Infant Ment Health J. Author manuscript; available in PMC 2016 December 20.

Published in final edited form as:
Infant Ment Health J. 2012 November 1; 33(6): 633–650. doi:10.1002/imhj.21353.

DEVELOPMENT OF DISRUPTIVE BEHAVIORS IN YOUNG CHILDREN: A PROSPECTIVE POPULATION-BASED COHORT STUDY

RAYMOND H. BAILLARGEON,
University of Ottawa

ALEXANDRE MORISSET,
Université de Montréal

KATE KEENAN,
University of Chicago

CLAUDE L. NORMAND,
Université du Québec en Outaouais

JEAN R. SÉGUIN,
Universite de Montréal

CHRISTA JAPEL, and
Université du Québec á Montréal

GUANQIONG CAO
University of Ottawa

Abstract

We know relatively little about the development of disruptive behaviors (DBs), and gender differences therein. The objective of this study was to describe the continuity and discontinuity in the degree to which young children in the general population are reported to exhibit specific DBs over time. Data came from the Québec Longitudinal Study of Child Development. First, the results show that relatively few children exhibit DBs on a frequent basis at 41 months of age. Second, the results show that a majority of children who exhibit a particular DB on a frequent basis at 41 months of age did not do so 1 year earlier. In addition, a majority of children who exhibited a particular DB on a frequent basis at 29 months of age no longer do so 1 year later. Third, gender differences in DBs (boys > girls) are either emerging or at least increasing in magnitude between 29 and 41 months of age. Consistent with the canalization of the behavioral development principle, children who exhibited DBs on a frequent basis at 29 months of age are less likely to stop doing so in the following year if they had exhibited the same behaviors at 17 months of age.

Many disruptive behaviors (DBs) already are part of the behavioral repertoire of the child by the end of the second year of life (Forman, 2007; Hay, 2005; Loeber & Hay, 1994; D.M.

Direct correspondence to: Raymond H. Baillargeon, Interdisciplinary School of Health Sciences, 35 University Private, University of Ottawa, Ottawa, Ontario, Canada, K1N 6N5; raymond.baillargeon@uottawa.ca.

Ross & Ross, 1976; Stifter & Wiggins, 2004; Tremblay et al., 1999). The next 2 years of life also are often considered to be very important for children's socioemotional development (Brownell & Kopp, 2007; Sroufe, 1995; see also Campbell, 1990, 2002).

There is now emerging epidemiological evidence about the development of DBs during toddlerhood. First, relatively few children in the general population exhibit DBs on a frequent/severe basis before 2 years of age (Baillargeon, Normand et al., 2007; Heinstein, 1969; Mathiesen & Sanson, 2000). In a probability sample representative of children born in 1997 to 1998 to mothers living in the Canadian province of Québec (N = 1,985), 13 behaviors of opposition-defiance, inattention, hyperactivity, and physical aggression were investigated (Baillargeon, Normand et al., 2007). At 17 months of age, based on mothers' reports (i.e., ratings on a 3-point Likert scale—*never*, *sometimes*, or *often*), behaviors of physical aggression and inattention were exhibited on a frequent basis by fewer than 6% of children. Behaviors of opposition-defiance were more common. Between 10 and 16% of children exhibited these behaviors on a frequent basis. As for hyperactivity behaviors, at least 17% and up to 36% of children exhibited them on a frequent basis. Similar findings were obtained in large-scale studies that documented the intensity/severity/frequency of DBs in children under 2 years of age (e.g., Tremblay et al., 1999; van Zeijl et al., 2006).

Second, gender differences appear to already be present in some DBs before 2 years of age (Baillargeon, Normand et al., 2007).[1] The study by Baillargeon, Normand et al. (2007) found that at 17 months of age, boys were more likely than were girls to be distracted, restless, or hyperactive and to fidget, kick, bite, and hit other children on a frequent basis. Further, gender differences increased in magnitude between 17 and 29 months of age in some of these DBs (i.e., restless or hyperactive and fidgets) and emerged in others (i.e., fights and attacks), with boys being more likely to start and girls being more likely to stop exhibiting DBs on a frequent basis during this period.

Third, there is substantial discontinuity in the degree to which children exhibit DBs during toddlerhood. In the study by Baillargeon, Normand et al. (2007), a majority of children who had exhibited a particular DB on a frequent basis at 17 months of age did not behave that way 1 year later. In addition, generally, a majority of children who exhibited a particular DB on a frequent basis at 29 months of age had not done so 1 year earlier.

In this article, we follow up on the earlier study by Baillargeon, Normand et al. (2007) and describe the continuity and discontinuity (and gender differences therein) in the degree to which children in the Québec population were reported to exhibit different DBs between 29 and 41 months of age. We do so while taking into account the degree to which these children were reported to have exhibited these behaviors at 17 months of age.

