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The daily lives of adolescents with an autism spectrum disorder:

Discretionary time use and activity partners

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Abstract

This study explores the daily lives, particularly discretionary time, of adolescents with an autism spectrum disorder (ASD). We describe the activities and activity partners of adolescents, the factors associated with their discretionary time use, and the impact of time use on their autism symptoms. Mothers of 103 adolescents with an ASD completed two 24-hour time diaries to describe their adolescent's activity participation during the third wave of a longitudinal study. Adolescents with an ASD spent considerable time in discretionary activities, with watching television and using a computer as the most frequent activities. They most frequently spent discretionary time alone or with their mothers. They spent little time engaged in conversations or doing activities with peers. Age, gender, the presence of intellectual disability, severity of autism symptoms and maladaptive behaviors, the number of siblings, maternal education, marital status, and family income were associated with adolescent time use. Notably, greater time spent in conversation and reading predicted future decreases in severity of social impairment. The way that adolescents with an ASD spend their free time may have implications for their development and the course of their autism symptoms.

Keywords

adolescents; autism; discretionary time; social; time use

Autism spectrum disorders (ASDs) are defined by impairments in social interaction and communication, as well as the presence of behaviors, interests, and activities that are repetitive and restrictive (American Psychiatric Association [APA], 2000). Although it is assumed that these core symptoms impact the daily lives of individuals with an ASD, there are few studies that examine the ways in which a person's life is shaped by living with an ASD. In this study, we examined the daily lives of adolescents with an ASD. Whereas previous time-use studies on children and adolescents with disabilities have utilized interviews to capture qualitative information (e.g. Buttner and Tierney, 2005; Law et al., 2006), in this study we used a time diary methodology to provide detailed quantitative information about how adolescents with an ASD spend their free time.

ASDs are lifelong disabilities (APA, 2000), and adolescence can be a time of increasing challenges for individuals with an ASD and their families (Seltzer et al., 2004). Specifically, adolescents with an ASD have been reported to experience difficulties in establishing or

maintaining peer relationships, participating in social and recreational activities, and often report having few friendships (Bauminger and Kasari, 2000; Orsmond et al., 2004). We have very little knowledge about the ways that adolescents with an ASD spend their free time, and the potential effects of their time use on their development. This information is needed to provide more helpful treatment recommendations and services for adolescents with an ASD.

Previous research examining the time use of children and adolescents with physical disabilities and those with intellectual disabilities indicates that children and adolescents with disabilities participate more frequently in dependent, solitary, and family-oriented activities (Brown and Gordon, 1987). They less frequently engage in social activities (Buttimer and Tierney, 2005); energy-consuming activities, such as household work or getting out the house (Brown and Gordon, 1987); and activities that are structured or require preplanning such as organized sports, music lessons or youth groups (Law et al., 2006). Moreover, their lower levels of engagement in a variety of activities at a younger age can lead to truncated activity patterns, whereby the skills needed and opportunities available for participation in a variety of activities become increasingly difficult as children get older (Brown and Gordon, 1987).

Our first goal in this study was to describe how adolescents with an ASD spend their time, in terms of what activities they engage in (specifically during discretionary time) and with whom they are doing these activities. Data from typically developing adolescents in the United States indicate that they spend around a half of their waking hours per day in free-time activities, with a large part of the time spent socializing with peers and friends (Csikszentmihalyi and Larson, 1984; Larson, 2001). In comparison, Hilton et al. (2008) investigated out-of-school activity participation of children with high-functioning ASD (HFASD) and found that children with HFASD participated in social activities less frequently than typically developing children. In light of the lifelong social and communication impairments and behavior problems associated with ASDs, we anticipated that adolescents with an ASD would spend less time engaged in activities that involve socialization. We were interested in what activities possibly took place instead of social activities.

We also sought to identify the factors associated with time spent in specific activities by adolescents with an ASD. Individual characteristics have been reported to be associated with adolescent time use in typically developing adolescents. Older adolescents participate in a greater variety of activities. For example, they talk to friends, listen to music, and 'hang out' with friends more frequently, while younger adolescents spend more time watching television (Timmer et al., 1985). Older adolescents also spend less time with family, and more time alone or with peers (Larson, 2001).

Adolescent time use also varies by gender. Generally, males spend more time watching television (Larson et al., 1989), using a computer (Subrahmanyam et al., 2001), and doing active sports and outdoor activities (Robinson and Bianchi, 1997), and less time in personal and household maintenance tasks (Duckett et al., 1989), and socializing (Raffaelli and Duckett, 1989) than females. We were interested in whether such patterns held for adolescents with an ASD.

In addition to adolescent characteristics, family characteristics also are related to adolescents' time allocation, although the findings are not consistent. Generally, television viewing occurs more frequently among children and adolescents with low socioeconomic status (SES) than those with high SES (Anderson et al., 2001). Timmer et al. (1985) also found that children of single mothers were more likely to help out with household work and

spent more time watching television than children from two-parent households. Adolescents with an employed mother spend more time on household tasks than those with an unemployed mother (Cogle et al., 1982). Also, adolescents in families with high SES spend less time alone than those with low SES (Timmer et al., 1985). However, Robinson and Bianchi (1997) found no relationship between adolescents' time allocation and parental employment status, maternal marital status, or adolescents' birth order.

