Examining playground engagement between elementary school children with and without autism spectrum disorder

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Abstract

Little is known about the social behavior of children with and without autism spectrum disorder during recess. This study documented the naturally occurring recess engagement and peer interaction behaviors of children with and without autism spectrum disorder in inclusive school settings. Participants included 51 children with autism spectrum disorder and 51 classmates without autism spectrum disorder who served as peer models matched on gender, classroom, grade, age, and ethnicity. Using a timed-interval behavior-coding system, children with autism spectrum disorder spent approximately 30% of their recess time engaged in solitary activities, whereas their classmates only spent approximately 9% of recess unengaged. In addition, children with autism spectrum disorder spent about 40% of the recess period jointly engaged with peers in a reciprocal activity, conversation, or game as compared to 70% for matched classmates. These findings provide a context for which to interpret intervention outcomes and gains for children with autism spectrum disorder in inclusive settings.

Keywords

autism spectrum disorder; peers; playground engagement; social communication

Children with autism spectrum disorder (ASD) often report they have few friends and are disconnected to the social milieu at school (Bauminger et al., 2010; Kasari et al., 2011). The extant literature has consistently shown that the majority of children with ASD experience poorer social outcomes in schools as compared to children without ASD (Chamberlain et al., 2007; Kasari et al., 2011, 2012; Locke et al., 2013; Rotheram-Fuller et al., 2010). Many studies of children with ASD on school playgrounds find they are often unengaged and isolated (Frankel et al., 2011; Kasari et al., 2011), but the extent to which they may be different from their general education classmates is unknown as comparisons are rarely reported of children within the same context. Without this comparison, it is not possible to determine the context of peer engagement and how to interpret intervention improvements for children with ASD who participate in social engagement interventions in schools.

Recess is a unique time of the school day, where children usually have the freedom to choose whom they play with and what they do. For most children, recess is a context and time when they can practice essential social skills with peers (Yuill et al., 2007). One of the challenges for children who are having difficulty with peer relationships at school is the extent to which adults provide interventions to help them during this time. Often teachers and parents have limited knowledge of what happens during recess. Teaching assistants rather than teachers often supervise recess, and parents are not present at school (Locke et al., 2015).

The use of systematic playground observations can provide important insight into the social engagement of children with ASD (Macintosh and Dissanayake, 2006; Schupp et al., 2013). Observations in mainstream settings have noted that children with ASD who do not have a co-occurring intellectual disability are generally unengaged and participate in more solitary activities during recess than in jointly engaged activities with other children (Bauminger-Zviely et al., 2013; Corbett et al., 2014; Frankel et al., 2011; Kasari et al., 2011; Macintosh and Dissanayake, 2006; Schupp et al., 2013). Children with ASD often do not initiate interactions with other children (reportedly at a rate of 33% of the observed period), but they are likely to respond to others (about three quarters of the time), although they often show increased levels of stress in response to peer initiations (Corbett et al., 2014; Kasari et al., 2011; Schupp et al., 2013).

Playground engagement and peer initiations and responses may serve as meaningful social outcomes for children with ASD in schools and have been consistently identified as intervention targets in research trials. Two recent school-based intervention studies found considerable improvement in children's playground engagement as a result of peer-mediated and adult-facilitated strategies (Kasari et al., 2012; Kretzmann et al., 2014). Other studies have shown improvements in the frequency of positive initiations and responses to peers for children with ASD in school settings using a variety of adult- and peer-mediated strategies (Kalyva and Avramidis, 2005; Licciardello et al., 2008; Wood et al., 2014). While these studies demonstrate that it is possible to improve peer initiations, responses, and engagement for children with ASD in schools, interpretation of improvement is more difficult without understanding the level of engagement and frequency of these social behaviors for classmates within the same recess context. Given children's variability in playground behaviors, it is important to determine what peer engagement looks like in children in inclusive settings.

While we have an increasing number of observational studies of children with ASD in real world settings, we often do not have comparable data on general education classmates. To our knowledge, this study is the first to include behavioral observations of classmates without ASD of children with ASD during the same recess period. Without an understanding of the context in which children with ASD are being compared, it is not possible to determine what is a social *deficit* in children with ASD. Interventions often are not designed for naturalistic settings such as school and when they are implemented in these contexts, they often are not successful (Dingfelder and Mandell, 2010). Comparison data on classmates can be very instructive as we develop interventions for children with ASD, determine intervention objectives in inclusive settings, and interpret intervention outcomes

and gains. In studies of classroom social networks, we now know that children with ASD are more often peripheral to social networks and not as isolated (Chamberlain et al., 2007; Kasari et al., 2011; Locke et al., 2013) as one might have predicted from case studies (e.g. Kanner, 1943). Significant differences in reciprocity for children with and without ASD exist, but we also note that reciprocated friendships are generally about 60% of the typical sample, a far smaller percentage than what might have been predicted. Thus, having comparable data on the classmates of children with ASD during recess will allow us to have a better understanding of what may be occurring in mainstreamed settings that will allow us to determine whether children with ASD indeed need intervention support (Shih et al., 2014). The aims of this study were to compare children with and without ASD during recess for: (a) levels of peer engagement; (b) initiations and responses to peers; and (c) characteristics of both groups that may be associated with more or less social behavior during recess. While we hypothesized significant differences between groups on all behaviors with the group with ASD less engaged with peers, we also expected great heterogeneity in the range of observed engagement such that some children with ASD will be unengaged and others fully engaged.