[1]Note, however, that no gender differences in DBs were found in the University of California Control Study (Macfarlane, Allen, & Honzik, 1954), except for one behavior of irritability (N = 116 for children at 21 months of age), in the Norwegian study by Mathiesen and Sanson (2000; N = 921 for children at 18 months of age) (K.S. Mathiesen, personal communication, May 2003), and in the 1956 Child Health Survey (Heinstein, 1969), based on our reanalysis of the data (n = 86 for children 12–17 months old; n = 97 for children 18–23 months old).

DEVELOPMENT OF DBs DURING LATE TODDLERHOOD AND THE EARLY PRESCHOOL PERIOD

Starting or Ceasing to Exhibit DBs on a Frequent Basis Between 29 and 41 Months of Age

Even during late toddlerhood and the early preschool period when there can be a marked decrease in the proportion of children who exhibit DBs, children who start exhibiting a particular DB between 29 and 41 months of age could represent a substantial proportion of the children who, at 41 months of age, frequently exhibit this behavior. To our knowledge, there is only one epidemiological study that has directly addressed that issue. Jenkins, Owen, Bax, and Hart (1984) found that a majority (i.e., 83.3%, or 10 of 12) of children who were difficult to manage on a frequent basis at 3 years of age had not been so 1 year earlier. They also found that more than one third (i.e., 43.3%, or 13 of 30) of children who exhibited temper tantrums on a daily basis at 3 years of age had not done so 1 year earlier. In contrast, even if the proportion of children who exhibit DBs were to increase during late toddler-hood and the early preschool period, children who stop exhibiting a particular DB on a frequent basis between 29 and 41 months of age could represent a substantial proportion of the children who, at 29 months of age, frequently exhibited this behavior. Again, Jenkins et al. found that a majority of children who had been difficult to manage (i.e., 71.4%, or 5 of 7) or had exhibited temper tantrums (i.e., 55.3%, or 21 of 38) on a frequent basis at 2 years of age did not behave that way 1 year later. Overall, it may be that starting to exhibit DBs on a frequent basis and ceasing to do so both constitute important aspects of the development of DBs in young children. The importance of the former may come from the fact that children's conflicts with their mothers and siblings (and, possibly, also with their peers) do not actually decrease in frequency during this period (Tesla & Dunn, 1992). In addition, children perhaps may be more likely to use not only their increasingly sophisticated sociocognitive skills but also other means (e.g., force, noncompliance) to get their own way (Tesla & Dunn, 1992; see also Dunn, 1988). Hence, children's close relationships may actually become less, not more, harmonious during this period. The importance of this aspect would be inconsistent, however, with the arrested socialization hypothesis according to which development essentially follows a unidirectional trajectory where children learn not to exhibit DBs over time (Patterson, 1982; Tremblay, 2003, 2008).

Development of Gender Differences in DBs Between 29 and 41 Months of Age

Another reason for describing the continuity and discontinuity in the degree to which children exhibit DBs over time is to determine whether gender differences in DBs are increasing in magnitude (or emerging if they were not already present) during late toddler-hood and the early preschool period. On one hand, it may be that boys are more likely than are girls to start exhibiting DBs on a frequent basis between 29 and 41 months of age. On the other hand, girls may be more likely than are boys to stop exhibiting these behaviors on a frequent basis during this period. All in all, gender differences could be present in both aspects of the development of DBs in young children. This would be consistent with a number of different explanations that have been proposed over the years to account for a hypothesized increase in the magnitude of gender differences in DBs during this period (Cairns & Kroll, 1994; Eme, 2007; Hay, 2007; Keenan & Shaw, 1997). For instance, boys

may be more likely to start exhibiting physically aggressive behaviors on a frequent basis between 29 and 41 months of age because when resorting to force in social conflicts, they are more effective in inflicting harm due to greater forearm length. In addition, girls may be more likely to stop exhibiting these behaviors on a frequent basis during this period because they are better able to use verbal strategies to resolve their disputes. Girls also may be under greater pressure from parents (and other socialization agents) to stop exhibiting DBs (Hay, 2007; Keenan & Shaw, 1997).

Effect of Early DBs on the Development of the Same Behaviors Between 29 and 41 Months of Age

Finally, it is important to determine whether DBs exhibited before 2 years of age affect the continuity and discontinuity in the degree to which children exhibit the same DBs during late toddlerhood and the early preschool period. On one hand, it may be that children who, at 29 months of age, did not exhibit a particular DB on a frequent basis are more likely to start doing so in the following year if they had exhibited the same behavior at 17 months of age. On the other hand, children who, at 29 months of age, exhibited a particular DB on a frequent basis may be less likely to stop doing so in the following year if they had exhibited the same behavior at 17 months of age. Overall, DBs exhibited before 2 years of age could affect both aspects of the development of DBs in young children. This would be consistent with Kuo's (1967/1976) concept of canalization of behavioral development, according to which there is a gradual reduction of behavioral plasticity during the course of development (also see Gottlieb, 1991; Schlichting & Pigliucci, 1998). This broadly applicable principle also is realized in the early onset hypothesis (Loeber, 1982; also see Caspi & Moffitt, 1995), according to which the DBs of some individuals are more likely to show continuity over time; namely, the DBs of children who exhibited the same DBs earlier in life. However, not all developmental theorists share the view that early DBs can affect the development of the same behaviors later in life. Some have postulated predictability at the level of the quality of the child's adaptations to salient developmental issues across developmental periods, but not at the level of specific behaviors (Sroufe, 1979, 1995; Sroufe & Rutter, 1984; also see Campbell, 2002), or, at least, not reaching before 2 years of age (Kagan & Moss, 1962; Kagan, 1984; Rutter, 1984). Others dispute altogether the possibility of prediction in individual development (e.g., Lewis, 1990, 2000).

