predicted psychosexual problems in early adolescence. Previous cross-sectional studies found that individuals with ASD showed psychosexual problems (e.g. Hellemans, Colson, Verbraeken, Vermeiren, & Deboutte, 2007; Stokes & Kaur, 2005), and hypothesized that these psychosexual problems were a result of the core symptoms of ASD (i.e. limited social cognition and skills). However, at the time of the study, no longitudinal studies on autistic traits and psychosexual problems had investigated such potential causal mechanisms. My study revealed that autistic traits in childhood, above and beyond pubertal development and conduct problems, predicted psychosexual problems in early adolescence. In particular, children who had limited social interests and problems with adapting their behavior to the conventions in social settings were found to have psychosexual problems (particularly thinking too much about sex and playing with own sex parts too much).

Methodological considerations

Although to my knowledge this study was the first to investigate the longitudinal relationship between autistic traits and psychosexual problems, there are some limitations that could be addressed in future research. First, only a limited range of psychosexual problems was covered, therefore research using more comprehensive measures is advisable. Second, only parent-reported data were used for the research in Chapter 2. Although the reliability of self-report in adolescents with autistic traits is questioned (e.g. Cederlund, Hagberg, & Gillberg, 2010), it is valuable to also include self-report, particularly on a topic so personal as psychosexual functioning. Third, a general population sample was selected to investigate if autistic traits were predictive of psychosexual problems. Although the use of a general population sample has some key advantages, e.g. generating results that are representative of the population, it also has some drawbacks. For example, my results can only with caution be translated to samples with more severe problems, both in terms of ASD symptoms and psychosexual problems. The results indicate that individuals with traits of ASD are at-risk, but it is important to note that not all adolescents with ASD

will develop psychosexual problems. Fourth, despite using a general population sample, due to missing data, some adolescents with lower IQ's were excluded from the sample. Although IQ was taken into account as a covariate in the analyses, my findings are confined to cognitively able individuals.

Part 2: Psychosexual functioning in adolescents with ASD

Part 2 of this thesis covers three studies that focus on the assessment of psychosexual functioning of adolescents with ASD. As many previous studies did not use a direct comparison group of TD adolescents, it was complex to determine if indeed the difficulties described for adolescents with ASD in previous studies were 'abnormal'/ excessive or actually typical and age appropriate. As adolescence is a difficult developmental period for any adolescent, it could very well be that at least some of the problems are more related to this turbulent developmental period, rather than a result of the difficulties related to ASD. In addition, often only a particular aspect of psychosexual functioning was the topic of interest in previous research (Dewinter et al., 2013), primarily sexual behavior. Lastly, self-report was not commonly used, and the simultaneous use of multiple informants was very uncommon (Dewinter et al., 2013; Kellaher, 2015). Therefore, I developed the TTI, which includes all three domains of psychosexual functioning (i.e. psychosexual socialization, psychosexual selfhood, and sexual/intimate behavior), in both a self-report and a parent-report format.

Main findings

In the first study (Chapter 3), I describe the development and initial testing of a comprehensive multi-informant psychosexual functioning measure, the Teen Transition Inventory (TTI). By means of the TTI, I investigated if adolescents with ASD differed from TD adolescents in their psychosexual functioning. My results showed that adolescents with ASD have a less favorable psychosexual functioning compared to TD adolescents. I found less psychosexual socialization (e.g. social acceptance, friendship skills and adequately dealing with boundaries) and poorer sexual selfhood (e.g. less self-esteem, less self-perceived social competence and less psychosexual knowledge) in adolescents with ASD compared to TD adolescents, on self-report and parent-report. These findings underline the findings of Chapter 2, indicating the ASD traits are specifically related to psychosexual difficulties. This puts adolescents with ASD at risk for less optimal long-term outcomes in terms of psychosexual functioning. For example, the poorer psychosexual socialization and psychosexual selfhood may lead to frustration and loneliness and possibly more extreme difficulties such as sexual victimization or delinquency (e.g. Brown-Lavoie, Viecili, & Weiss, 2014; de Bruijn, Burrie, & van Wel, 2006; Sevlever, Roth, & Gillis, 2013).

Chapter 3 also showed that depending on the informant, the results differed slightly. Particularly, in the domain of sexual behavior I found that parents of ASD adolescents reported significantly less typical sexual and more inappropriate sexual behavior in their adolescent children compared to parents of TD adolescents. However, the adolescents themselves did report a significant difference on either of these behaviors. Thus, to extend the work of Chapter 3, I compared informant discrepancies (self-report vs. parent-report) for ASD versus TD dyads in Chapter 4. It is the first study to investigate informant discrepancies between parent-child dyads on the topic of psychosexual functioning, in a group of adolescents with ASD and TD adolescents. An important finding was that there was a significantly larger informant discrepancy between ASD dyads than TD dyads. In addition, the results indicate that adolescents with ASD are more optimistic about their psychosexual functioning, while their parents report more negatively and point out more risky sexual behaviors in their offspring. Whose subjective report on psychosexual functioning is most in line with 'an objective truth' (if this even exists) will remain topic of further debate or study. But more importantly, this discrepancy indicates that teens and parents are clearly not on the same page concerning psychosexual functioning, which could be reflective of a problem (communication/perception) in itself and is meaningful for both research and clinical practice (De Los Reyes & Kazdin, 2005; De Los Reyes & Ohannessian, 2016).

Many interventions aim to bring individuals with ASD closer to neurotypically accepted standards, and one of the most common types of treatments is aimed to improve social skills. However, previous studies have found that high-quality romantic relationship and friendship outcomes are not a given for many individuals with ASD (Church, Alisanski, & Amanullah, 2000; May, Pang, & Williams, 2017; Petrina, Carter, & Stephenson, 2014). At the same time, those individuals with ASD who do have such intimate relationships are satisfied with them (e.g. Calder, Hill, & Pellicano, 2013; Strunz et al., 2017). It is unclear if adolescents with ASD desire the same things in intimate and social relationships as TD adolescents (Hancock, Stokes, & Mesibov, 2017). Therefore, in Chapter 5 I investigated if adolescents with ASD have different desires in terms of which characteristics they find important in romantic partners and friends than TD adolescents. For nine characteristics (i.e. funny, popular, nice, cool, smart, trustworthy, good-looking, similar interests, and being rich) I investigated if adolescents with ASD desired these to a different level than TD adolescents. Next, using seven of the nine characteristics (i.e. funny, popular, nice, cool, smart, trustworthy, and good-looking), I investigated the match between self-perceived characteristics and what is desired in a partner and friend. Possibly a mismatch between desired characteristics in potential partners/friends and what the adolescent can offer may lead to fewer possible matches (Finke, 2016). My results show that in fact, the desires in terms of which characteristics are sought after mostly, as well as to what level, by adolescents with ASD are very similar to TD adolescents. Furthermore, both adolescents with ASD as well as TD adolescents

desire partners/friends who are congruent (i.e. similar to themselves) in intrinsic characteristics (i.e. trustworthy and funny) while complementing (i.e. dissimilar to themselves) in social status characteristics (i.e. cool and popular).

Methodological considerations

There are some methodological considerations when interpreting the results of part 2. First I will discuss those that are relevant to all three of the chapters included in this part, after which I will discuss the methodological considerations specific to each chapter.