Methods

Participants

Participants were drawn from a randomized-controlled treatment trial conducted in 42 classrooms in seven public schools in a large urban school district that examined the effects of targeted interventions on the peer relationships and social functioning of elementary-age children with ASD (Autism Intervention Research—Behavioral (AIR-B) network, 2008–2011). The data included in this study were collected at baseline before intervention activities began. Children were included if they were referred by school administrators and had a diagnosis of ASD from a licensed professional, had a documented nonverbal IQ of 65 or higher, were between the ages of 5 and 12 years, and were included in a general education K-5 classroom for at least 80% of the school day. From this study, 51 children with ASD (9 females and 42 males; M_{age} = 8.12, SD = 1.58 years old) with an average IQ of 86.88 (SD = 12.61) were included. The number of males to females with ASD was consistent with the 4:1 male to female prevalence ratio. An additional 51 children (20 females and 31 males) who were nominated by their teachers to serve as peer models for children with ASD were randomly selected using a random- number generated list and matched on classroom, grade, age, and ethnicity, and whenever possible on gender, to be in a comparison group. Children with ASD were first matched to their peers on classroom followed by age, ethnicity, and gender. For children with ASD who did not have a full match on these four variables, they were then matched on age, ethnicity, and gender. The last matching criterion was ethnicity and gender. The proportion of females was significantly higher in the matched sample as compared to the sample with ASD because teachers tend to nominate female peers more frequently than male peers (Locke et al., 2012). Matched peers were an average of 8.06 (SD = 1.54) years old. Overall, there were 21 children in first grade, 33 children in second grade, 17 children in third grade, 20 children in fourth grade, and 11 children in fifth grade. The ethnic backgrounds of the children were over 80% minority consistent with the school population in Los Angeles (LA), and included 10.2% Caucasian, 4.1% African American,

37.8% Asian, 44.9% Latino, and 3% Other. The Autism Diagnostic Observation Schedule subscale scores along with the severity scores for the children with ASD are presented in Table 1. See Table 1 for demographic information.

Measures

Playground Observation of Peer Engagement—The Playground Observation of Peer Engagement (POPE) is a timed-interval behavior-coding system. Independent, blinded observers rated children on the playground for 40 consecutive seconds and then coded for 20 s during the recess or lunch play period (Kasari et al., 2005, 2011). Observers were trained in vivo by one of the developers of the POPE and considered reliable with a criterion α > 0.80. Reliability was collected on 20% of sessions during the study with an average percent agreement score of 0.87 with a range from 0.82 to 0.93. Playground engagement states were expressed as the percentage of intervals children spent in solitary play (i.e. unengaged with others) and jointly engaged with others (i.e. turn-taking in a game or reciprocal engagement in conversations or joint activities). In addition, coders noted two types of initiations toward other children. First, observers coded successful initiations to peers where the target child directed nonverbal or verbal communication to a peer or group of peers who then responded with a nonverbal gesture (e.g. head nod/shake, follows the child, laughs, etc.) or verbal language. Second, observers rated children's unsuccessful initiations where the target child directed communication to a peer/peers and there was no verbal or nonverbal response. Coders also noted two types of responses to others including the target child's appropriate responses to a peer's initiation (e.g. a peer asks, "how are you?" and the child says, "fine") as well as missed responses to a peer's initiation (e.g. a peer asks the child, "how are you?" and the child does not respond). Six variables were computed and used for analysis: successful initiation rate (successful initiations/total length of time observed), total initiation rate (total initiations/total length of time observed), percentage of successful initiations (successful initiations/total initiations), positive response rate (positive response/total length of time observed), response rate (total responses/total length of time observed), and percentage of positive responses (positive response/total opportunities).

Friendship survey—Sociometric data were gathered within each participating class to gain a robust picture of children's peer groups (Cairns et al., 1988). Participating students were asked, "Are there kids in your class who like to hang out together? Who are they?" as a method of identifying specific children within each classroom social network grouping (see coding below). Children listed the names of all children within their classroom who hung out together in a group using free call without additional prompting, class lists, or pictures. Children were reminded to include themselves in groups as well as students of both genders. Young children (in Kindergarten and first grade) with reading and writing difficulties were interviewed individually. These data are presented as a proxy of social inclusion among children with and without ASD.

Coding social network centrality—Social network centrality refers to the prominence of each individual in the overall classroom social structure (Cairns and Cairns, 1994; Kasari et al., 2012). A series of social network analyses were conducted to obtain each student's social network centrality score following the procedures outlined by Cairns and

Cairns (1994). Four categories of social network centrality were generated: isolate (no social connections in the classroom), peripheral (children in the bottom 30% of social connections in the classroom), secondary (children in the middle 40% of social connections in the classroom), and nuclear (children in the top 30% of social connections in the classroom).