Objective

We know relatively little about the development of DBs that usually comprise scales of externalizing behavior problems (Task Force on Research Diagnostic Criteria: Infancy and Preschool, 2003). In addition, there is now emerging epidemiological evidence that substantial differences do exist in the development of DBs that are often used to assess a particular behavior problem (Baillargeon, Normand et al., 2007). As a corollary, results obtained at the level of a particular behavior problem (e.g., gender differences) are not generalizeable to the DBs (and vice versa) (Thissen, Steinberg, & Gerrard, 1986) (In contemporary psychiatry, both the syndromes and the individual symptoms are believed to be appropriate units of analysis; Mojtabai & Rieder, 1998; also see Costello, 1992; Persons, 1986.) Another reason for focusing on the development of specific DBs is that similarities

that exist in the development of DBs may help us infer the main characteristics of what constitutes the normative development of these behaviors.

The aim of this study is to describe the continuity and discontinuity in the degree to which boys and girls in the general population exhibit different DBs between 29 and 41 months of age. More specifically, we want to investigate the following issues:

- *The importance of starting and ceasing to exhibit DBs on a frequent basis between 29 and 41 months of age.* What is the proportion of children who exhibited a particular DB on a frequent basis at 41 months of age who had not done so 1 year earlier? What is the proportion of children who exhibited a particular DB on a frequent basis at 29 months of age who were no longer doing so 1 year later?
- *Gender differences in the likelihood of starting and/or ceasing to exhibit DBs on a frequent basis during this period.* Are boys more likely to start exhibiting a particular DB on a frequent basis between 29 and 41 months of age, are girls more likely to stop doing so, or both?
- *Whether DBs exhibited at 17 months of age affect the likelihood of starting and/or ceasing to exhibit the same DBs on a frequent basis between 29 and 41 months of age.* Are children who did not exhibit a particular DB on a frequent basis at 29 months of age more likely to start doing so in the following year if they had exhibited the same behavior at 17 months of age? Are children who exhibited a particular DB on a frequent basis at 29 months of age less likely to stop doing so in the following year if they had exhibited the same behavior at 17 months of age?

METHOD

Participants

The Québec Longitudinal Study of Child Development (QLSCD) is conducted by the Direction des enquêtes longitudinales et sociales (formerly Santé Québec), a division of the Institut de la statistique du Québec (ISQ). It has been following a representative birth cohort of singletons born to mothers living in the province of Québec, Canada, between October 1997 and July 1998. The 2,817 infants selected from the official records of birth certificates represented approximately 94.5% of the target population, which in turn represented approximately 96.6% of the Québec population of newborns (for more details on the QLSCD methodology, see Jetté, 2002; Jetté and Des Groseilliers, 2000). For the first wave of data collection, when the infants were between 59 and 64 weeks of corrected age (defined as the sum of the duration of pregnancy and the chronological age of the baby), the parents of 2,120 infants (i.e., 2,120/2,817 = 75.3% cross-sectional response rate) were respondents to the main questionnaire used by the QLSCD (discussed later). Subsequently, the parents of 2,045 [i.e., 2,045/2,120 = 96.5% longitudinal response rate (LRR)], 1,997 (i.e., 94.2% LRR), and 1,950 (92.0% LRR) infants participated in the second, third, and fourth waves, respectively, of data collection when the children were approximately 17, 29, and 41 months of age, respectively. In fact, relatively few respondents stopped participating after the first

wave of data collection, with 1,924 (90.8% LRR) respondents taking part in all four waves. The following is known about the first wave of data collection: Of the 2,120 respondents, 41.5% of the infants were firstborn, 80% of families were still intact when the infant reached 5 months of age, 11.7% of respondents reported social assistance as the household's principal source of income, 16% of parents were immigrants (mainly of non-European origin), and 18.0% of them did not have a high-school diploma. French was the only language spoken at home in 75% of the households (for a more detailed description of the sociodemographic characteristics of the infants' households in the first wave of data collection, see Baillargeon, Zoccolillo et al., 2007; Desrosiers, 2000).