In part 2, I used the newly developed TTI and discussed the initial testing. As this is a new measure, more research should be performed to test the reliability and validity of the TTI. Based on the length of the TTI in combination with the sample size, I was unable to perform (confirmatory) factor analyses to establish the scales. The current scales, based on content and expert opinion, were checked by means of Cronbach's alpha for their internal consistency. The results indicated that most scales met the criteria for internal consistency, however some items did not meet the criteria to remain on the scale, and may therefore better be excluded from the scales. In addition, item-reduction may be valuable to decrease the time necessary to fill out the TTI, which could increase usability in both research and clinical practice. In addition, the results of part 2 reflect the findings in a cognitively able group of adolescents with ASD. The majority of my sample had an IQ within the normal range (scores between 85-115), thus my results may be less applicable to adolescents with ASD who are less cognitively able. Lastly, of the ASD sample, 14% (n=11) was female, which is a small number, both compared to the percentage of girls in the whole ASD population (Lai et al., 2014) as well as to the current TD sample (54%; n=71). Although gender was included in the analyses as a covariate, the results predominantly reflect the psychosexual functioning of males with ASD.
In chapter 3, several differences between adolescents with ASD and TD adolescents were uncovered, however on some comparisons I did not find differences (so called 0-findings). Due to multiple testing, I applied the Bonferroni correction to the results before interpreting them. The Bonferroni correction is rather conservative and causes some loss of power (Narum, 2006). This means that some of the 0-findings may not be actual lack of differences, but rather a lack of power to detect these differences.

Chapter 4 describes the informant discrepancies between parent-child dyads, while also comparing the ASD sample to the TD sample. Although the content of the scales which were compared in the dyads are the same regardless of informant, the scales vary in the number of items included per informant. While I used the mean scores on the scales, it could be valuable to create more alignment between the informants to improve direct comparison.

Lastly, in Chapter 5 I used a matched sample of boys with ASD and TD boys. With this design, I aimed to ensure that the comparison of desired characteristics would be as optimal as possible. Unfortunately, this also meant that I could only use a smaller sample (38 participants per group) than generally used in part 2. Furthermore, no girls were included in chapter 5. The smaller sample as well as the lack of girls means that generalization of my results should be done with caution, and more research is clearly needed. In addition, only a limited amount of characteristics were investigated on a three-point scale. This means that possibly some differences in desired characteristics have not been identified possibly as not all relevant characteristics were included and that perhaps insufficient variance was possible to detect subtle differences between the two samples.

Part 3: Psychosexual training program for adolescents with ASD

Main findings

For many typically developing individuals, parents and peers are a primary information source for learning about psychosexual topics, i.e. through social learning (Bushwick, 2001). Research has shown that this is not the same for adolescents with ASD (Hancock et al., 2017). Many adolescents with ASD receive less, and have less or less accurate psychosexual knowledge compared to their peers (Brown-Lavoie et al., 2014; Hancock et al., 2017; Kellaher, 2015). One explanation may be that adolescents with ASD have less (optimal) social learning possibilities, as they have fewer social interactions (Hancock et al., 2017) and more difficulty with unclear/vague and often implicit instructions in social and sexual situations (Hudson, Nijboer, & Jellema, 2012). Previous research showed that reliable information is often not (sufficiently) available for individuals with ASD (Dewinter et al., 2013; Ginevra, Nota, & Stokes, 2015; Nichols & Blakeley-Smith, 2009). Based on these results, and the findings of part 1 and 2 of this thesis, it seemed that adolescents with ASD could benefit from extra guidance and training regarding their psychosexual functioning (Gougeon, 2010; Hénault, 2006). At the start of my study, to my knowledge there was no evidence-based individual psychosexual training program available serving the particular needs of adolescents with ASD. This resulted in the development of the Tackling Teenage Training (TTT; in Dutch: Ik Puber-training; Boudesteijn, Van der Vegt, Visser, Tick, & Maras, 2011). Before a large scale randomized controlled trial was initiated, I performed a pilot study to systematically evaluate the effects of the TTT program on psychosexual knowledge. As knowledge is a predictor of healthy psychosexual behavior in TD individuals (Ryan, Franzetta, & Manlove, 2007), the main aim of the current systematic evaluation was to investigate whether psychosexual knowledge increased after participation in the TTT program, using a pre- post-training design. My results showed an increase of psychosexual knowledge at the end of the training. Particularly, psychosexual knowledge regarding sexual selfhood (i.e. sexual preference) and sexual behavior (i.e. practical knowledge regarding foreplay) increased; on each at least 40% of the

adolescents improved their knowledge on these specific items. Parents reported a perceived transfer of the knowledge in adapting behavior in everyday life. In terms of which adolescents' knowledge increased the most, I found that particularly the younger adolescents as well as those who their trainer reported to have more difficulty with the training program increased the most in their psychosexual knowledge. This may mean that particularly young adolescents and those who have insufficiently acquired psychosexual knowledge in other ways may benefit the most from a formal program, such as the TTT program.

Methodological considerations

As the study described in Chapter 6 was a pilot study, the limitations associated with pilot studies apply. This means that the sample was relatively small (n=30, and particularly very few girls n=7, were included), there was no control condition to which controls were randomly assigned, and exactly the same version of the psychosexual knowledge test was used before and after the training program. These limitations mean that the results of the pilot study cannot definitively be attributed to the training program, as other factors - like natural social learning and/or maturation - may explain the increase in knowledge over the duration of the training program. However, by now, our results have been corroborated by a randomized controlled trial investigating the Tackling Teenage Training (Visser et al., 2017), which showed the TTT to be an effective program increasing both knowledge and insights.

Overall conclusions

Part 1 and 2 of this thesis showed that ASD traits are specifically linked to psychosexual difficulties, above and beyond other known influences (e.g. pubertal development). In fact, those with psychosexual problems in adolescence showed a slight worsening of autistic traits from childhood to early adolescence. It is important to be mindful that autistic traits are only one of multiple predictors of psychosexual problems; other predictors may be antisocial behavior and low self-esteem (Ueda, 2017). In addition, psychosexual functioning is different for adolescents with ASD compared to TD adolescents. Adolescents with ASD have a less favorable psychosexual functioning, mostly in terms of socialization (interpersonal) and selfhood (intrapersonal) aspects compared to TD adolescents. As for many individuals, interpersonal (socialization) and intrapersonal (selfhood) domains form a healthy basis for overall psychosexual functioning (O'Sullivan, Cheng, Harris, & Brooks-Gunn, 2007), difficulties in these areas may underlie the more noticeable behavioral difficulties. In addition, there are interactions between the various elements of psychosexual functioning (Hancock et al., 2017). Therefore it is important to include all domains of psychosexual functioning when studying this concept.