The third aim of our study was to examine whether the activities that adolescents with an ASD engaged in had subsequent effects on their development in terms of their autism symptoms. From an ecological perspective, adolescents' everyday activities are integral in shaping their development (Larson, 2001). Time-use studies with typically developing adolescents have shown that experiences in a variety of activities and settings help to shape the development of adolescents' skills, attitudes, and behavior patterns (e.g. Larson, 2001), and that different activities provide different developmental benefits and liabilities in adolescence. For example, engagement in social activities offers opportunities for adolescents to exchange their thoughts with friends, to increase their self-understanding, and to practice reciprocal interactions (Larson and Kleiber, 1993). Interacting with peers also is associated with more prosocial and cooperative behaviors (Wentzel et al., 2004). Research on adolescent media use indicates that high levels of television viewing, the activity that adolescents do most frequently in their free time, can be associated with high rates of antisocial or aggressive behavior (Mahoney and Stattin, 2000).

Activity partners are another important consideration. Typically, adolescents spend less time with family compared with time alone or with friends (Csikszentmihalyi and Larson, 1984). The developmental implications of family and peer time depend on the types of interactions that take place during this period of time and the nature of the relationships within which these interactions take place (Larson, 2001). Similarly, spending time alone can have both positive and negative consequences, but no adolescent benefits from extreme amounts of time spent alone (Larson and Csikszentmihalyi, 1980).

We posed the following three research questions in the present study, with a focus on discretionary time use: (1) How do adolescents with an ASD spend their time, and are there differences between weekday and weekend time use? (2) Do time-use patterns of adolescents with an ASD, including the activities they engage in and the companions with whom they do activities, vary by their demographic characteristics (age, gender, and level of abilities), family characteristics (SES, parental educational and occupational status, mother's marital status, and family size) and severity of their autism symptoms (including language and social impairments, and behavior problems)? and (3) What are the longitudinal effects of time-use patterns on the development of adolescents with an ASD, specifically on autism symptoms in terms of impairment in language, reciprocal social interaction and maladaptive behaviors?

Based on the findings of children and adolescents with disabilities (e.g. Brown and Gordon, 1987), we expected that adolescents with an ASD would engage in many passive and solitary activities. Based on research with typically developing adolescents, we expected time use to vary by adolescents' age and gender (e.g. Larson, 2001). We also assumed that adolescents with an ASD who also had an intellectual disability would do more solitary and passive activities as well as spend more time with family members than those without an intellectual disability (Buttimer and Tierney, 2005). Regarding the severity of autism symptoms, we hypothesized that adolescents who had more severe social impairment, less developed communication skills, and more maladaptive behaviors would spend less time engaging in social activities and less time with peers than those who had less severe social impairment, more developed communication skills, and fewer behavior problems (Orsmond

et al., 2004; Sigman and Ruskin, 1999). In terms of family characteristics, we predicted that adolescent time use would vary by family SES, maternal employment status, and family size (Robinson and Bianchi, 1997; Timmer et al., 1985). Finally, we hypothesized that more time spent in passive activities, such as television viewing, would be associated with a decrease in language and social interaction skills, and an increase in behavior problems over time (Mahoney and Stattin, 2000).

By posing these questions, we hoped this study would illuminate the daily activities of adolescents with an ASD and would increase our understanding of the relationships between time use and other factors, such as demographics, family characteristics, and symptoms, as well as the missing link in our understanding of how and with whom adolescents with an ASD spend their free time and how this might impact their subsequent development.

Method

Participants

Participants were recruited from 406 families of adolescents and adults with an ASD participating in the third (Time 3) and fourth waves (Time 4; 18 months later) of a longitudinal study on family caregiving (Seltzer et al., 2003). The adolescents with an ASD in our study were between the ages of 12 and 21 and were co-resident with their mothers at Time 3. Almost all adolescents were in middle or high school, except for 14 of them who were either in college ($n = 7$) or had left high school and were not pursuing post-secondary education ($n = 7$). All adolescents with an ASD in these families had been diagnosed by a medical or educational professional, and met the criteria for an ASD according to the Autism Diagnostic Interview – Revised (ADI-R; Lord et al., 1994).

We conducted the time-use survey at the third wave of the study. At this time, of the 393 families who continued to participate in the study, 145 included an adolescent (ages 12–21) with an ASD who was living at home. Mothers of 103 of these adolescents completed the time-use surveys, for a response rate of 71 per cent. Just under half of the adolescents lived in Massachusetts ($n = 45$) and just over half lived in Wisconsin ($n = 58$). Table 1 presents the adolescents' and their mothers' characteristics at Time 3. The adolescents had an average age of 18. Three-quarters of the adolescents were male and more than half had an intellectual disability according to parental report and direct testing. Most adolescents had functional use of language. The mothers averaged 48 years of age. Most mothers were Caucasian, married, and employed either full-time or part-time outside the home. Approximately half of the mothers had graduated from college or had an advanced degree. The majority of families had a household income of more than \$60,000 per year.

Procedures

All data were provided by the mothers during interview or during completion of self-administered questionnaires. At Time 3, mothers completed time diaries regarding how their son or daughter with an ASD spent their time on the most recent weekday and weekend day. At both Time 3 and Time 4 of the study, mothers completed questionnaires regarding their adolescent's behavior problems, and were interviewed regarding their adolescent's communication and social skills.