Materials

A computerized questionnaire was administered during a face-to-face interview conducted in the child's home with the person most knowledgeable (PMK) about the child. In more than 99% of cases, the PMK was the child's biological mother. Mothers are arguably the most important source of information about young children's DBs because they are likely to be familiar with their child's behavior across a range of different settings. Furthermore, mothers are expected to be good informants especially when, as in this study, the focus is on specific behaviors that are relatively easy to observe and require little inference (Campbell, 1990; Carter, Briggs-Gowan, Jones, & Little, 2003; Dunn & Kendrick, 1980; Earls, 1980b; Jenkins, Bax, & Hart, 1980; Radke-Yarrow & Zahn-Waxler, 1984; Willoughby & Haggerty, 1964; Zahn-Waxler & Radke-Yarrow, 1982).

Ten behaviors of opposition-defiance, inattention, hyperactivity, and physical aggression were considered in this study (see Table 1). These DBs are the same as those in the study by Baillargeon, Normand et al. (2007), except for three behaviors of physical aggression (i.e., kicks other children, bites other children, and hits other children). At the fourth wave of data collection when children were approximately 41 months of age, these were replaced by a single behavior (i.e., kicks, bites, or hits) to reduce the overall length of the face-to-face interview. Most DBs came from the Child Behavior Checklist/2–3 (Achenbach, 1992; Achenbach, Edelbrock, & Howell, 1987). One behavior of inattention (Behavior 4: inattentive) was taken/adapted from the Preschool Behavior Questionnaire (Behar & Stringfield, 1974; Fowler & Park, 1979) (see Table 1). Three behaviors of inattention (Behavior 5: easily distracted) and hyperactivity (Behaviors 7: fidgets and 8: difficulty waiting) were taken from the Survey Diagnostic Instrument (Boyle et al., 1987; Offord et al., 1987) (see Table 1). Further evidence of the DBs' validity comes from their use in a number of different scales of externalizing behavior problems (e.g., Achenbach & Rescorla, 2000; Carter et al., 2003; R. Goodman 1994, 1997). Each DB was rated by the PMK using a 3-point Likert scale: 1 (*never or not true*), 2 (*sometimes or somewhat true*), and 3 (*often or very true*). At the fourth wave of data collection, a 12-month reference period was specified. At the third wave of data collection, such a reference period was not specified, but mothers probably recalled being asked about these behaviors (and other recurring themes in the questionnaire) at the previous visit when children were approximately 17 months of age. Hence, it seems fair to assume that they were reporting about events that occurred since the last interview. If the issue was raised, the mothers were told by the interviewers to report on events since the last interview (ISQ, personal communication, 10 June 2011).

Design and Procedure

Weighted data for each DB were subjected to hierarchical loglinear modeling (Fienberg, 1980), with the behavior in question at 41 months of age (denoted *D*) as the dependent variable, and the same behavior at 17 and 29 months of age and the child's gender (denoted *B*, *C*, and *G*, respectively) as the independent variables. A parameter of particular interest in this study consisted of the conditional probability of a randomly selected child in the general population exhibiting a particular DB never, sometimes, or often at 41 months of age given the degree to which he or she had exhibited the same behavior at 17 and 29 months of age as well as the child's gender. The goal was to reproduce the observed frequencies in the four-way contingency table while including as few effects as possible (i.e., BD, CD, GD, BCD, CGD, BGD, and BCGD). Note that the BCG interaction effect as well as the BC, BG, and CG main effects were all included in the different hierarchical loglinear models considered in this study. For each DB, we eliminated cases with missing values (i.e., *don't know* or *refusal* rating categories) on any given wave of data collection. Very few cases (<2.0%) were eliminated for that reason, except for one behavior of hyperactivity (Behavior 8: difficulty waiting), where the partial nonresponse rate was 4.3% for boys and 4.4% for girls because of a higher than usual rate of *don't know* responses (see Table 1).

Goodness-of-fit assessment and maximum likelihood estimation—The goodness-of-fit of a particular hierarchical loglinear model was assessed using three goodness-of-fit test statistics: the Pearson chi-square (χ^2), the likelihood-ratio chi-square (L^2), and the Cressie-Read (CR), with Cressie and Read's (1984) recommended weight of 2/3 for sparse data. These statistics have a large sample χ^2 distribution under certain conditions (Clogg, 1979). The L^2 statistic also was used to compare hierarchically related models because it can be partitioned exactly (Fienberg, 1980). Because of the QLSCD's design effect that increases the risk of falsely rejecting the null hypothesis, a conservative alpha level (i.e.,$\alpha = 0.01$) was used (Thomas & Heck, 2001). Maximum likelihood parameter estimates for the different hierarchical loglinear models considered in this study were obtained using the Expectation Maximization (EM) algorithm from lEM, a computer program for the analysis of categorical data (Vermunt, 1997).