Despite the differences there are also some key similarities in terms of for example desires. Adolescents with ASD desire intimate relationships (Bauminger & Kasari, 2000; Calder et al., 2013; Hellemans, Roeyers, Leplae, Dewaele, & Deboutte, 2010; Hénault, 2006; Stokes, Newton, & Kaur, 2007), both friendly and romantic, and seek more or less the same characteristics in the other person as TD adolescents. A speculative explanation for the difficulties with developing and maintaining high-quality relationships, despite the similar desires as TD adolescents, may be that individuals with ASD are less acceptant of 'trade-offs', which could stem from their difficulty with mental flexibility. At the same time, some research has found that children with ASD are less convincing and strategic in their self-presentation when seeking personal gains (Begeer et al., 2008). It could thus also be that adolescents with ASD are less strategic and convincing of presenting the 'right' characteristics to a potential partner/friend, making them less desirable for potential partners/friends. To further advance our knowledge on why many adolescents with ASD struggle to engage in and maintain close personal relationships, more research is needed.

In part 2 of this thesis it also became apparent that the results found regarding psychosexual functioning, depend on the informant and his/her perspective. Parent-child dyads of adolescents with ASD differed more than the TD dyads in their reports. This suggests that in ASD dyads it is important to also include the discrepancies when providing treatment or support. Previous studies have found that part of informant discrepancy in parents and adolescents may be caused by a lack of open communication (Ehrlich, Richards, Lejuez, & Cassidy, 2016). Therefore, one explanation may be that limited or unclear communication between the parents and teens with ASD about psychosexual topics, has led to the larger informant discrepancy. In contrast, TD dyads are more similar in their reports, which could suggest that TD dyads are communicating more openly or clearly about psychosexual topics, possibly increasing the higher agreement between their scores. Therefore increasing parent-child communication about psychosexual functioning may be one valuable aim of interventions designed to improve psychosexual functioning (Corona, Fox, Christodulu, & Worlock, 2016). Using multiple informants is prudent to better place previous findings from research as well as to inform clinical practice (e.g. to improve communication between parent-child dyads).

Finally, part 3 showed that psychosexual knowledge of adolescents with ASD can improve with training, a finding substantiated by a more recent randomized controlled trial (Visser et al., 2017). Although the majority of adolescents included in this thesis had no extreme problems, the less optimal functioning in adolescence may escalate over time. A review by Sevlever et al. (2013) indicated that some milder problems (e.g. difficulty with interpreting social cues) may lead to more severe problems (e.g. inability to identify abuse, putting them at risk for victimization). Therefore, providing adequate and appropriate support to adolescents with ASD

may be valuable to not only improve psychosexual functioning in adolescence, but also on the long-term.

Recommendations for future research

Based on the overall conclusions and methodological considerations previously discussed, there are several recommendations for future research worth mentioning.

First, a reliable comprehensive measure in the domain of psychosexual functioning suited for individuals with ASD, as well as other informants, is important. In this study the aim was to develop such a measure. However, it would be valuable to continue testing and adapting the TTI for several reasons. Some of the reasons, as discussed above, are related to the reliability and validity of the inventory. For example, future research could investigate the content of the scales by including larger samples to perform (confirmatory) factor analyses, as well as to investigate possible item-reduction. The currently used inventory is relatively long, which limits the feasibility of the use of the TTI in clinical practice and for research purposes. Although subsections can be used separately, it could be valuable to get more insight into which items load most strongly on the scales (i.e. constructs), and which items could possibly be excluded from the TTI. This could decrease the time necessary to fill out the entire TTI, making it more suitable particularly for clinical use. In addition, it could be valuable to create TTI versions for other informants, for example partners or clinicians. They could possibly shed new light on the psychosexual functioning of individuals with ASD and provide insight from a different perspective than self and parent-report.

Second, the sample for the second and third part of this thesis existed predominantly of males who were cognitively able. Replicating my study within different, more diverse samples (e.g. including more females and/or different cognitive abilities) would be valuable to gain better insight in the interpretations and implications of the current findings.

Third, I would recommend doing more longitudinal research on psychosexual functioning. In this way, more insight could be gained in the psychosexual development (i.e. including learning and maturation processes) of individuals with ASD. This would also give more insight in the bidirectional relationships between (changes in) ASD symptoms and psychosexual functioning, and the possible escalation of mild psychosexual problems in adolescence into young adulthood. Also, it would allow us to better understand the need and value of providing extra support and training on the topic of psychosexuality to children, adolescents and even adults with ASD.

Fourth, it could be valuable to investigate parent-child communication on the topic of psychosexual functioning more. My results show that there are informant discrepancies more so for adolescents with ASD and their parents, than TD dyads. Part of the discrepancy may be the result of insufficiently open communication (Ehrlich et al., 2016). In addition, some research suggests that parent-child communication may reduce risk behavior in TD adolescents (Widman, Choukas-Bradley, Noar, Nesi, & Garrett, 2016). Therefore, more knowledge about if, when, how, and what is discussed with adolescents with ASD by their parents or caregivers regarding psychosexual functioning, may lead to more insight into the effects of the communication on psychosexual functioning in adolescents of ASD.

Last, much research has investigated psychosexual functioning in ASD as a group, despite the fact that ASD is a heterogeneous disorder. With more knowledge and insights, it would be interesting to see if specific characteristics of ASD are related to specific difficulties in psychosexual functioning. Such insights could provide information for more targeted clinical or parental support on psychosexual well-being.

Clinical and policy suggestions

Several implications and suggestions follow from the current thesis, although some are more achievable than others.

First and foremost, I think it is important for anyone who interacts with adolescents with ASD to realize that regardless of the severity of their ASD, there is an interest in psychosexuality in the majority of individuals with ASD (Fernandes et al., 2016). This has been underlined by both previous studies as well as the current thesis. Therefore, I would suggest that psychosexuality should be (at least) part of the general assessment with individuals with ASD, and preferably also included during the treatment phase. Currently, it depends on the adults involved (i.e. parents, caregivers, and teachers) to provide information where they think this is necessary. Unfortunately, they all report experiencing difficulties in discussing such intimate topics (Holmes, Himle, & Strassberg, 2015; Nichols & Blakeley-Smith, 2009), for example, difficulty with prioritizing what should be discussed, fear of misunderstanding by the individual with ASD of the given information, or lack of accurate information. Or the communication is limited, for example to safety issues, both in terms of what the child could do to others as well as possible victimization and personal hygiene (Nichols & Blakeley-Smith, 2009). By creating a more open atmosphere, by for example incorporating psychosexual functioning as a more standard element of assessment, the individual with ASD as well as their caregivers may feel that psychosexuality is a topic which can be openly discussed, thus lowering the barriers on both sides to do so.

Second, several studies, including this thesis, have shown that individuals with ASD run into more difficulties than their TD peers in terms of psychosexual functioning. Both more extreme forms, such as sexual misconduct (e.g. stalking), as well as more mild difficulties (e.g. lower self-esteem; less social acceptance), have been found. It is important to mention that not all adolescents with ASD develop psychosexual problems; the research to date merely shows that this population is at-risk. If the psychosexual problems and possible indicators of these problems are assessed in time, support - for example a specific psychosexual training for individuals with ASD - may be provided more timely to prevent problems as well as the escalation of these problems. As evidence for the benefits of the Tackling Teenage Training (Boudesteijn et al., 2011) is vastly growing (Dekker et al., 2014; Escalona et al., 2016; Visser et al., 2017, O Healy et al. personal communication, Pederson et al. personal communication), this training seems to be a suitable method. A psychosexual training, like the TTT, which explicitly teaches many of the generally subtle and sometimes even unwritten rules of psychosexual interaction, could increase the likelihood of a healthy psychosexual development and potentially minimize or even prevent the risk of developing problems and their possible escalation.