Measures

Time diaries—At Time 3, two 'yesterday' time diaries were sent to mothers along with other self-report measures to be completed before a scheduled interview. Mothers were asked to complete two time diaries to describe their adolescent's activity participation for the most recent weekday and the most recent or upcoming weekend day. First, mothers were

asked to list the primary activity of their son or daughter with an ASD for each half-hour time period beginning at midnight and ending at 11:30 P.M. Next, they indicated where the activity occurred (home, work, school, public place, friend or relative's home, car/van/public transportation, and other). Finally, they indicated with whom the adolescents did the activities (alone, with mother, with father, with a sibling, with other relative, with peers or friends, with staff person, and with others). Mothers could list more than one person, but only one location. Time-use data were collected over an 18-month period beginning in May 2002, with some families participating during summer ($n = 37$; 35%) and some during school months ($n = 66$; 64%).

Activities were coded by the first author, based on an adapted version of Szalai's (1972) activity coding scheme. We then created four summary activity categories: (1) sleeping, (2) nondiscretionary activities (non-free-time activities, primarily ones related to schoolwork), (3) discretionary activities (free-time activities, such as recreational activities or social activities, excluding sleep, personal care, and nondiscretionary activities), and (4) personal care (such as dressing, eating, or bathing). Ten time diaries were coded independently by a research assistant for reliability, with 84 per cent agreement on activity codes.

Considerable prior research has substantiated the reliability and validity of time diary data. Robinson (1977) examined the reliability of recalled time diary by asking participants to complete a yesterday time diary (which records what they did yesterday) and a tomorrow diary (which records what they expect to do for the following day). A correlation of .88 was found, which indicated a strong degree of correspondence between estimates generated from yesterday diary and tomorrow diary. Also, previous studies have examined the validity of time diary by comparing time diary findings to measurements with well-established validity, such as direct observation or experience sampling methods which ask participants to carry a beeper and to record what they are doing when the beeper rings (Juster, 1985; Robinson, 1985).

Symptoms and behaviors of adolescents with an ASD—Scores from the Autism Diagnostic Interview – Revised (ADI-R; Lord et al., 1994) were used as measures of communication and social impairment. The ADI-R was administered by trained interviewers at both Time 3 and Time 4. In this set of analyses, three scores from the ADI-R were used: (1) impairment in verbal communication (the sum of 8 items: reciprocal conversation, social vocalization, stereotyped utterances, delayed echolalia, inappropriate questions or statements, pronominal reversal, neologisms, and verbal rituals), (2) impairment in nonverbal communication (the sum of 4 items: conventional and instrumental gestures, pointing to express interest, head shaking to indicate no, and nodding head to indicate yes) and (3) impairment in social reciprocity. A higher score for each domain indicated more severe impairment. The inter-rater reliability between trained interviewers and two supervising psychologists, both of whom were experienced in the diagnosis of ASDs and in the use of the ADI-R, averaged 88 per cent.

The Scales of Independent Behavior – Revised (SIB-R; Bruininks et al., 1996) were used to measure the adolescents' maladaptive behaviors. The SIB-R behavior problems scale is comprised of eight behaviors in three domains, including asocial behaviors (socially offensive behavior, uncooperative behavior), internalized behaviors (hurtful to self, unusual or repetitive habits, withdrawal or inattentive behavior), and externalized behaviors (hurtful to others, destructive to property, disruptive behavior). The mother was asked whether her child with an ASD had each of these eight behavior problems within the last 6 months at both Time 3 and Time 4, and if so, she was asked to rate the frequency and severity of the behaviors. Standardized algorithms (Bruininks et al., 1996) were used to translate frequency and severity ratings into a general summary score with higher scores indicating more severe

maladaptive behaviors. In the sample in this study, the average SIB-R scores at Time 3 and Time 4 were 115.05 (range = 99–151) and 112.27 (range = 100–149), respectively. Good reliability and validity of the SIB-R have been documented by the test authors (Bruininks et al., 1996).

Demographic characteristics—Basic demographic characteristics of adolescents with an ASD and their mothers were collected from the mothers during the first wave of the longitudinal study. Adolescents were categorized as to whether or not they had an intellectual disability using data from administration of the Wide Range Intelligence Test (WRIT; Glutting et al., 2000) and maternal report of her child's adaptive behavior on the Vineland Screener (Sparrow et al., 1987). Individuals with a standard scores of 70 or below on each instrument were classified as having an intellectual disability, whereas those with scores above 75 on either measure were deemed not to have an intellectual disability. For the remaining cases, independent review of records (including psychological testing records when available, adaptive behavior information, parental report of a prior diagnosis of intellectual disability) by three psychologists, combined with a clinical consensus procedure, was used to determine whether or not an individual had an intellectual disability.

Demographic data collected on the mothers included age, the number of children in the family, marital status, ethnicity, the level of education, employment status, and the yearly household income.