Procedure

The consent process involved informed consent by parent, child assent, and school letter of participation. Once target children met criteria for inclusion, research personnel met with the target student's teacher and distributed consent forms to families of teacher-nominated peer models in the classroom for participation in the larger trial. Independent raters observed all children using the POPE twice before the intervention began for both children with ASD and the matched sample during two separate recess periods within 1 week. All observations for children with ASD and their matched peers occurred at the beginning of the morning or lunch recess period and ended when recess was over; observations for both groups occurred in the same playground context. If inclement weather or other special event (e.g. minimum day, field trip, assembly) prevented children from having outdoor recess, observers returned on a different day within the same week to observe children on the playground. Observations were conducted during the normally scheduled recess period across the school year from October to April based on the time of study enrollment. School staff were not directed to interact or facilitate play with children with or without ASD. The number of children on the playground during each observation varied as children's recess period coincided with their grade or grade levels; thus, the exact number of children present during each observation could not be determined. Observers positioned themselves close enough to the target child to hear peer interactions but did not engage children or interfere with normal daily activity. Children were told that the purpose of the observations was to learn what children play on the playground. Only baseline data were used for the analyses.

Data analysis

Of the children, 11% were missing the POPE at entry; hence, multiple imputation (MI) was used to impute missing values for the outcomes of interest (Little and Rubin, 1987; White et al., 2011) in order to achieve maximal power. MI is a simulation-based approach to work with incomplete data using reasonable values to replace missing data. It differs from single imputation because MI generates multiple datasets by replacing each missing value multiple times. Consequently, the error structure is preserved so that valid inferences can be made (Harel, 2009). MI uses a sequential regression multivariate imputation algorithm to generate multiple copies of the dataset where each dataset contains different estimates of the missing values. This algorithm was implemented using the Multiple Imputation by Chain Equations package (Van Buuren and Groothuis-Oudshoorn, 2011) for R CRAN version 3.1.1 (R Core Team, 2014) to generate 30 imputed datasets. Results did not differ if fewer or more imputations were used (e.g. m = 5 or m = 300) indicating that the number of imputations performed was acceptable for generating plausible values to replace the amount of missing data. Variables used for the imputations included the role of child (child with ASD or peer), POPE solitary, POPE joint engagement, as well as all of the peer interaction variables measured. Furthermore, the peer interaction variables depicted severe skewness and were normalized using a log transformation except for the rate variables, which were transformed

using a logit transformation. A small value of 0.01 was added or subtracted from individual values in order to avoid undefined values post transformation. In addition, consistent with Von Hippel (2009), transformation of the measures was performed prior to imputation.

Though age was one of the matching criteria, age was controlled for in all analyses since play and engagement differ for children by age (Dean et al., 2014). Analysis of covariance (ANCOVA) was used to evaluate the differences between children with ASD and matched peer models while controlling for age in each imputed dataset. The degrees of freedom were calculated based on Barnard and Rubin's rule for combining results of identical analyses performed on each of the 30 imputed datasets (Barnard and Rubin, 1999). Random effects (clustering by school) were checked for each of the outcome measures and were found to be non-significant. Hence, the final models in the analysis did not include random effects by school. In addition, Spearman's correlation was used to evaluate the monotonic relationship between initiations, responses, and joint engagement and child characteristics.

Results

Social network centrality descriptive data

A total of 9 children with ASD were isolated, 22 were peripheral, 15 were secondary, and 3 had nuclear social status in their social networks. In contrast, 2 of the matched peers were isolated, 12 were peripheral, 22 were secondary, and 14 had nuclear status. The differences in the distribution of the children's social network were significantly different ($\chi^2(3) = 15.83$, $p = 0.001$). Two children with ASD and one matched peer were missing these data (see Table 1).

Playground observation data

Receiver operating characteristic (ROC) curve analysis indicated that the optimal cut-point for discriminating between children with ASD and the matched sample was 0.53 on the POPE (sensitivity, 0.73; specificity, 0.79). At this cut-point, the POPE was able to detect the majority of true positive cases differentiating children with ASD from their peers (see Figure 1).

Children with ASD spent 29.63% of the total intervals solitary/unengaged and 42.17% jointly engaged with their peers. The matched peers only spent 8.89% solitary/unengaged and 71.69% jointly engaged with their peers on the playground. As expected, there was considerable variability in children's playground engagement and most of the children with ASD had engagement lower than the average engagement of their matched peers. There were a total of 12 children with ASD who had engagement lower than two standard deviations of the mean joint engagement of their matched peers and 14 children with ASD who were between one and two standard deviations below the mean joint engagement of their matched peers. A total of 16 children with ASD were between the mean and one standard deviation below the mean joint engagement of their matched peers. There were nine children with ASD at or above the mean joint engagement of their matched peers, and only one child with ASD who had engagement greater than one standard deviation of the mean engagement of their matched peers (see Figure 2).

The differences in the total percentage of time spent in solitary/unengaged ($M_{diff} = 19.12$ after adjusting for age) or jointly engaged ($M_{diff} = -27.66$ after adjusting for age) between children with ASD and their matched peers were statistically significant ($t(66.34) = 3.53$, $p < 0.001$ and $t(72.24) = -4.16$, $p < 0.001$, respectively) (see Figure 3).