RESULTS

DBs at 41 Months of Age

Table 1 presents the percentage of boys and girls who were reported to exhibit a particular DB at 41 months of age (Estimates of the same percentage at 17 and 29 months of age also are presented for comparison purposes.) Relatively few children exhibited DBs on a frequent basis at 41 months of age. In fact, generally less than 10% of children did so, except for four behaviors of hyperactivity (Behaviors 6: restless or hyperactive, 7: fidgets, and 8: difficulty waiting) and opposition-defiance (Behavior 1: defiant) (see Table 1). Among the 10 DBs considered in this study, *physically attacked people* was the least common, with less than 30% of children exhibiting this behavior at 41 months of age (see Table 1). The behavior *was defiant or refused to comply with adults' requests or rules* was the most common, with over 90% of children exhibiting this behavior occasionally or frequently at 41 months of age (see Table 1).

Starting or Ceasing to Exhibit DBs on a Frequent Basis Between 29 and 41 Months of Age

Table 2 presents the percentage of boys and girls who were reported to have started exhibiting a particular DB on a frequent basis between 29 and 41 months of age. The percentage of children who did so varied greatly from one behavior to another (see Table 2). At one extreme, 1% of girls started physically attacking people on a frequent basis during this period. At the other extreme, 18.1% of boys started being frequently defiant during this period. Further, a majority of children who exhibited a particular DB on a frequent basis at 41 months of age had not done so 1 year earlier, except for two behaviors of hyperactivity (Behaviors 6: restless or hyperactive, and 7: fidgets) (see "1 − Hit Rate" in Table 2). For instance, 78.0% of boys and 82.2% of girls who frequently fought at 41 months of age had not done so 1 year earlier. Hence, the percentage of children who started exhibiting DBs on a frequent basis between 29 and 41 months of age appears substantial.

Table 2 also presents the percentage of boys and girls who were reported to have stopped exhibiting a particular DB on a frequent basis between 29 and 41 months of age. Again, the percentage of children who did so varied greatly from one behavior to another (see Table 2). Furthermore, a majority of children who exhibited a particular DB on a frequent basis at 29 months of age were no longer doing so 1 year later, except for two behaviors of opposition-defiance (Behavior 1: defiant) and hyperactivity (Behavior 6: restless or hyperactive) for boys (see "False-Alarm Rate" in Table 2). For instance, 57.9% of boys and 64.6% of girls who frequently fought at 29 months of age were no longer doing so 1 year later. Overall, these results suggest that starting or ceasing to exhibit a particular DB on a frequent basis between 29 and 41 months of age each constitute important aspects of the development of DBs in young children.

Selecting a Baseline Hierarchical Loglinear Model

Table 3 presents the L^2 goodness-of-fit test statistic for some of the hierarchical loglinear models considered in this study. Model 1 included a main effect for each independent variable (i.e., BD, CD, GD), but no interaction effects (i.e., BCD, CGD, BGD, BCGD). According to the L^2, this model fit the data for all DBs (see Table 3) (Note that this also was the case according to the χ^2 and the CR goodness-of-fit test statistics.) Moreover, this model did not represent a statistically significant decrease in fit over the eight hierarchically related loglinear models that included interaction effects (BCGD), (BCD, CGD, BGD), (BCD, CGD), (BCD, BGD), (CGD, BGD), (BCD, GD), (CGD, BD), and (BGD, CD), except for one behavior of hyperactivity (Behavior 6: restless or hyperactive). For this behavior, the selected baseline model included an interaction effect between the same behavior at 17 months of age and the child's gender (CD, BGD) [This model fit the data; see Table 3 (Note that this also was the case according to the χ^2 and the CR goodness-of-fit test statistics.) Further, this model did not represent a statistically significant decrease in fit over hierarchically related loglinear models that included other interaction effects.] Overall, these results suggest that there are no gender differences in the stability of interindividual differences in DBs between 29 and 41 months of age. Further, these results suggest that the stability in question does not vary according the degree to which children exhibited the same DBs at 17 months of age.

Table 4 presents the estimates of the conditional probability of a randomly selected boy and girl in the general population exhibiting a particular DB never, sometimes, or often at 41 months of age, given the degree to which he or she exhibited the same behavior at 17 and 29 months of age. For instance, 62.1% of children who, at 29 (and 17) months of age, changed their behavior after punishment were still doing so at 41 months of age. In addition, 25.6% of children who, at 29 (and 17) months of age, frequently did not change their behavior after punishment were still not doing so at 41 months of age.

Are There Gender Differences in the Likelihood of Starting and Ceasing to Exhibit a Particular DB on a Frequent Basis Between 29 and 41 Months of Age?