Results

Time-use patterns of adolescents with an ASD

As a preliminary step, we first examined differences in all the outcome variables by state. No differences were observed between participants in Wisconsin and Massachusetts, and therefore their data were combined. Next, we examined weekday and weekend differences in time use. As shown in Table 2, adolescents with an ASD spent significantly more time sleeping ($t(102) = -4.46, p < .001$), doing personal care ($t(102) = -2.14, p = .035$), and doing discretionary activities ($t(102) = -12.75, p < .001$) on weekend days than on weekday days, and less time doing nondiscretionary activities on weekend days than on weekdays ($t(102) = 18.08, p < .001$).

To examine overall patterns, we calculated the average daily hours spent in each activity category across the weekday and weekend time diaries by multiplying the weekday hours of each activity by 5 and multiplying the weekend hours of each activity by 2, and then dividing the sum of these two calculations by 7. Thus, the average time for each category shown in Table 2 is not merely an average of the weekday and weekend hours, but is weighted to reflect more weekday than weekend days in a week. As shown, adolescents with an ASD spent an average of 8.7 hours sleeping and 8.3 hours engaging in discretionary activities per day. They spent an average of 4.3 hours engaging in non-discretionary activities and 2.7 hours on personal care per day. During waking hours, they spent most of their time in discretionary activities (54%), followed by non-discretionary activities (28%) and personal maintenance (18%).

We also examined whether adolescents' time use differed between those who were in middle or high school and those who had exited high school ($n = 14$). Adolescents who were in middle or high school spent more time sleeping ($t(101) = 1.70, p = .035$) and less time in personal care ($t(101) = -2.61, p = .010$) than those who had exited the school system.

Because adolescents with an ASD spent most of their waking hours in discretionary activities, we then examined which discretionary activities they did most frequently and with

whom they did these activities. In Table 3, we present both the frequency and the amount of time on the 10 activities that adolescents with an ASD engaged in most frequently during discretionary time across the weekday and weekend time diaries. We present two sets of mean values. The first represents the average amount of time for adolescents who engaged in that activity (excluding the zero values for those who did not engage in the activity). In the last column, we provide the mean for all adolescents, including those who did not engage in the activity. We do this so that our data can be compared with time use studies presented in the literature, which frequently only include this variable.

In terms of the number of adolescents who engaged in these activities, watching television was the most frequent discretionary activity, with an average of 86 per cent of adolescents with an ASD watching television on either day in their free time. Computer use (which included time on the Internet and playing computer games) was the second most frequent activity, followed by physical activity (which included walking). Having a conversation was relatively infrequent, with only 15 per cent of adolescents with an ASD engaging in this activity during their discretionary time. Regarding the amount of time spent on activities for those who engaged in each activity, adolescents with an ASD spent an average of 2.3 hours watching television, 1.7 hours using a computer, and 1.2 hours doing physical activity. The average time spent in conversation was less than an hour.

Because of the large number of adolescents who did not engage in each activity, and thus the non-normal distributions of variables, we conducted non-parametric analyses. We used McNemar tests (the matched-pairs equivalent of a chi-square test) to examine whether specific discretionary activities were more likely to occur on weekends compared to weekdays (Sheskin, 2004). We report the McNemar test statistic (z) because of small cell sizes. On weekends, adolescents were more likely to watch television (81% versus 71%; $z = 2.25$, $p = .023$), use a computer (50% versus 33%; $z = 3.49$, $p < .001$), go shopping (38% versus 16%; $z = 3.72$, $p < .001$), read (30% versus 19%; $z = 2.09$, $p = .039$), and visit friends and relatives (17% versus 6%; $z = 2.29$, $p = .019$). No significant differences were found for doing physical activity, listening to music, relaxation, and engaging in conversation between weekdays and weekend days.

Adolescents with an ASD spent significantly more time participating in discretionary activities during the summer months (June, July, and August) than during the school year (9.05 hours versus 7.89 hours; $F(1, 102) = 4.56$, $p = .035$). Whether or not adolescents spent time in specific discretionary activities did not vary significantly between the school year and summer months. The amount of time spent on each of these discretionary activities also did not vary significantly between the school year and summer months, with the exception of shopping. Adolescents spent more time shopping during the summer months than during the school year ($F(1, 44) = 6.87$, $p = .012$). Adolescents' participation in each discretionary activity did not differ between those who were in middle or high school and those who had exited the school system.

As shown in Table 4, most adolescents with an ASD spent their discretionary time with their mother or alone. They more frequently did discretionary activities with adults, such as parents and paid professionals (respite workers, paid companions, and leaders of group leisure activities) than with peers. Regarding the amount of time for those who spent time with various companions, adolescents with an ASD spent the largest amount of time doing discretionary activities alone ($M = 3.5$ hours), and with their mother ($M = 3.1$ hours). Average discretionary time spent with paid professionals was also relatively high (around 3 hours per day) compared to time spent with a father or sibling (ranging from 2.0 to 2.5 hours per day) and time spent with peers (2.1 hours per day). There were no differences in time spent alone and with companions doing discretionary activities during the school year and

summer months. However, we found that adolescents with an ASD who were in middle or high school were more likely to spend time with their father than those who had exited the school system (69.9% versus 7.8%; $\chi^2 = 3.94$, $p = .047$).