Similar to playground engagement, the initiation and response measures were scaled by the total time observed since not all children were observed for the same amount of time during morning or lunch recess (range 10 to 15 min per observation). Peer interaction behaviors included successful initiation rate, total initiation rate, percentage of successful initiation, positive response rate, total response rate, and percentage of positive response. Children with ASD had on average 6.11 successful initiations, 7.45 total initiations, 5.42 positive responses, and 6.34 opportunities to respond within an average 15-min interval. On the other hand, the peers had on average 10.37 successful initiations, 10.92 total initiations, 9.39 positive responses, and 10.15 opportunities to respond within an average 15-min interval.

Overall, the average percentage of successful initiations for children with ASD to peers was 0.75 and the average percentage of positive responses was 0.82. In contrast, the average percentage of successful initiations for the matched sample was 0.94 and the average percentage of positive response was 0.91 (see Table 2).

There were significant differences for all measures between children with ASD and their peers where children with ASD had significantly fewer successful initiations ($t(87.16) = -3.44$, $p < 0.001$), fewer total initiations ($t(80.71) = -2.33$, $p = 0.02$), lower percentage of successful initiations ($t(41.80) = -3.34$, $p < 0.002$), fewer positive responses ($t(41.80) = -3.34$, $p = 0.002$), fewer total opportunities to respond ($t(80.44) = -2.32$, $p = 0.02$), and lower percentage of positive responses ($t(65.75) = -2.97$, $p = 0.004$). In addition, within the children with ASD, successful and total initiations were significantly and negatively correlated with age, $r = -0.33$, $p = 0.02$ and $r = -0.31$, $p = 0.03$, respectively. However, joint engagement with peers, positive responses, and total responses were not correlated with age, cognitive level, and Autism Diagnostic Observation Schedule (ADOS) severity scores among the children with ASD. On the other hand, among the matched sample, successful and total initiations as well as joint engagement were not significantly correlated with age. Finally, successful initiations, total initiations, positive responses, total responses, and joint engagement with peers did not significantly differ between males and females in both children with ASD or the matched sample.

Discussion

This study examined joint engagement and peer interaction behaviors during recess of children with ASD in comparison to a matched sample of general education classmates. On average, children with ASD spent about 40% of the recess period jointly engaged with peers in a reciprocal activity, conversation, or game as compared to 70% of their classmates. Consistent with the literature, children with ASD spent approximately 30% of their recess time engaged in solitary activities (Frankel et al., 2011; Kasari et al., 2011), whereas the matched peer models only spent approximately 9% of recess unengaged. In addition, children with ASD had fewer initiations and responses and were less frequently successful

in initiating and responding as compared to children in the matched sample. Although these data provide further evidence of the disparity in social functioning between children with ASD and their peers in school, they also raise important implications for children with ASD in inclusive settings.

Much of the literature focuses on the social limitations of children with ASD; however, it is important to note that in this study, children with ASD demonstrated several socially successful behaviors with peers on the playground. Although significantly less than their matched peers, children with ASD were jointly engaged for just under half of the recess period prior to undergoing intervention. In fact, there were nine children with ASD at or above the mean joint engagement of the matched sample, with one student with ASD at 100% joint engagement. These data suggest that there are some children with ASD who are doing well with peers during recess and do not need additional intervention support. Although peer interaction may be very stressful and uncomfortable for some children with ASD especially since they are expected to behave in certain ways in line with their classmates throughout the school day, children with ASD had remarkable initiation (75%) and response (82%) rates as compared to previous reports in the literature (Kasari et al., 2011). While there may be considerable variability in playground engagement and frequency of peer interaction behaviors for children with ASD, these results suggest that children with ASD are not completely socially isolated and, in fact, do have frequent interactions with their peers at school contrary to what some believe. Future studies should explore individual characteristics of children with ASD to determine specific profiles and learn from children with ASD who are successfully engaging with their peers in inclusive settings without intervention support as well as the environmental supports that may be needed to promote successful peer engagement for some children with ASD.

The data from this study document the level of engagement and frequency of peer interaction behaviors that may provide a context in which to interpret intervention outcomes and gains. The playground and peer interaction behaviors of children with ASD and their peers vary, and these data may be helpful in making decisions about intervention objectives, duration of treatment, and adaptations of intervention strategies to fit the needs of children with ASD and their schools (Shih et al., 2014). There is an assumption that all children with an ASD diagnosis require social skills intervention. In fact, various factors that influence peer engagement at school may affect if, when, and how interventions are delivered. For example, some children with ASD may truly prefer solitary activities and may not want intervention support, whereas others may need some sort of structured support to interact with peers on the playground. There were 26 children with ASD between one and two standard deviations below the mean joint engagement of the matched sample. For these children, environmental manipulations (e.g. structured opportunities to engage with their peers, peer training) or other support (e.g. coaching) on the playground may be warranted. Ultimately, the decision to intervene should include the needs and desires of the child with ASD.