Third, although introspection and self-report may be more difficult with individuals with ASD, including them when acquiring information on their own functioning is crucial. Regardless of the discussion on whether it is 'valid' or 'reliable' information, by including self-report, better insight in the personal experience of someone's own functioning is gained. To obtain an as balanced, complete and thus 'truthful' picture *as possible*, it remains prudent to include multiple informants, especially when investigating psychosexual functioning in which many elements are personal but also integrated in the interaction between people. Discrepancies in reports can be meaningful by themselves; when an adolescent and parent give very different reports on particular topics, this might be useful to discuss, so that they learn about each other's perspectives (De Los Reyes & Kazdin, 2005). Such a discussion on differences in perspectives can also be helpful in deciding on – and prioritizing – training goals, making sure that all involved are heading in a similar direction.

To conclude, psychosexual functioning is without a doubt a topic relevant for individuals with ASD. It seems that particularly this group runs into difficulties in their psychosexual functioning during adolescence and support is needed to help them through the difficulties. As the research interest and publications related to this interest are steadily growing, the increased insights also allow us to better assist and support individuals with ASD in their needs and wishes regarding psychosexual functioning.

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Summary

During adolescence, one important development is psychosexual functioning, which can be divided into three domains: sexual selfhood (i.e. intrapersonal functioning, such as self-esteem, self-perceived competence, and knowledge), sexual socialization (i.e. interpersonal functioning, such as interaction with peers, family, and media), and sexual/intimate behavior. Autism Spectrum Disorder (ASD) symptoms may make psychosexual functioning particularly challenging, as individuals with ASD often have difficulties in social communication and display restricted, repetitive behavior and interests. This affects important skills necessary for optimal psychosexual functioning, such as social skills, social ´know-how´, and being able to adapt to changes. Research into psychosexual functioning in adolescents with ASD has remained scarce, especially in cognitively able individuals with ASD and it is rarely directly compared to that of typically developing (TD) individuals. In fact, primarily atypical or problematic aspects of psychosexual functioning have been studied and particularly sexual behavior. This instead of the positive elements, or how psychosexual functioning of adolescents with ASD differs from TD adolescents. In addition, self-reports have been used only limitedly. One potential reason for the paucity of research into psychosexual functioning in cognitively able adolescents with ASD may be the lack of a comprehensive multi-informant measure. In order to contribute to the understanding of psychosexual functioning in cognitively able adolescents with ASD, the aims of the current thesis were: to investigate if ASD is related to difficulties in psychosexual functioning (chapter 2), and if psychosexual functioning is different in adolescents with ASD compared to TD adolescents (chapters 3, 4 and 5). Additionally, we aimed to study the effects of a training program on psychosexual knowledge (chapter 6). More background information regarding psychosexual functioning in adolescence, particularly in adolescents with ASD, is provided in **chapter 1**.

Chapter 2 describes the longitudinal relation between childhood autistic traits (T1; age 10-12) and psychosexual problems in early adolescence as reported by parents (T2; age 12-15) in a sample of a general population cohort study (*n* = 1873; the Tracking Adolescents' Individual Lives Survey (TRAILS)). This study showed that higher levels of autistic traits in childhood significantly predicted mild psychosexual problems in adolescence, above and beyond pubertal development and conduct problems. The results indicated that children with autistic traits, - especially those with limited social interest and social regulation problems -, are at a higher risk to have psychosexual problems in early adolescence. Although this shows a direct longitudinal relationship between autistic traits and psychosexual problems, it is only one of multiple predictors.

The second aim, comparing the psychosexual functioning of cognitively able adolescents with ASD to that of TD adolescents, was investigated in chapters 3, 4 and 5. In **chapter 3** the development and testing of a new comprehensive inventory of psychosexual functioning in both parent- and self-reports (Teen Transition Inventory; TTI) is described. This new instrument covers all three domains of psychosexual functioning (i.e. psychosexual socialization, psychosexual selfhood, and sexual/intimate behavior). The initial testing of the TTI is done with a group of adolescents with ASD (*n*=79 parent-report; *n*=58 self-report) compared to a group of TD adolescents (*n*=131 parent-report; *n*=91 self-report). Results indicate that the three domains of psychosexual functioning significantly correlate with each other. As psychosexual difficulties may escalate over time, it is important to assess difficulties in all domains of psychosexual functioning early on. This allows for possible guidance, not only to decrease difficulties, but possibly also to prevent escalation of problems. Results from both informants (parent and self-report) indicate more difficulties regarding psychosexual socialization and psychosexual selfhood in the ASD group when compared to the TD group. However, in terms of sexual behavior, only parents report problems. Due to the private nature of psychosexuality, different informants have different perspectives, but it is valuable to know if this discrepancy is different for adolescents with ASD and their parents compared to TD dyads.

The discrepancy was further investigated in **chapter 4**, in which informant discrepancies were studied within a larger sample (136 parent-child ASD dyads and 70 parent-child TD dyads). Often self-reports are not used in ASD samples, due to doubts about the validity and reliability of self-report in such samples. This has resulted in limited knowledge about their own perspective, especially in comparison to other informants (e.g. parents). Chapter 4 describes the direct comparison of informant discrepancies both within and between an ASD and TD group. Although in both groups informant discrepancies existed, the discrepancy was significantly larger in the ASD dyads in almost all domains of psychosexual functioning. As discrepancies may reflect anything ranging from slight differences in perception or opinion, to a lack of knowledge or insight regarding the topic on which is reported, discrepancies are relevant for both research and clinical practice into psychosexual functioning. To include the unique perspective of each informant regarding the symptoms, problems, feelings and functioning of the adolescent, it is important to include multiple informants when studying psychosexual functioning. With limited use of self-report in adolescents with ASD compared to TD adolescents, little is known about their desires in terms what they seek in a partner or friend.

In **chapter 5** of this thesis, while comparing the groups, these desires for a partner and friend in relation to self-perception (i.e. how an adolescent perceives him-/herself) were investigated in more detail by comparing 38 adolescents with ASD to matched sample of TD adolescents. The results show that for the ASD and TD

group the top three of most desired characteristics, as well as the extent to which they are desired, are the same for partners as well as friends. Regardless of the group, the top three desired characteristics are: 1. trustworthiness, 2. being nice, and 3. being funny. When comparing the desired characteristics to self-perceived characteristics (i.e. how an adolescents regards oneself) it was found that both groups desire a partner and friend who is similar to how they see themselves in terms of intrinsic characteristics (e.g. trustworthiness), but dissimilar on social status characteristics (less cool and popular than they rate themselves). Our results suggest that adolescents with ASD have a larger discrepancy between self-perceived and desired characteristics in a partner of a friend than TD adolescents. More research is required to investigate why adolescents with ASD often struggle to develop and maintain high-quality relationships despite the similar desires, as there are several potential explanations. Possibly, adolescents with ASD may be less accepting of 'trade-offs' due to difficulties with mental flexibility. Another reason may be that adolescents with ASD are less optimal in self-presentation and may therefore struggle to convince others of their value as a potential good friend or partner, and thus to develop long-lasting friendships.