Associations between adolescents' characteristics and time-use patterns

We used chi-square and t tests to examine the associations between time-use patterns at Time 3 and adolescents' characteristics, family characteristics, and autism symptoms at Time 3. We also calculated effect sizes (Cohen's d , Cohen, 1988) of the chi-square and t tests. Because of the non-normal distribution of variables, and the many adolescents who did not do the activities, we used dichotomous variables which indicated whether adolescents participated in each of discretionary activities on any given day (0 = no, 1 = yes), with the exception of the summary activities (sleeping, discretionary activities, non-discretionary activities, and personal care). For these four activities, we used the amount of time spent in the activity category in the analyses, because all or almost all adolescents participated in these activities. Variables, including gender (1 = male, 2 = female), intellectual disability (0 = without ID, 1 = with ID), maternal education level (1 = lower than bachelor's degree, 2 = bachelor's degree or higher), maternal employment status (1 = unemployed, 2 = employed), and maternal marital status (1 = married, 2 = unmarried), were dichotomous. Other variables were continuous (e.g. age, family size, autism symptoms and behaviors).

Contrary to our hypotheses, the amount of time spent sleeping, and engaging in discretionary activities, non-discretionary activities, and personal care were not significantly correlated with any examined factors, except for adolescents' age. Older adolescents spent more time engaging in personal care than younger adolescents ($r = .20$, $p = .04$).

Regarding specific discretionary activities, there were no significant differences or patterns by age and gender. Adolescents with co-morbid intellectual disability (ID) were less likely to use a computer than those who did not have ID (45% versus 55%; $\chi^2(1) = 5.40$, $p = .020$; $d = 0.47$), less likely to engage in conversation (31% versus 69%; $\chi^2(1) = 4.84$, $p = .028$; $d = 0.44$), and more likely to visit friends or relatives (76% versus 24%; $\chi^2(1) = 4.24$, $p = .040$; $d = 0.41$). In addition, adolescents with an ASD who had more severe maladaptive behaviors were more likely to go shopping than those had less severe maladaptive behaviors ($t(97) = -2.78$, $p = .007$; $d = -0.56$). Adolescents who had less severe verbal communication impairment were more likely to watch television ($t(97) = 2.04$, $p = .044$; $d = 0.41$), use a computer ($t(87) = 2.29$, $p = .025$; $d = 0.49$) and read ($t(87) = 2.33$, $p = .022$; $d = 0.50$) than those with more severe verbal communication impairment. Also, adolescents with more severe nonverbal communication impairment were more likely to spend time unoccupied than those with less severe nonverbal communication impairment ($t(97) = -2.07$, $p = .041$; $d = -0.42$).

Of the family characteristics, family size, maternal education level and maternal marital status were significantly related to whether or not an adolescent engaged in specific discretionary activities. Adolescents with an ASD who spent time watching television tended to come from smaller families than those who did not watch television on either the weekday or weekend day (2.7 versus 3.5 children in the family; $t(101) = 2.33$, $p = .022$; $d = 0.46$). Adolescents whose mothers had a bachelor's degree or higher were more likely to exercise than those whose mothers did not have a bachelor's degree (71% versus 29%; $\chi^2(1) = 5.02$, $p = .040$; $d = 0.45$). Also, adolescents who lived with married mothers were more likely to use a computer than those who lived with unmarried mothers (92% versus 8%; $\chi^2(1) = 4.37$, $p = .037$; $d = 0.42$).

With respect to activity partners, adolescents with an ASD with a co-morbid diagnosis of ID were more likely to spend discretionary time alone than those without ID (51% versus 49%;

$\chi^2(1) = 4.85, p = .028; d = 0.44$). Those with co-morbid ID were also more likely to spend time with paid professionals (65% versus 35%; $\chi^2(1) = 6.68, p = .010; d = 0.53$), and less likely to spend time with peers (43% versus 57%; $\chi^2(1) = 6.88, p = .009; d = 0.54$) than those without ID. Regarding the family characteristics, adolescents who spent discretionary time with their father were more likely to be from two-parent household (96% versus 4%; $\chi^2(1) = 31.94, p < .001; d = 1.34$) and from families with higher household incomes ($t(34) = -3.46, p = .001; d = -1.17$) than those who did not spend time with their father. Also, adolescents who spent time with siblings were more likely to be from larger than smaller families (3.0 versus 2.4 children in the family; $t(101) = -2.49, p = .015; d = -0.50$). Adolescents with less severe verbal communication impairment were more likely to spend time alone than those with more severe verbal communication impairment ($t(87) = 2.22, p = .046; d = 0.48$). Moreover, adolescents with an ASD who had less severe maladaptive behaviors were more likely to spend discretionary time with peers than those who had more severe maladaptive behaviors ($t(97) = 2.24, p = .028; d = 0.45$).

Longitudinal effects of time-use patterns on autism symptoms and behaviors

For the third research question regarding the longitudinal effects of adolescents' time-use patterns on their autism symptoms and behaviors, we conducted ordinary least squares multiple regression analyses (separately for each discretionary activity listed in Table 3), controlling for level of symptoms and behaviors at Time 3 and the presence of intellectual disability. In these analyses, we used the dichotomous variables which indicated whether or not adolescents participated in the specific activity or spent time with the specific companion as predictors.