To answer this question, we considered a hierarchical loglinear model that included a main effect for each independent variable except for the child's gender (BD, CD). Under this model, there is no association (beyond that expected by chance alone) between a particular DB at 41 months of age and the child's gender after taking into account gender differences in the same behavior at 17 and 29 months of age. This model provided an acceptable fit for all DBs, except for the two behaviors of inattention (Behavior 5: easily distracted) and hyperactivity (Behavior 6: restless or hyperactive) (see Model 2 in Table 3) (Note that this also was the case according to the χ^2 and the CR goodness-of-fit test statistics.) This model also represented a statistically significant decrease in fit over the selected baseline hierarchical loglinear model for the four behaviors of opposition-defiance (Behaviors 1: defiant and 2: didn't feel guilty), hyperactivity (Behavior 8: difficulty waiting), and physical aggression (Behavior 9: fights) (see Table 3). These results suggest that there are gender differences in the likelihood of starting and ceasing to exhibit on a frequent basis these six DBs between 29 and 41 months of age.

Table 5 presents the estimates of the odds ratios that describe the association between a particular DB at 41 months of age and the child's gender after taking into account gender differences in the same behavior at 17 and 29 months of age.

On one hand, boys were more likely than were girls to start exhibiting a particular DB on a frequent basis between 29 and 41 months of age. For example, 9.5% of boys who had not exhibited defiance at 29 (and 17) months of age often exhibited this behavior at 41 months of age; in comparison, only 6.9% of girls did so (see Table 4). In fact, between 29 and 41 months of age, boys were 1.42 times more likely than were girls to have started exhibiting defiance on a frequent basis (see Table 5).

On the other hand, between 29 and 41 months of age, girls were more likely than were boys to stop exhibiting a particular DB on a frequent basis. For example, 2.8% of girls (but only 2.2% of boys) who, at 29 (and 17) months of age, had exhibited defiance on a frequent basis were no longer exhibiting this behavior at 41 months of age (see Table 4). In fact, between 29 and 41 months of age, girls were 1.42 times more likely than were boys to have stopped exhibiting defiance on a frequent basis (see Table 5). Overall, these results suggest that gender differences in DBs increase in magnitude between 29 and 41 months of age, except for the two behaviors of opposition-defiance (Behavior 3: didn't change behavior) and inattention (Behavior 4: inattentive).

Figure 1 depicts the relationships between a particular DB at 17, 29, and 41 months of age and the child's gender. This path diagram illustrates the development of gender differences in DBs during toddlerhood and the early preschool period, showing that gender differences have (a) not yet emerged at 41 months of age for the two behaviors of opposition-defiance (Behavior 3: didn't change behavior) and inattention (Behavior 4: inattentive); (b) emerged at 41 months of age for the three behaviors of opposition-defiance (Behaviors 1: defiant and 2: didn't feel guilty) and hyperactivity (Behavior 8: difficulty waiting); (c) emerged at 29 months of age and increased in magnitude over the next year for two behaviors of physical aggression (Behaviors 9: fights and 10: attacks); and (d) emerged at 17 months of age and increased in magnitude over the next 2 years for the three behaviors of hyperactivity (Behavior 6: restless or hyperactive and 7: fidgets) and inattention (Behavior 5: easily distracted). Overall, these results suggest that gender differences in DBs emerge at different points in time, but once they do for a particular DB, they tend to increase in magnitude over time.

Does the Degree to which Children Exhibited a Particular DB at 17 Months of Age Affect the Likelihood of Starting and Ceasing to Exhibit the Same Behavior on a Frequent Basis Between 29 and 41 Months of Age?

To answer this question, we considered a hierarchical loglinear model that included a main effect for each independent variable except the DB at 17 months of age [i.e., Model 3 (CD, GD)]. Under this model, there is no association (beyond that expected by chance alone) between a particular DB at 17 and 41 months of age after taking into account the association between the same behavior at 29 and 41 months of age. This model did not provide an acceptable fit to the data for the DBs, except for one behavior of opposition-defiance (Behavior 2: didn't feel guilty) (see Table 3) (Note that this also was the case according to the χ^2 and the CR goodness-of-fit test statistics.) In this case, however, this model represented a statistically significant decrease in fit over the selected baseline hierarchical loglinear model, $\Delta L^2 = 37.63 - 17.09 = 20.55$; $\Delta df = 28 - 24 = 4$; $p < .001$. These results suggest that the likelihood of starting and ceasing to exhibit a particular DB on a frequent basis between 29 and 41 months of age varies according to the degree to which children exhibited the same behavior before 2 years of age.

Table 5 also presents the estimates of the odds ratios that describe the association between a particular DB at 17 and 41 months of age after taking into account the association between the same behavior at 29 and 41 months of age.

On one hand, children who, at 29 months of age, did not exhibit a particular DB on a frequent basis were more likely to start doing so in the following year if they had exhibited the same behavior at 17 months of age. For example, 28.9% of boys who did *not* fight at 29 months of age were doing so on a frequent basis 1 year later if they had exhibited this behavior on a frequent basis at 17 months of age; in comparison, among boys who, at 17 months of age, had exhibited this behavior on an occasional basis or not at all, only 6.0 and 2.9%, respectively, were reported to fight frequently at 41 months of age (see Table 4). In fact, children who had fought on a frequent basis at 17 months of age were 2.89 times more

likely than were those who had not fought at all to have started exhibiting this behavior on a frequent (rather than occasional) basis between 29 and 41 months of age (see Table 5).