To sum up chapters 3, 4 and 5, our results indicate that psychosexual functioning is different, often in a negative sense, for adolescents with ASD compared to TD adolescents, although it does seem to partially depend on the informant. This shows that for adolescents with ASD it is important to use multiple informants when studying psychosexual functioning. At the same time, there are also important similarities between adolescents with ASD and TD adolescents, indicating that psychosexual functioning is relevant for adolescents with ASD. This underlines the importance of including psychosexual functioning when investigating overall functioning, both in research as well as in clinical practice. However, the results must be interpreted carefully, as the TTI is newly developed, and thus more rigorous investigation is warranted to assess the quality of the instrument, as well as to adapt the inventory.

Based on the results of chapters 2 to 5, as well as previous studies, it seems adolescents with ASD could benefit from more support in their psychosexual functioning. For many TD adolescents, peers and parents are a primary source of information (i.e. informal education) on psychosexual knowledge. However, many adolescents with ASD have less, or less accurate, psychosexual knowledge. This can partially be explained due to less access to such informal sources due to their difficulties with social interactions, and the vague and often implicit elements of psychosexual situations. Therefore, as a third aim of this thesis, in **chapter 6** we systematically evaluated the effect of a specialized individual training program, the Tackling Teenage Training (TTT) program, on psychosexual knowledge. In this pilot study, 30 adolescents with ASD were evaluated pre-training and post-training on their psychosexual knowledge. After completing the TTT program psychosexual

knowledge had significantly increased. Although this is a positive result, as there was no control condition, it cannot be fully attributed to the TTT program.

However, in the meanwhile, a larger scale randomized controlled trial has substantiated that the TTT program significantly improves psychosexual knowledge. As psychosexual difficulties may escalate over time, it can be valuable to offer the TTT program to adolescents with ASD, even if they do not have extreme difficulties at the time, to improve current functioning and prevent possible future problems.

Chapter 7 offers the general discussion in which the main findings, methodological considerations, recommendations for future research and the possible clinical and policy implications are discussed. The results of the current thesis show that ASD is uniquely related to psychosexual functioning. Although there are similarities with TD adolescents, adolescents with ASD have a less optimal psychosexual functioning and providing the TTT program may improve their current functioning, at least their psychosexual knowledge. In addition, regardless of the reason of data gathering, whether it is for research or clinical purposes, it is prudent to include multiple informants. Every informant offers a unique and valuable perspective, and discrepancies may indicate a lack of insight by one or more informants, but may also imply a lack of communication between the informants. Minimizing such discrepancies may be a goal in itself in clinical care, for example by means of increasing communication between parent and child, and increasing the awareness that psychosexuality is a normative part of development, - also for adolescents with ASD -, which is worth discussing. It would be valuable to investigate current parent-child communication, i.e., if, what and how psychosexuality is discussed, to further tailor support in this area. To get reliable information about psychosexual functioning in a population with ASD, a comprehensive measure suited for multiple informants such as the TTI is important. However, the TTI can benefit from continued research, to test the reliability and validity, reduce the length of the instrument and possibly the development of other-informant versions (e.g. partner). Also, the current thesis predominantly studied cognitively able males, investigating psychosexual functioning in other samples can place the current findings, and thus the implications, in a larger context and allow for generalization. A final suggestion is to investigate if specific ASD characteristics are related to specific difficulties in psychosexual functioning. With a disorder that is as heterogeneous as ASD, it could be valuable to get more specific personalized information to better target support that is provided.

In terms of clinical and policy suggestions, our findings stress the relevance of psychosexual functioning in adolescents with ASD. Therefore, psychosexual functioning should be included in the clinical assessment of individuals with ASD, preferably using multiple informants, and if possible also included during treatment. Even if self-report may be more complex due to worries about reliability,

including their own perspective on a topic as personal as psychosexual functioning is imperative. As individuals with ASD have less optimal psychosexual functioning compared to TD peers, and this puts them at risk for continued and possibly increasing difficulties, it is important to provide support where possible to improve current functioning and prevent escalation. One method to provide support is the TTT, as many elements of psychosexual functioning are discussed and taught in a structured and explicit manner.

Samenvatting

Psychoseksueel functioneren is een belangrijke ontwikkeling tijdens de adolescentie, wat onderverdeeld kan worden in drie domeinen: seksuele eigenheid (i.e. intrapersoonlijk functioneren, bijvoorbeeld zelfvertrouwen, zelf ingeschatte competentie, en kennis), seksuele socialisatie (i.e. interpersoonlijk functioneren, zoals de interactie met leeftijdsgenoten, familie en de media) en seksueel of intiem gedrag. Autisme spectrum stoornis (ASS) symptomen kunnen optimaal psychoseksueel functioneren een uitdaging maken, omdat mensen met ASS vaak problemen hebben met sociale communicatie en beperkte en/of repetitieve gedragingen en interesses laten zien. Dit heeft een effect op belangrijke vaardigheden die nodig zijn voor optimaal psychoseksueel functioneren, zoals bijvoorbeeld sociale vaardigheden, sociale 'know-how' en aanpassen aan veranderingen. Onderzoek naar psychoseksueel functioneren bij jongeren met ASS is erg beperkt gebleven, vooral onder cognitief vaardige jongeren met ASS, en zelden wordt er een directe vergelijking gemaakt met typisch ontwikkelende (TO) jongeren. Sterker nog, vooral de atypische en problematische aspecten van psychoseksueel functioneren, en dan voornamelijk seksueel gedrag zijn onderzocht. Dit in plaats van de positieve elementen of hoe het psychoseksueel functioneren van adolescenten met ASS verschilt van TO-jongeren. Daarnaast wordt zelf-rapportage maar beperkt gebruikt. Een mogelijke reden voor de schaarsheid aan onderzoek naar psychoseksueel functioneren van cognitief vaardige jongeren met ASS kan zijn het gebrek aan een alomvattend instrument geschikt voor verschillende informanten. Om bij te dragen aan kennis over psychoseksueel functioneren bij cognitief vaardige jongeren met ASS zijn de volgende zaken onderzocht in de huidige thesis: of ASS gerelateerd is aan moeilijkheden in psychoseksueel functioneren (hoofdstuk 2) en of psychoseksueel functioneren anders is bij adolescenten met ASS in vergelijking met TO-jongeren (hoofdstukken 3, 4 en 5). Aanvullend is onderzocht wat de effecten zijn van een trainingsprogramma op de psychoseksuele kennis (hoofdstuk 6). Meer achtergrondinformatie over psychoseksueel functioneren, in het bijzonder bij jongere met ASS is beschikbaar in **hoofdstuk 1**.

Hoofdstuk 2 beschrijft de longitudinale relatie tussen autistische kenmerken in de kindertijd (T1; 10-12 jaar) en door de ouders gerapporteerde psychoseksuele problemen in de vroege pubertijd (T2; 12-15 jaar) in een geselecteerde groep uit een algemene bevolkingsstudie (n = 1873; de Tracking Adolescents' Individual Lives Survey (TRAILS)). Deze studie liet zien dat hogere niveaus van autistische kenmerken in de kindertijd significant voorspellend zijn voor milde seksuele problemen in de adolescentie, zelfs als er rekening wordt gehouden met lichamelijke ontwikkeling en gedragsproblemen. De resultaten lieten zien dat kinderen met autistische kenmerken – vooral diegene met beperkte sociale interesse en sociale regulatie problemen – een verhoogd risico hebben op psychoseksuele problemen in de vroege adolescentie. Hoewel dit een direct longitudinale relatie tussen autistische

kenmerken en psychoseksuele problemen bewijst, is het slechts één van meerdere voorspellers voor psychoseksuele problematiek.