We first examined the associations between adolescents' characteristics and specific discretionary activities across Time 3 and Time 4. We then conducted regression analyses for variables where the Time 3 activity was significantly associated with a Time 4 outcome. These significant associations were between Time 3 having conversations and Time 4 social impairment, Time 3 reading and Time 4 social impairment and Time 4 maladaptive behaviors, and Time 3 shopping and Time 4 maladaptive behaviors. Adolescents who engaged in conversation at Time 3 had fewer social impairments at Time 4 ($t(84) = 2.98, p = .004; d = 0.65$). And, adolescents who spent time reading at Time 3 had fewer social impairments ($t(84) = 2.28, p = .025; d = 0.50$) and fewer maladaptive behaviors ($t(91) = 2.76, p = .007; d = 0.58$) at Time 4. And, adolescents who went shopping at Time 3 had more maladaptive behaviors at Time 4 ($t(91) = -2.40, p = .018; d = -0.50$).

Table 5 presents the multiple regression analyses used to examine the longitudinal effects of spending time shopping, engaging in conversation and reading. For each of these regression analyses, we controlled for the Time 3 autism symptoms and behaviors as well as the presence of ID. As shown, engaging in conversation and reading at Time 3 predicted less severe social impairment at Time 4, controlling for Time 3 social impairment and intellectual disability. There were no significant findings for maladaptive behaviors.

To help understand these associations, we then examined with whom adolescents with an ASD engaged in conversation and reading most frequently. As shown in Table 6, adolescents with an ASD most frequently engaged in conversation with their mothers, followed by fathers, paid professionals, and siblings. Only 3 adolescents with an ASD engaged in these activities with peers, but when they did it was for relatively long periods of time. In terms of reading, adolescents with an ASD most frequently engaged in reading alone or with their mothers, followed by fathers, siblings and then paid professionals.

We then examined associations between adolescents' characteristics and specific partners. We conducted regression analyses for variables where the Time 3 companion was

significantly associated with Time 4 outcomes, namely the association between Time 3 doing activities alone and Time 4 social impairment ($t(84) = 2.44, p = .017; d = 0.53$), and the association between Time 3 spending time with peers and Time 4 maladaptive behaviors ($t(91) = 2.73, p = .008; d = 0.57$). However, none of the predictors was significant in the regression analyses. Doing activities alone did not significantly predict Time 4 social impairment ($B = -.068, p = .378$), controlling for Time 3 social impairment and intellectual disability. Similarly, spending time with peers did not significantly predict Time 4 maladaptive behaviors ($B = -.043, p = .572$), controlling for Time 3 maladaptive behaviors and intellectual disability.

Discussion

This study is a first step in helping us to understand the daily life patterns of adolescents with an ASD. The findings reflect some similarities and differences in time use patterns between adolescents with an ASD and typically developing adolescents. Similar to typically developing adolescents, adolescents with an ASD spent most of their waking hours doing discretionary activities; this was especially true on weekends and during the summer months. Watching television was the most frequent discretionary activity. The amount of time spent watching television was similar to that of typically developing adolescents, who spend an average of 2.7 hours per day watching television (Robinson and Bianchi, 1997). Moreover, as with typical adolescents, adolescents with an ASD spent more time engaging in self-care as they got older. It is interesting to note that the range of time spent in activities was large, which suggests that some adolescents with an ASD spent extremely large amounts of time on some activities, and many did not do these activities. This phenomenon likely reflects the great heterogeneity in symptoms and development in this population.

Our findings differed from those of typically developing adolescents in that adolescents with an ASD spent relatively more time engaged in solitary activities and less time doing social activities. Typically developing adolescents spend a large amount of time socializing, and most of this time is spent talking to their friends (Larson and Seepersad, 2003; Raffaelli and Duckett, 1989). Adolescents with an ASD spent most of their time alone or with adults, including parents and paid professionals.

The functional dependence and communication impairments of adolescents with an ASD may explain some of this developmental pattern. Interestingly, we found that adolescents with an ASD with a co-morbid diagnosis of intellectual disability, who likely need assistances in many aspects of daily living, spent more time alone and more time with their parents and paid professionals than those without intellectual disability. It is not surprising that they spent more time with paid professionals, but the fact that they spent more time alone stands in contrast to their functional dependence. We surmise that this time spent alone replaces time spent with peers. Their time spent alone may be less out of choice, and more out of necessity or unavailability of others' company. On the other end of the spectrum, however, adolescents with fewer communication impairments were also more likely to spend time alone, although the amount of time did not differ. This solitary time may reflect time spent alone by choice. These individuals were more likely to watch television, use a computer, and read during their discretionary time, and thus they may have abilities that allow them to engage in solitary activities independently.

Also, the interfering role of behavior problems was substantiated. Individuals with less severe maladaptive behaviors were more likely to spend time with peers. This finding is similar to the findings in our previous research on adolescents and adults with autism, wherein adolescents and adults with autism with fewer behavior problems were more likely to have peer relationships and participate in social activities (Orsmond et al., 2004).

Interestingly, adolescents with more maladaptive behaviors were more likely to go shopping. We tested whether time spent shopping at Time 3 was associated with subsequent behavior problems at Time 4, but this regression model was not significant. We were not able to test the reverse causal path – that more behavior problems led to more shopping. We suspect, however, that the presence of behavior problems necessitated that family members brought the adolescent with them while they were shopping, in part because they were unable to find alternative activities or activity partners (e.g. respite workers) to engage their son or daughter while they needed to do this activity.