On the other hand, children who exhibited a particular DB on a frequent basis at 29 months of age were less likely to stop doing so in the following year if they had exhibited the same behavior at 17 months of age. For example, 70.7% of boys who fought on a frequent basis at 29 months of age were no longer doing so 1 year later if they had not exhibited this behavior at 17 months of age; in comparison, among boys who had exhibited this behavior on an occasional and a frequent basis at 17 months of age, the percentage was only 58.5 and 21.9%, respectively (see Table 4). In fact, children who had fought on a frequent basis at 17 months of age were estimated to be 2.89 times less likely than were those who had not fought at all to have stopped exhibiting this behavior on a frequent basis (and gone to exhibiting it on an occasional basis) between 29 and 41 months of age (see Table 5). Overall, these results suggest that DBs before 2 years of age affect the development of the same behaviors between late toddlerhood and the early preschool period.

Figure 1 also depicts the impact of early DBs on the development of the same behaviors during late toddlerhood and the early preschool period. As shown in the path diagram, this impact is made up not only of the direct effect of early DBs on the same behaviors at 41 months of age but also of their indirect/chain reaction (Rutter, 1989) effect via the same behaviors at 29 months of age (The estimates of the odds ratios that describe the total (i.e., direct + indirect) effect of early DBs on the same behaviors at 41 months of age are available from R.H.B. upon request.)

DISCUSSION

Most previous longitudinal studies of disruptive behavior development have not explicitly considered the continuity and discontinuity in the degree to which young children exhibit DBs over time. As a result, we know little about the importance of starting and ceasing to exhibit DBs on a frequent basis during toddlerhood and the preschool period. Another neglected developmental issue is whether boys and girls differ in their likelihood of starting and/or ceasing to exhibit DBs on a frequent basis during this period. Finally, we know little about the impact of DBs before 2 years of age on the development of the same behaviors later in life. The aim of this study was to investigate these issues in the context of a prospective population-based cohort study. More specifically, we wanted to describe the continuity and discontinuity (and gender differences therein) in the degree to which children were reported to exhibit different DBs between 29 and 41 months of age while taking into account the degree to which these children were reported to have exhibited these behaviors at 17 months of age. Overall, the results are remarkably consistent across DBs, suggesting that they describe quintessential aspects of the development of these behaviors during toddlerhood and the early preschool period.

Exhibiting DBs in the Fourth Year of Life

Being defiant or refusing to comply with adults' requests or rules was the most common of the 10 DBs considered in this study, with about one fourth of children reported to exhibit this behavior on a frequent basis at 41 months of age. But overall, relatively few children

exhibited DBs on a frequent basis at this age. Similar results were obtained in other epidemiological surveys (Baillargeon, Tremblay, & Willms, 2005; Crowther, Bond, & Rolf, 1981; Earls, 1980a, 1980b; Heinstein, 1969; Jenkins et al., 1980; Koot & Verhulst, 1991; Luk, Leung, Bacon-Shone, & Lieh-Mak, 1991; Richman, Stevenson, & Graham, 1982; also see Jenkins et al., 1984) as well as in recent large-scale studies that have documented the intensity/severity/frequency of DBs in children during the fourth year of life (e.g., NICHD Early Child Care Research Network, 2004; van Zeijl et al., 2006). Further, these results are similar to those obtained in population-based studies that have documented the intensity/severity/frequency of DBs in school-aged children (e.g., Offord & Lipman, 1996; Tremblay et al., 1996). In summary, these results suggest that when exhibited on a frequent basis, DBs are not more age-appropriate in preschool-aged children than they are in school-aged children.

Starting or Ceasing to Exhibit DBs on a Frequent Basis During Late Toddlerhood and the Early Preschool Period

According to the arrested socialization hypothesis, children who exhibit physically aggressive behaviors toward their peers are simply those who have not responded to socialization efforts and have failed to learn not to act aggressively (Patterson, 1982; Tremblay, 2003, 2008). This characterization of DB development seems to be based on existing longitudinal studies that have mostly considered change in DBs at the aggregate level (i.e., net or mean change). In contrast, our results show that a majority or close to a majority of children who exhibited a particular DB on a frequent basis at 41 months of age had not done so 1 year earlier. Further, the proportion of children who exhibited DBs on a frequent basis at 41 months of age was more or less the same as, or even higher than, the one at 29 months of age for seven behaviors of opposition-defiance (Behavior 1: defiant), inattention (Behaviors 4: inattentive and 5: easily distracted), hyperactivity (Behaviors 6: restless or hyperactive and 8: difficulty waiting), and physical aggression (Behaviors 9: fights and 10: attacks). Together, these results contradict the view that DBs (the hallmark of the “terrible twos”) are normative during toddlerhood, with toddlers simply growing out of them over time (also see Baillargeon, Normand et al., 2007). A variety of factors may actually contribute to children starting to exhibit DBs on a frequent basis during late toddlerhood and the early preschool period. We consider some of these factors in the next section, where we contemplate different explanations as to why boys are more likely than are girls to do so.