These data suggest several recommendations. First, it is natural for all children to spend a portion of recess (approximately 10% of the recess period) engaged in solitary activities. This may be an opportunity for children to get a drink of water, use the bathroom,

decompress from classroom stressors, and so on; thus, children with ASD should be given this opportunity as well. While recess is a natural break during the school day, the percentage of time children with ASD spend in solitary activities should be closely monitored to determine why children with ASD are unengaged. There is a clear difference between solitary and solitude. Although it is possible that some children with ASD choose to spend their recess period unengaged, it is important to ask children and their families what they wish to do at recess. Many children with ASD who have been interviewed report they desire friends and do not wish to be alone (Bauminger and Kasari, 2000). It also is possible that some children with ASD are unengaged on the playground even though they are socially motivated to interact with their peers because they lack social skills. If the latter, efforts ought to be made to better support children with ASD during recess. Second, since the goal of many interventions is to decrease the amount of time children spend unengaged, thereby increasing the amount of time in joint engagement, setting a goal of 53% (the cutpoint that differentiates children with ASD from their peers) engagement may be a reasonable intervention objective to strive toward. Children who spend approximately 53% of the recess period engaged may not need intervention that specifically targets joint engagement (Shih et al., 2014). Third, in this study, the matched sample had extremely high initiation (94%) and response (91%) rates to peers, whereas children with ASD had slightly lower, but statistically significantly different levels of initiation and response rates. Given the frequency with which children initiate and respond to peers, children with ASD may need additional support in these domains to keep up with their peers. Lastly, additional research on school-based interventions that address social ability is needed to determine appropriate strategies to close the gap between children with ASD and their peers. Because the goal of many interventions is to remediate deficits, gains often are interpreted with regard to what is generally observed in the typical population. However, it may be unrealistic to expect children who spend 0% joint engagement to blossom to 53% joint engagement after a short-term intervention. Thus, setting attainable and practical goals tied to important decision points (time of the school year or dose of intervention) may be an important step needed in intervention trials (Shih et al., 2014). Additional measures of social involvement also are important to consider when creating intervention goals, as playground behavior is only one dimension of a complex social situation for children with ASD at school. Social network surveys, parent and teacher reports, and environmental measures add dimensionality to understanding children's social behavior and relationships. Furthermore, understanding interactions between the quality and quantity of peer engagement of children with ASD and their schoolmates will provide a better research base on which to build and refine intervention techniques.

Limitations

Several study limitations should be noted. First, the relatively small sample size of children with ASD and matched peers limit the generalizability of the findings to larger cohorts. Second, the data were cross-sectional; therefore, changes in playground engagement and peer interaction behaviors over time were not examined. Thus, it was not possible to determine whether the observed findings are consistent within time of the school year or a function of age and grade given the relatively small numbers per grade. Future longitudinal studies are needed to determine when playground engagement and peer interaction

behaviors change that might warrant intervention and additional supports. Third, only two observations were used to characterize the playground engagement and peer interaction behaviors of children with and without ASD. Although consistent with previous observational studies of children with ASD (Frankel et al., 2011; Kasari et al., 2011, 2012), the extent to which two observations are enough to adequately characterize the interactions of children with and without ASD in the school context may not be sufficient (Bottema-Beutel et al., 2014). Rather, Bottema-Beutel et al. (2014) suggest that the number of observations required to produce reliable estimates may vary depending on the outcome measure and time point in the school semester. While behavioral observations serve as a gold standard for assessing children's social engagement on the playground, they often are time intensive and costly to conduct (Locke et al., 2014). Future research should carefully consider increasing the number of observations to ensure reliability of the data. Fourth, the use of peer models as the matched sample may inflate the level of peer engagement and overall peer interaction behaviors found in typically developing children as peer models may be more socially adept as compared to children not selected as peer models (Locke et al., 2012). We included descriptive data on children's social network centrality as a proxy of social functioning. These data indicated a range of social network inclusion for both children with and without ASD with the majority of children with ASD in the peripheral range and the majority of the matched peers in the secondary range. It is important to note that there were 14 matched peers in the isolate or peripheral categories, which suggest that not all peer models have social abilities well in advance of their peers with ASD. Teachers selected peer models because they exhibit strong social skills and may be better equipped to support students with ASD on the playground; however, there is not a one to one correspondence between teachers' perceptions of peer models and peer assessments of social inclusion. Nevertheless, the results of this study should be interpreted with caution as the level of joint engagement and frequency of peer interaction behaviors observed in this study may be overinflated considering their source. A normative comparison group (i.e. classmates that were not selected as peer models) might have levels of joint engagement that actually fall between children with ASD and the matched sample addressed in this study. Observing typically developing children at random who are not selected to be peer models may provide a more accurate representation of the level of engagement and frequency of peer interaction behaviors during recess and may provide a more appropriate context in which to compare children with ASD. Furthermore, there were more females than males in the matched sample. Because ASD affects more males than females, there were more males with ASD in this study. Unfortunately, the number of males and females did not reflect the same 4:1 ratio for the matched sample of general education classmates. The increased number of females in the matched sample is important to note as females may have more frequent as well as qualitatively different interactions with peers on the playground as compared to males (Dean et al., 2014). Future studies should examine factors associated with the different patterns of social behavior between males and females with or without autism.

Conclusion

Numerous studies have highlighted the importance of conducting observations to judge what is really happening at school for children with ASD (Kasari et al., 2012; Locke et al., 2012).