We also found several family constellation variables that were associated with specific discretionary activities and activity partners. Obviously, access to family members was important, as adolescents from smaller families spent less time with siblings, and adolescents whose parents were not married spent less time with their fathers. Interestingly, adolescents from families with higher incomes were more likely to spend time with their fathers, suggesting that their fathers were more available to spend time with them because they were working during the hours that their son or daughter was occupied with other activities, or because their income allowed them to engage in activities for which they had more money.

Not surprisingly, we found that for adolescents with an ASD, engaging in conversations with others predicted a decline in social impairment. Having conversations involves social exchange. When conversing, adolescents with an ASD need to use a broad range of skills such as initiating, responding, conversing on a variety of topics, giving and accepting compliments, and sharing ideas. One way to improve social skills is to practice through conversations (Barry et al., 2003). Our data support this assertion.

It was interesting to find that engaging in reading predicted future decreases in social impairment in adolescents with an ASD. This finding supports a previous study which investigated reading abilities of adolescents with an ASD (Jones et al., 2009). Greater reading comprehension was associated with lower severity of social impairment. One possible explanation is that reading tasks demand skills ranging from recognizing words to understanding the intended meaning of texts (Nation et al., 2006). Engaging in reading might provide opportunities for adolescents with an ASD to practice and enhance their skills, such as understanding and interpreting various cues in the narratives and inferring characters' emotions and intentions; then, these skills might be used in social contexts. It is also possible that another unmeasured factor is responsible for the observed relationship between social skills and reading, as well as the association between social skills and engagement in conversation. Although one could hypothesize about how engagement in these activities might have social benefits, we have not systematically examined a variety of possible confounding variables.

Another limitation of this study is that the data were collected from the mothers rather than directly from the adolescents with an ASD. Because mothers were not together with their adolescent all day, they are not able to accurately account for as much of adolescents' time as would the adolescents themselves. By collecting data directly from adolescents rather than from parents, we could potentially have more detailed time use information. However, not all adolescents with an ASD would be able to provide this type of information accurately. Another shortcoming of proxy reports is that adolescents' subjective feelings and perspectives toward the activities cannot be examined. Although the data on activities and companions of daily lives provide a general picture of what their lives are like, without knowing how adolescents with an ASD actually experience these activities we do not know how they feel about their daily lives. Future studies could obtain information directly from the individuals with an ASD to examine their own perspectives on their daily participation.

Furthermore, gathering information directly from adolescents with an ASD would allow them to have an active role in research, and encourage them to have a greater say in their lives and to voice their concerns and perspectives.

In addition, we should be mindful of the sample characteristics in interpreting the findings. The findings represented the time use patterns of adolescents with an ASD who lived in two states in the United States. Most mothers were Caucasian and had a middle-to-high socioeconomic status, although a range of incomes were present. Furthermore, these families had volunteered and continued to be part of a longitudinal study, which may have created a select group of families interested and engaged in research. Thus, generalization of the results should be used with caution.

The present study is the first study investigating the time-use patterns of adolescents with an ASD by using time diaries. This study not only goes beyond the description of time use patterns in adolescents with an ASD, but also discloses factors that are associated with adolescents' time use. This is also the first longitudinal study to examine the effects of activity participation on developmental outcomes for this population. Moreover, this study provides a general picture of how adolescents with an ASD live that may be useful to practitioners and has clinical implications. Compared to typically developing adolescents, adolescents with an ASD live in a more passive and solitary way. Adolescents with an ASD participate more frequently in activities that can be done alone and activities without involving interactions. Practitioners may be encouraged to find a greater variety of meaningful activities for adolescents with an ASD, but must also be mindful of understanding what is meaningful and important to the adolescent himself or herself. Moreover, additional research is needed to better understand the developmental consequences of activity participation for this population through prospective longitudinal studies.

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Table 1Characteristics of adolescents with an ASD and their mothers ($N=103$)

Characteristics	Mean or %	SD	Range
<i>Adolescents</i>			
Age (in years)	17.8	2.2	12.7–21.8
Gender (% male)	75.7%		
Intellectual disability (%)	56.3%		
Language skills (% functional use)	90.2%		
<i>Mothers</i>			
Age (in years)	47.9	5.1	35.7–64.2
No. of children in family	2.8	1.3	1.0–8.0
Marriage status (% married)	84.8%		
Ethnicity (% caucasian)	95.1%		
Education level (% college grad)	59.1%		
High school graduate	12.6%		
Some college	26.2%		
College graduate	22.3%		
Some graduate school	11.7%		
Graduate degree	25.2%		
Employment status (% employed)	88.8%		
<i>Household income</i>			
\$20,000–39,999/year	16.7%		
\$40,000–59,999/year	22.3%		
\$60,000/year	61.1%		

Table 2

Average time spent in sleep, non-discretionary, personal care and discretionary activities