Het tweede doel, het vergelijken van psychoseksueel functioneren van cognitief vaardige adolescenten met ASS ten opzichte van TO-adolescenten, is onderzocht in hoofdstukken 3, 4 en 5. In **hoofdstuk 3** wordt de ontwikkeling en het testen van een nieuwe alomvattende vragenlijst over psychoseksueel functioneren voor zowel ouder- als zelf-rapportages (Teen Transition Inventory; TTI) beschreven. Dit nieuwe instrument omvat alle drie domeinen van psychoseksueel functioneren (i.e. psychoseksuele socialisatie, psychoseksuele eigenheid en seksueel/intiem gedrag). De eerste test van de TTI is gedaan met een groep adolescenten met ASS (*n*=79 ouderrapportage; *n*=58 zelfrapportage) in vergelijking met een groep TO-adolescenten (*n*=131 ouderrapportage; *n*=91 zelfrapportage). De resultaten wijzen uit dat de drie domeinen van psychoseksueel functioneren significant correleren met elkaar. Dit kan een indicatie zijn dat problemen in één van de domeinen, onderliggend zijn aan problemen in een ander domein. Aangezien psychoseksuele problemen kunnen escaleren over de tijd, is het belangrijk om moeilijkheden in alle drie de domeinen van psychoseksueel functioneren in een vroeg stadium te evalueren. Dit geeft de mogelijkheid tot begeleiding, niet alleen om problemen te verminderen, maar ook om mogelijke escalatie te voorkomen. Ook tonen de resultaten op basis van beide informanten (ouder- en zelf-rapportage) aan dat in de groep met ASS er meer moeilijkheden zijn op het gebied van psychoseksuele socialisatie en psychoseksuele eigenheid dan in de TO-groep. Maar op het gebied van seksueel/intiem gedrag rapporteren enkel de ouders problemen. Door het privé karakter van psychoseksualiteit hebben verschillende informanten ook verschillende perspectieven. Het is waardevol om te weten of deze discrepantie anders is voor jongeren met ASS en hun ouders in vergelijking met TO-dyades.

De discrepantie is verder onderzocht in **hoofdstuk 4**, waarin informant-discrepantie onderzocht is in een grotere groep (136 ouder-kind ASS-dyades en 70 ouder-kind TO-dyades). Zelfrapportage wordt vaak niet gebruikt in ASS-groepen, omdat er getwijfeld wordt aan de validiteit en betrouwbaarheid van zelfrapportage in deze groep. Dit heeft geresulteerd in beperkte kennis van het eigen perspectief, vooral in vergelijking met het perspectief van andere informanten (bijvoorbeeld ouders). In hoofdstuk 4 wordt de directe vergelijking van informant-discrepanties zowel binnen als tussen een ASS-groep en TO-groep besproken. Hoewel in beide groepen informant-discrepanties voorkwamen, was de discrepantie in de ASS-dyades significant groter in bijna alle domeinen van psychoseksueel functioneren. Aangezien discrepanties tekenen kunnen zijn van kleine verschillen in perceptie of meningen, maar ook een gebrek aan kennis of inzicht in het onderwerp waarover gerapporteerd wordt, zijn discrepanties omtrent psychoseksueel functioneren relevant voor zowel onderzoek als in de klinische praktijk. Het is daarom belangrijk om meerdere informanten te includeren wanneer psychoseksueel functioneren

wordt onderzocht, zodat het unieke perspectief omtrent symptomen, problemen, gevoelens en het functioneren van het kind van iedere informant geïncludeerd is. Door het beperkte gebruik van zelfrapportage in adolescenten met ASS in vergelijking met TO-jongeren, is er weinig bekend over wat voor eigenschappen zij wensen in een partner of een vriend.

In **hoofdstuk 5** van deze thesis worden de verschillen tussen de groepen omtrent de wensen voor een partner en vriend in relatie tot zelf-perceptie verder onderzocht door 38 adolescenten met ASS te vergelijken met een '*matched*' groep van TO-adolescenten. De resultaten laten zien dat voor zowel de ASS-groep als de TO-groep de top drie van meest begeerde karakteristieken, maar ook het niveau van in hoeverre deze gewenst zijn, voor zowel partners als vrienden hetzelfde is. De top drie gewenste karakteristieken zijn betrouwbaarheid, aardig zijn en grappig zijn, ongeacht de groep. Wanneer de gewenste karakteristieken worden vergeleken met zelf-waargenomen karakteristieken, blijkt dat beide groepen een partner en vriend wensen die vergelijkbaar is met henzelf op het gebied van intrinsieke karakteristieken (e.g. betrouwbaarheid), maar verschillend op het gebied van sociale status karakteristieken (minder cool en populair dan zijzelf). Onze resultaten suggereren dat adolescenten met ASS een grotere discrepantie hebben tussen zelf-waargenomen en gewenste karakteristieken. Meer onderzoek is nodig om te onderzoeken waarom adolescenten met ASS moeite hebben met het ontwikkelen en onderhouden van goede kwaliteit relaties, ondanks de gelijke wensen, aangezien er meerdere mogelijke verklaringen zijn. Mogelijk accepteren adolescenten met ASS minder snel '*trade-offs*' (oftewel compromissen) door problemen met mentale flexibiliteit. Een andere verklaring kan zijn dat adolescenten met ASS zichzelf minder optimaal kunnen presenteren, en dat ze daardoor meer moeite hebben om anderen te overtuigen van hun waarde als potentiële goede vriend of partner.

Samengenomen duiden de resultaten uit hoofdstukken 3,4 en 5 erop dat psychoseksueel functioneren anders is – vaak in de negatieve zin – voor jongeren met ASS in vergelijking met TO-adolescenten, alhoewel dit gedeeltelijk af lijkt te hangen van de informant. Dit laat zien dat het ook voor jongeren met ASS belangrijk is om meerdere informanten te gebruiken wanneer psychoseksueel functioneren wordt bestudeerd. Tegelijkertijd zijn er ook belangrijke overeenkomsten tussen adolescenten met ASS en TO-adolescenten, wat aangeeft dat psychoseksueel functioneren een relevant onderwerp is voor adolescenten met ASS. Dit onderstreept het belang van het meenemen van psychoseksueel functioneren bij het inventariseren van algeheel functioneren, zowel in wetenschappelijk onderzoek als in de klinische praktijk. De resultaten moeten wel voorzichtig geïnterpreteerd worden, aangezien de TTI een nieuw ontwikkeld instrument is, en meer rigoureuze toetsing is nodig om de kwaliteit van het instrument te testen en aan te passen.