Without some metric for comparison in a real world context, however, it is difficult to know what one should expect for children with ASD. This study provided potential standards of playground engagement and frequency of peer interaction behaviors in children with and without ASD during public school recess periods. These data may be critically important in setting engagement goals for children with ASD as school-based interventions become the norm to support children with ASD with their peers.

Acknowledgements

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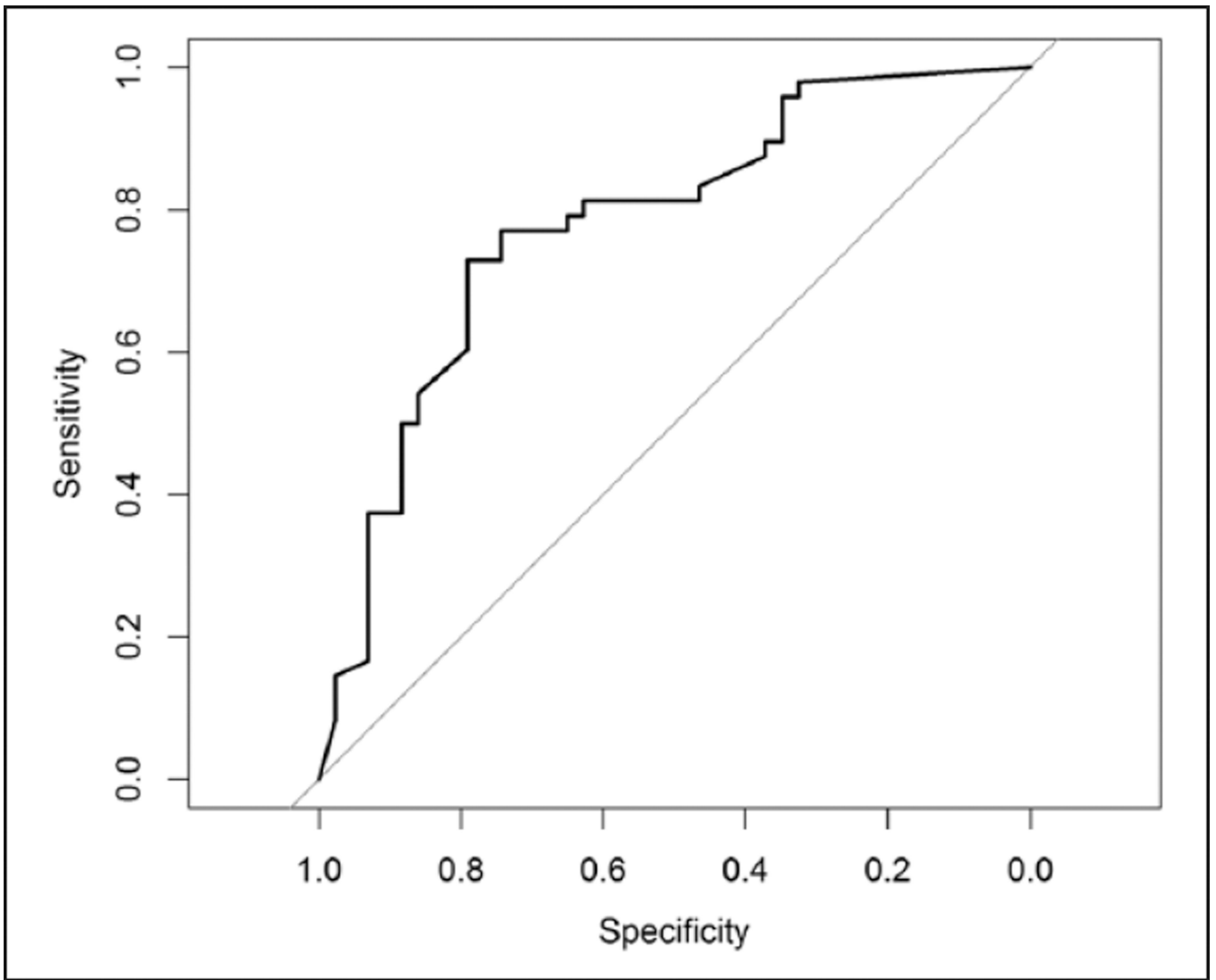
Figure 1.