Activity	Mean	SD	Range	% of total	% of waking hours
<i>Sleep</i>					
Average	8.71 hrs	1.62	3.36–11.71 hrs	36%	
Weekday	8.44 hrs	1.83	1.00–11.50 hrs	35%	
Weekend	9.38 hrs	2.02	1.50–13.50 hrs	40%	
<i>Non-discretionary</i>					
Average	4.27 hrs	2.36	0.00–12.71 hrs	18%	28%
Weekday	5.85 hrs	3.15	0.00–15.00 hrs	24%	38%
Weekend	0.31 hrs	1.23	0.00–7.50 hrs	1%	2%
<i>Personal care</i>					
Average	2.68 hrs	1.25	0.68–7.57 hrs	11%	18%
Weekday	2.56 hrs	1.38	0.50–8.50 hrs	11%	16%
Weekend	2.98 hrs	1.89	0.00–10.50 hrs	12%	20%
<i>Discretionary</i>					
Average	8.31 hrs	2.68	1.92–17.21 hrs	35%	54%
Weekday	7.10 hrs	3.27	1.00–17.50 hrs	30%	46%
Weekend	11.33 hrs	2.56	3.50–16.50 hrs	47%	78%

Table 3

Most frequent discretionary activities of adolescents with an ASD

Variable	n	% of total	Mean ^a	SD	Range	Mean ^b
Watching television	89	86%	2.27 hrs	2.19	0.14–13.21 hrs	1.96 hrs
Computer use	53	51%	1.65 hrs	1.64	0.14–7.07 hrs	0.85 hrs
Physical activity	48	47%	1.21 hrs	0.96	0.14–4.79 hrs	0.56 hrs
Listening to radio or music	46	45%	0.92 hrs	0.83	0.07–2.86 hrs	0.41 hrs
Shopping	45	44%	0.74 hrs	0.80	0.07–4.57 hrs	0.32 hrs
Relaxing or not occupied	37	36%	1.00 hrs	1.08	0.07–4.36 hrs	0.36 hrs
Reading	37	36%	0.71 hrs	0.79	0.07–3.93 hrs	0.26 hrs
Visiting with friends or relatives	21	20%	0.83 hrs	0.70	0.14–2.50 hrs	0.17 hrs
Napping	16	15%	1.07 hrs	1.36	0.14–5.79 hrs	0.17 hrs
Having a conversation	16	15%	0.40 hrs	0.32	0.07–1.14 hrs	0.06 hrs

^a. Mean value represents average time if adolescent engaged in specific activity.^b. Mean value represents average time for all adolescents, including zeros if no time was spent engaged in that specific activity.

Table 4

Most frequent companions during discretionary activities for adolescents with an ASD

Variable	n	%	Mean ^a	SD	Range	Mean ^b
With mother	98	95	3.05 hrs	2.12	0.14–11.36 hrs	2.90 hrs
Alone	84	82	3.45 hrs	2.86	0.14–16.50 hrs	2.81 hrs
With father	80	78	1.97 hrs	1.44	0.14–7.21 hrs	1.53 hrs
With paid professionals	71	69	2.78 hrs	2.16	0.36–8.93 hrs	1.92 hrs
With siblings	67	65	2.45 hrs	2.31	0.14–13.71 hrs	1.59 hrs
With peers	49	48	2.11 hrs	2.16	0.14–9.43 hrs	1.00 hrs
With relatives	24	23	0.68 hrs	0.41	0.14–1.64 hrs	0.16 hrs
With others	9	9	0.98 hrs	0.87	0.14–2.50 hrs	0.09 hrs

^a. Mean value represents average time if adolescents spent time with specific activity partners.

^b. Mean value represents average time for all adolescents, including zeros if no time was spent with that specific activity partner.

Table 5

Longitudinal prediction of T4 autism symptoms based on whether or not adolescents engaged in specific discretionary activities

Variable	Standardized betas
T4 Social impairment	
Intellectual disability	.148
T3 Social impairment	.646 ***
T3 Spent time in conversation	-.154 *
R^2	.586 ***
T4 Social impairment	
Intellectual disability	.179 *
T3 Social impairment	.645 ***
T3 Spent time reading	-.162 *
R^2	.590 ***
T4 Maladaptive behaviors	
Intellectual disability	.202 **
T3 Maladaptive behaviors	.641 ***
T3 Spent Time reading	-.107
R^2	.558 ***
T4 Maladaptive behaviors	
Intellectual disability	.209 **
T3 Maladaptive behaviors	.650 ***
T3 Spent time shopping	.047
R^2	.549 ***

*
 $p < .05$;

**
 $p < .01$;

 $p < .001$.

Table 6

The companions with whom adolescents with ASD engage in conversation ($n = 16$) and read ($n = 37$) across a weekday and a weekend day

Variables	n	%	Mean	SD	Range
<i>Conversation</i>					
With mother	7	44	0.49 hrs	0.27	0.17–1.00 hrs
With father	4	25	0.88 hrs	0.25	0.50–1.00 hrs
With paid professionals	3	19	0.72 hrs	0.48	0.17–1.00 hrs
With siblings	3	19	0.31 hrs	0.17	0.17–0.50 hrs
With peers	2	13	1.25 hrs	1.06	0.50–2.00 hrs
Alone	1	6	0.25 hrs	0	N/A
<i>Reading</i>					
With mother	10	27	0.41 hrs	0.24	0.18–0.71 hrs
Alone	10	27	0.74 hrs	0.72	0.12–2.50 hrs
With father	5	14	0.29 hrs	0.10	0.18–0.36 hrs
With siblings	4	11	0.27 hrs	0.10	0.18–0.36 hrs
With paid professionals	2	5	0.45 hrs	0.38	0.18–0.71 hrs