Gebaseerd op hoofdstukken 2 tot en met 5, alsmede eerdere studies, lijkt het erop dat jongeren met ASS baat kunnen hebben bij meer ondersteuning in hun psychoseksueel functioneren. Voor veel TO-adolescenten zijn leeftijdsgenoten en ouders de primaire bron van informatie voor psychoseksuele kennis. Helaas hebben veel jongeren met ASS minder, of minder accurate, psychoseksuele kennis. Dit kan deels worden verklaard door beperkte toegang tot zulke informele bronnen vanwege hun moeilijkheden met sociale interacties, maar ook de vage en vaak impliciete elementen van psychoseksuele situaties. Daarom, als derde doel van deze thesis, heb ik in **hoofdstuk 6** een systematische evaluatie gedaan van het effect van een gespecialiseerd individueel trainingsprogramma, de Ik Puber-training (in het Engels: Tackling Teenage Training) op psychoseksuele kennis. In dit pilot-onderzoek werden 30 jongeren met ASS pre-training en post-training getoetst op hun psychoseksuele kennis. Na het volgen van de Ik Puber-training was psychoseksuele kennis significant toegenomen. Hoewel dit een positief resultaat is, was er geen controle conditie, daarom kan het resultaat niet volledig toegeschreven worden aan de Ik Puber-training. Maar, een grootschalige *randomized controlled trial* heeft de bevinding dat de Ik Puber-training psychoseksuele kennis significant verbetert gestaafd. Aangezien psychoseksuele moeilijkheden kunnen escaleren over de tijd is het waardevol om de Ik Puber-training aan te bieden aan jongeren met ASS. Zelfs wanneer er geen extreme problemen zijn, kan een dergelijke training huidig functioneren verbeteren en kunnen mogelijke toekomstige problemen worden voorkomen.

Hoofdstuk 7 biedt een algemene discussie van de belangrijkste bevindingen en methodologische zaken om rekening mee te houden, maar worden ook aanbevelingen voor toekomstig onderzoek en mogelijke klinische en beleids-implicaties besproken. De resultaten van de huidige thesis laten zien dat ASS een unieke samenhang heeft met psychoseksueel functioneren. Hoewel er overeenkomsten zijn met TO-adolescenten, functioneren jongeren met ASS minder optimaal op het gebied van psychoseksualiteit en kan het aanbieden van de Ik Puber-training mogelijk hun huidig functioneren – ten minste hun psychoseksuele kennis – verbeteren. Ongeacht de reden voor data verzameling, voor wetenschappelijk onderzoek of voor klinische doeleinden, is het verstandig om meerdere informanten te gebruiken. Immers, iedere informant biedt een uniek en waardevol perspectief. Bovendien kunnen de discrepanties een gebrek aan inzicht van één of meerdere informanten zijn, maar kunnen ook een gebrek aan communicatie tussen de informanten aanduiden. Het minimaliseren van zulke discrepanties kan een doel op zichzelf zijn binnen de klinische zorg, bijvoorbeeld door communicatie tussen ouder en kind te verhogen. Daarnaast kan door het bespreekbaar te maken het besef dat ook voor jongeren met ASS psychoseksualiteit een normatief onderdeel van ontwikkeling is verhoogd worden. Het zou waardevol zijn om te onderzoeken hoe de huidige ouder-kind communicatie eruit ziet, bijvoorbeeld wordt het besproken, welke onderwerpen komen aan bod en hoe wordt psychoseksualiteit besproken, zodat begeleiding hierop beter kan aansluiten.

Om betrouwbare informatie te krijgen over psychoseksueel functioneren in een populatie met ASS is een alomvattend instrument dat geschikt is voor meerdere informanten, zoals de TTI, belangrijk. Maar de TTI heeft baat bij meer onderzoek, om zo de betrouwbaarheid en validiteit verder te onderzoeken, het instrument in te korten en mogelijk verder te ontwikkelen in versies voor andere informanten (zoals de partner). Ook zijn in de huidige thesis vooral cognitief vaardige jongens met ASS onderzocht. Het onderzoeken van psychoseksualiteit in andere populaties kan de huidige bevindingen en dus ook de implicaties, beter in een grotere context plaatsen. Een laatste suggestie is om te onderzoeken of specifieke ASS kenmerken gerelateerd zijn aan specifieke problemen op het gebied van psychoseksualiteit. Bij een heterogene stoornis zoals ASS, kan het waardevol zijn om meer specifieke informatie te krijgen om ook ondersteuning doeltreffender te maken.

Voor wat betreft klinische en beleidssuggesties, onderstrepen mijn bevindingen de relevantie van psychoseksueel functioneren in jongeren met ASS. Daarom zou psychoseksueel functioneren ook betrokken moeten worden bij de klinische assessment van mensen met ASS, bij voorkeur met meerdere informanten en waar mogelijk ook tijdens de behandelfase. Zelfs al is zelfrapportage complexer te interpreteren vanwege zorgen over betrouwbaarheid, dan nog is het betrekken van hun eigen perspectief op een onderwerp zo persoonlijk als psychoseksueel functioneren belangrijk. Aangezien mensen met ASS minder optimaal functioneren op psychoseksueel gebied dan TO-leeftijdsgenoten, lopen ze een groter risico op het voortduren en mogelijk escaleren van de problemen en is het belangrijk om ondersteuning te bieden waar mogelijk om huidig functioneren te verbeteren en mogelijke escalatie te voorkomen. Een manier om deze ondersteuning te bieden is de Ik Puber-training, waarin veel elementen van psychoseksueel functioneren op een gestructureerde en expliciete manier worden besproken en onderwezen.

Curriculum Vitae

Linda Dekker was born April 23rd, 1986 in Haarlem, the Netherlands. After receiving her secondary school diploma (Voorbereidend Wetenschappelijk Onderwijs) at the Kaj Munk College in Hoofddorp, she continued her studies at the University College Roosevelt (UCR; at the time Roosevelt Academy) in Middelburg, the Netherlands. In 2008 she graduated Cum Laude from UCR with a Bachelor of Arts in Liberal Arts and Sciences. She then went on to study at Leiden University, where she completed the Master Child and Adolescent Psychology in 2010. During her Master's program she did a clinical internship at Yulius (at the time RMPI) and wrote her Master thesis at the Department of Child and Adolescent Psychiatry/Psychology at the Erasmus MC Sophia Children's hospital. During the final stages of her Master, Linda helped to acquire funding from the Sophia Foundation for Scientific Research for the Tackling Teenage project. After completing her master, she officially started with her PhD research on the Tackling Teenage project in September 2010 at the Department of Child and Adolescent Psychiatry/Psychology at the Erasmus MC Sophia Children's hospital, under the supervision of prof. dr. F.C. Verhulst and dr. K. Greaves-Lord, which resulted in the work described in this thesis. The Tackling Teenage project is a collaborative project of the Erasmus MC Sophia Children's hospital and Yulius. The project was partially funded by the Sophia Foundation for Scientific Research (SSWO; Grant 617, 2010), as well as Yulius and through kind contributions from the work package 'Relations' of the Academic Workplace Autism Joint Effort!. Linda was largely responsible for the coordination of the study, the development of the Teen Transition Inventory, data collection, data management and analyses. In addition, she extensively studied psychosexual development of adolescents with autism spectrum disorder, and has given several lectures and workshops discussing this theme. She also helped in training several professionals to use the Tackling Teenage Training to assist adolescents with ASD in their psychosexual development. In January 2014 Linda started working as a lecturer at the Erasmus University Rotterdam at the Department of Clinical Psychology, where she teaches several courses, such as Developmental Psychology and Cognitive Behavioral Therapy, as well as supervises clinical internships and master' theses.