ROC curve for 53% engagement cutoff differentiating children with ASD with typical developing peers.
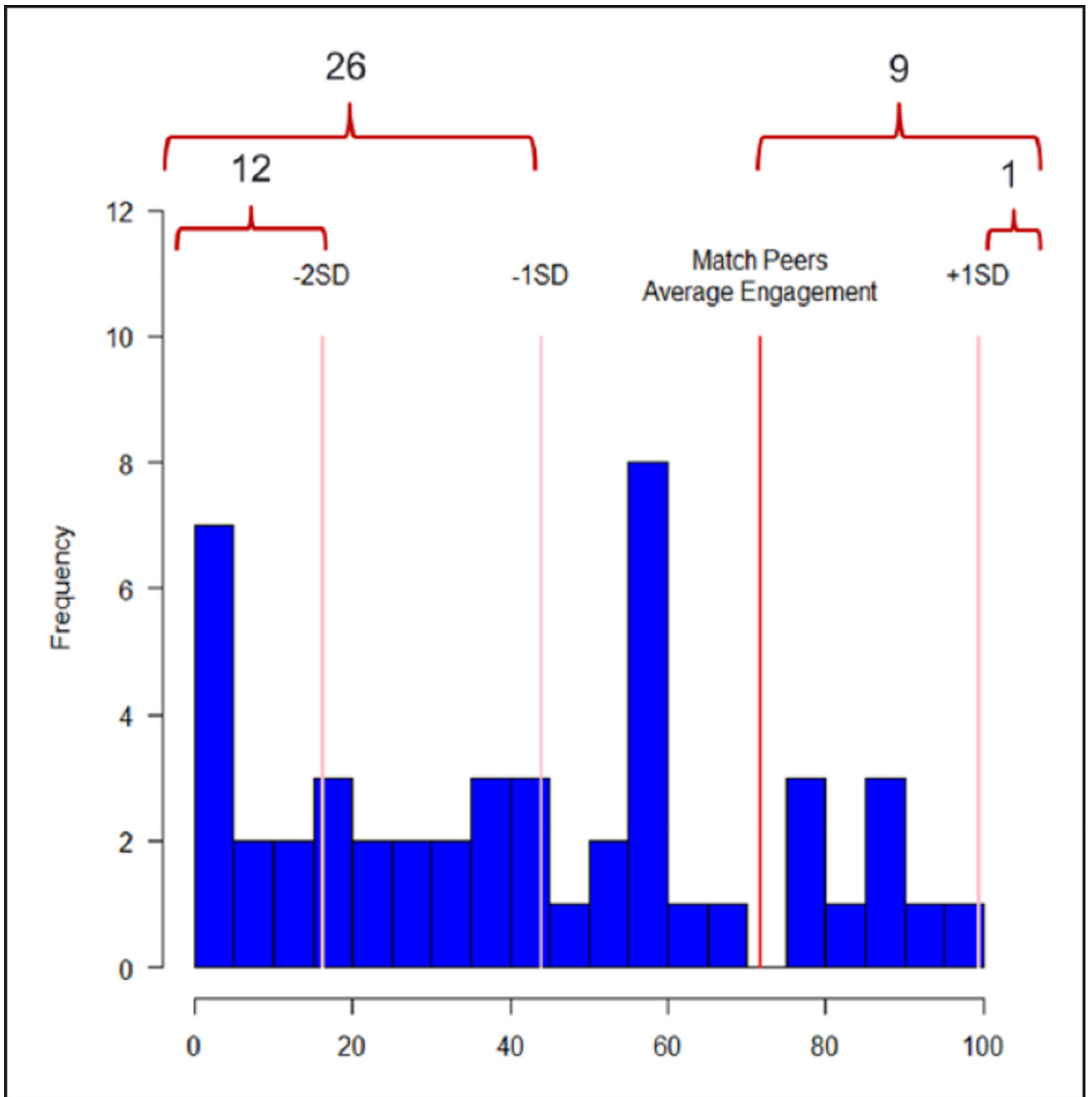
Figure 2.
Joint engagement for children with ASD along with the number of children with ASD above/below ±1 SD or ±2 SD of the matched peers' average engagement.
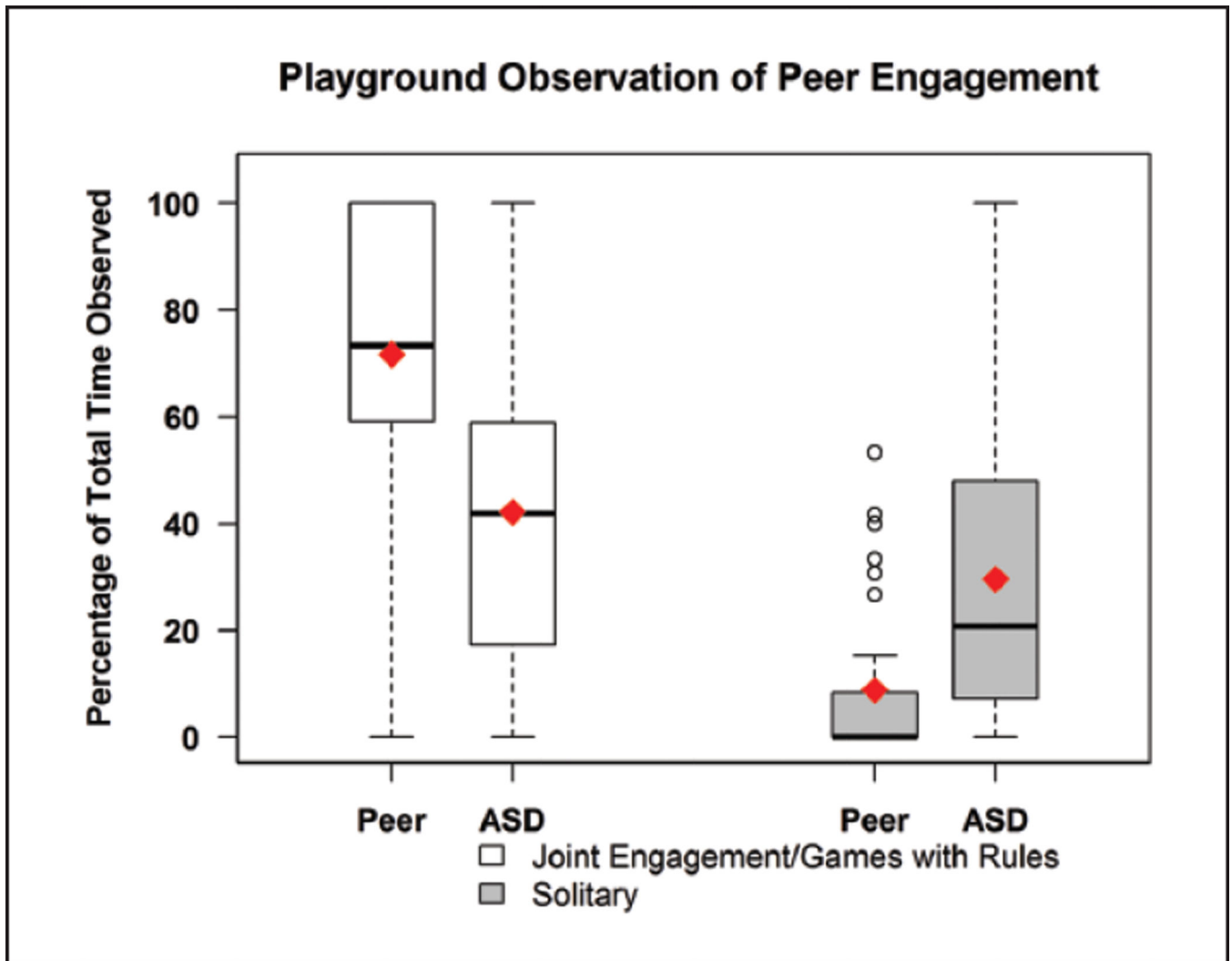
Figure 3.
Solitary and joint engagement comparisons of children with ASD and their matched peers. Black bars indicate the median and the diamonds are the averages. The length of the whiskers of the box plot represents ±1.5 interquartile range from the 25th percentile or the 75th percentile.

Table 1

Demographic characteristics, engagement, and peer interaction behaviors for children with autism spectrum disorder (ASD) and their matched peers.

Demographics	Matched Peers (n = 51)	Children with ASD (n = 51)	Cohen's d
	Mean (SD)	Mean (SD)	
Male: n (%)	31 (60%)	42 (82%)	
Age	8.06 (1.54)	8.12 (1.58)	
Social network centrality			0.22[a]
Isolate	2 (4%)	9 (18%)	
Peripheral	12 (24%)	22 (45%)	
Secondary	22 (44%)	15 (31%)	
Nuclear	14 (28%)	3 (6%)	
Stanford–Binet IQ[b]	–	86.88 (12.61)	
ADOS			
Social affect	–	9.80 (3.99)	
Restricted and repetitive behavior	–	2.90 (1.76)	
Severity score	–	7.14 (2.16)	
Playground Observation of Peer Engagement			
Solitary	8.89% (15%)	29.6% (27.31%)	0.94
Joint engagement	71.69% (27.70%)	42.17% (29.09%)	1.04
Peer interaction behavior			
Successful initiations rate	0.69 (0.53)	0.41 (0.38)	0.61
Total initiations rate	0.73 (0.53)	0.50 (0.40)	0.49
% of successful initiation	0.94 (0.11)	0.75 (0.23)	1.07
Positive response rate	0.63 (0.46)	0.36 (0.33)	0.66
Total response rate	0.68 (0.46)	0.42 (0.36)	0.62
% of positive response	0.91 (0.15)	0.82 (0.19)	0.51

SD: standard deviation; ADOS: Autism Diagnostic Observation Schedule.

[a] Cramer's V.

[b] IQ was not measured for the matched sample.

Table 2

Engagement and peer interaction behaviors for children with ASD and their matched peers.

	Matched peers		Children with ASD	
	Female	Male	Female	Male
	Mean (SD)		Mean (SD)	
POPE				
Engagement	69.17 (27.61)	73.51 (28.18)	40.37 (29.02)	42.53 (29.45)
Solitary	8.16 (15.29)	9.42 (15.09)	25.22 (22.27)	30.51 (28.37)
Peer interaction behavior per minute				
Successful initiation rate	0.76 (0.64)	0.64 (0.45)	0.56 (0.41)	0.38 (0.38)
Total initiation rate	0.77 (0.63)	0.69 (0.46)	0.68 (0.48)	0.46 (0.37)
% of successful initiation	0.96 (0.08)	0.92 (0.12)	0.83 (0.15)	0.74 (0.24)
Positive response rate	0.66 (0.44)	0.60 (0.48)	0.36 (0.28)	0.36 (0.35)
Total opportunities to respond rate	0.69 (0.43)	0.66 (0.49)	0.40 (0.29)	0.43 (0.37)
% of positive response	0.93 (0.16)	0.91 (0.16)	0.92 (0.10)	0.81 (0.21)

ASD: autism spectrum disorder; SD: standard deviation; POPE: Playground Observation of Peer Engagement.