List of publications

Dekker, L. P., van der Vegt, E. J., van der Ende, J., Tick, N., Louwerse, A., Maras, A., Verhulst, F.C. & Greaves-Lord, K. (2017). Psychosexual functioning of cognitively-able adolescents with autism spectrum disorder compared to typically developing peers: The development and testing of the teen transition inventory-a self-and parent report questionnaire on psychosexual functioning. *Journal of autism and developmental disorders*, *47*(6), 1716-1738.

Dekker, L. P., Hartman, C. A., van der Vegt, E. J., Verhulst, F. C., van Oort, F. V., & Greaves-Lord, K. (2015). The longitudinal relation between childhood autistic traits and psychosexual problems in early adolescence: The Tracking Adolescents' Individual Lives Survey study. *Autism*, *19*(6), 684-693.

Dekker, L. P., van der Vegt, E. J., Visser, K., Tick, N., Boudesteijn, F., Verhulst, F. C., ... & Greaves-Lord, K. (2015). Improving psychosexual knowledge in adolescents with autism spectrum disorder: pilot of the tackling teenage training program. *Journal of autism and developmental disorders*, *45*(6), 1532-1540.

Louwerse, A., Eussen, M. L. J. M., Van der Ende, J., de Nijs, P. F. A., Van Gool, A. R., **Dekker, L. P.**, Verheij, C., Verheij, F., Verhulst, F.C. & Greaves-Lord, K.. (2015). ASD symptom severity in adolescence of individuals diagnosed with PDD-NOS in childhood: Stability and the relation with psychiatric comorbidity and societal participation. *Journal of autism and developmental disorders*, *45*(12), 3908-3918.

Visser, K., Greaves-Lord, K., **Dekker, L.P.**, Boudesteijn, F., Maras, A., & van der Vegt, E.J.M. (2014). De psychoseksuele begeleiding van jongeren met een autismespectrumstoornis: Toepassing van de Ik Puber-training. *Wetenschappelijk Tijdschrift Autisme, 13(4),* 132-137.

Visser, K., Greaves-Lord, K., **Dekker, L.P.,** Boudesteijn, F., Maras, A., & van der Vegt, E.J.M. (2012). "Ik Puber" Een onderzoek naar de effectiviteit van de Ik Puber-training. *Wetenschappelijk Tijdschrift Autisme, 11(2),* 64-67.

PhD Portfolio

Summary of PhD training and teaching

Name PhD student: Linda Dekker
Erasmus MC Department: KJPP

PhD period: September 2010 – September 2013
Promotor(s): Prof. Dr. Frank Verhulst
Supervisor: Dr. Kirstin Greaves-Lord

1. PhD training

	Year	Workload (ECTS)
General courses		
- Ik Puber Train-the-trainer	2011	1
- Biomedical English Writing and Communication	2011-2012	4
- BROK ('Basiscursus Regelgeving Klinisch Onderzoek'	2012	1
- Courses for the Quantitative researcher	2012	1.4
- Repeated measures	2012	1.4
Specific courses (e.g. Research school, Medical Training)		
- Autism Diagnostic Interview training (parent interview) including exam	2010/2011	1.5
- Autism Diagnostic Observation Schedule training module 3&4, (child observation) including exam, Accare, Assen, NL	2010/2011	1.5
- Repeated measurements in Clinical Studies	2012	1.4
- Multivariate data analyses – Leuven, Belgium	2012	1
Seminars and workshops		
- Standardized Assessment of Child Psychopathology: New Developments – Rotterdam	2011	0.5
- Workshop 'Negotiations' organized by VENA, Rotterdam	2013	0.1
- Mini symposium 'Methodology of studies involving patients and preparation for fund acquisition', Erasmus MC, Rotterdam, Nl	2013	0.5
- Workshop Systematic Literature Retrieval in PubMed Medical Library, Erasmus MC, Rotterdam, Nl	2013	1
Presentations		
- Poster presentation at IMFAR – Toronto, Canada (Psychosexual problems in individuals with ASD: prevalence, predictors and developmental course)	2012	1
- Poster presentation at IMFAR – Toronto, Canada (The outcomes of an individual training program targeting the psychosexual development adolescents with ASD; the Tackling Teenage Training)	2012	1
- Poster presentation at Nationaal Autisme Congres – Rotterdam, The Netherlands (Puberty and the psycho-sexual development of adolescents: comparison of adolescents with and without Autism Spectrum Disorders (ASD) in the Netherlands)	2013	1

- Poster presentation at Nationaal Autisme Congres – Rotterdam, The Netherlands (A psycho-sexual training for adolescents with autism spectrum disorders (ASD); preliminary outcomes of the Tackling Teenage training)	2013	1
- Oral presentation at International conference 'From adolescence to adulthood normality and psychopathology' – Cyprus, Greece	2010	1
- Oral presentation at Nederlandse Vereniging voor Psychiatrie (NVvP)	2011	1
- Wetenschapsmartk Yulius – oral presentation	2010	1
- Wetenschapsmartk Yulius – oral presentation	2011	1
- Wetenschapsmartk Yulius – oral presentation	2012	1
(Inter)national conferences		
- International conference 'From adolescence to adulthood normality and psychopathology' – Cyprus, Greece	2010	1
- Nationaal Autisme congres - Rotterdam, the Netherlands	2010	0.3
- Nationaal Autisme congres – Rotterdam, the Netherlands	2011	0.3
- Nationaal Autisme congres – Rotterdam, the Netherlands	2012	0.3
- Congres Amsterdamse School – Seksualiteit – Seks in beeld – Amsterdam, the Netherlands	2012	1
- IMFAR – Toronto, Canada	2012	2
- Jeugd op Drift congres - Utrecht, the Netherlands	2012	1
Other		
- Colloquia at the Erasmus MC, Rotterdam, the Netherlands	2010-2013	1
- Research Work Meetings at the department of child and adolescent psychiatry/psychology, Erasmus MC, Rotterdam, Nl	2010-2013	1
2. Teaching		
Lecturing		
- Skills education (Vaardigheden onderwijs), Medical faculty Erasmus MC – Observation & diagnostic skills	2012	0.3
- Skills education (Vaardigheden onderwijs), Medical faculty Erasmus MC – Observation & diagnostic skills	2013	0.3
- Workshop 'autisme en seksualiteit' ambulante schoolbegeleiders Yulius, Rotterdam, Nl	2013	0.5
- Train-the-trainer TTT program, Rotterdam, Nl	2013	2
Supervising Master's theses		
- Caitlin De le Cluse, Department of Child and Adolescent Psychology, Leiden University: 'Dimensional disorders; common traits in ASD and disruptive children and adolescents'	2011	1.5
- Lisa Oppenoorth, Clinical child- and adolescent psychology, Erasmus University Rotterdam: 'Verband tussen autistische trekken en angst'	2012	1.5
Total		39.3 ECTS