Change in the Magnitude of Gender Differences in DBs During Late Toddlerhood and the Early Preschool Period

Our results show that gender differences in some DBs emerged between 29 and 41 months of age, with boys being more likely to start and girls being more likely to stop exhibiting DBs on a frequent basis during this period. This also accounted for an increase in the magnitude of gender differences for the other DBs for which gender differences already were present at 17 and/or 29 months of age.

This effect may be due to parents (and other socialization agents) exerting more pressure on girls than on boys to curb DBs (Hay, 2007; Keenan & Shaw, 1997). For instance, boys are

less likely to be required to stop attempts to wrest objects from peers (H. Ross, Tesla, Kenyon, & Lollis, 1990). However, this effect was not replicated in the context of sibling conflicts (Lollis, Ross, & Leroux, 1996; Martin & Ross, 2005; Power & Parke, 1986; also see Lytton & Romney, 1991). In addition, parents' gender-differentiated socialization practices may be contingent upon constitutionally based predispositions [e.g., gender differences in rough-and-tumble play (Bjorklund & Pellegrini, 2002; Geary, 1998; also see Fagen, 1981); gender differences in activity level (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006; Halverson & Waldrop, 1973); gender differences in forearm length (Gindhart, 1973; Tanner, 1962); person-orientation (as opposed to object-orientation) (Baron-Cohen, 2003; Bell, 1968; Geary, 1998; Hoffman, 1975, 1981; Lippa, 2005); and gender differences therein (Garai & Scheinfeld, 1968; Haviland & Malatesta, 1981; Hoffman, 1977; Hutt, 1977; Lippa, 2005; McGuinness & Pribram, 1979)]. Further, gender differences in these predispositions could in and of themselves explain, at least in part, the observed increase in the magnitude of gender differences in DBs. In the case of DBs for which gender differences were not already present at 17 and/or 29 months of age, this would amount to a sleeper (i.e., delayed) effect.

Another possible social-learning explanation is that toddlers/preschoolers are applying socially prescribed rules and standards to regulate their own behavior, with girls exhibiting fewer DBs to avoid self-criticism and to maintain self-satisfaction and self-worth (Bussey & Bandura, 1999; Maccoby, 2002). However, it is not clear whether such sex-stereotyped roles are already part of the repertoire of children before 41 months of age. In addition, children begin playing in same-sex play groups during this period (e.g., La Freniere, Strayer, & Gauthier, 1984), with play styles that tend to be more rough/physical in male pairs than in female pairs or opposite-sex pairs (DiPietro, 1981; also see Jacklin & Maccoby, 1978). But, again, gender-segregated play groups and their associated sex-stereotyped play behaviors may be contingent upon constitutionally based predispositions (Maccoby, 1988).

An alternative explanation is that the increase in the magnitude of gender differences in DBs may be due to girls maturing faster than boys in the context of a decrease with age in the proportion of children exhibiting DBs on a frequent basis. In other words, when compared to boys during the same period, girls should be less likely to start and more likely to stop exhibiting DBs because of their faster rate of physical maturation (maturational tempo). In addition, negotiating conflicts with peers and caregivers requires sophisticated linguistic, cognitive, emotional, and social abilities on the part of toddlers, abilities which may develop at an earlier age for girls than they do for boys. Although this explanation might be plausible for some DBs, it is not for others; namely, those for which the proportion of children exhibiting them on a frequent basis at 41 months of age is the same or higher compared to what it was 1 year earlier (i.e., Behaviors 1: defiant, 4: inattentive, 5: easily distracted, 6: restless or hyperactive for boys, 8: difficulty waiting, 9: fights, and 10: attacks for boys).

The Second Year of Life as a Milestone in the Development of DBs

The second year of life is considered by some developmental psychologists as the point in life when DBs first become manifest (e.g., Baillargeon, Normand et al., 2007; Baillargeon, Sward, Keenan, & Cao, 2011; Baillargeon, Zoccolillo et al., 2007; Hay, 2005; Hay & Ross,

1982; Loeber & Hay, 1994; Tremblay et al., 1999). This period may not only mark the onset of DBs in children but also exert a lasting influence over the development of DBs later in life. Our results show that DBs exhibited at 17 months of age affect the continuity and discontinuity in the degree to which children exhibit the same behaviors between 29 and 41 months of age. Consistent with Kuo's (1967/1976) theory of behavioral potentials, we observe a "canalization" of disruptive behavior development during this period, with early DBs both increasing the likelihood of starting to exhibit the same behaviors on a frequent basis and decreasing the likelihood of ceasing to do so over time.

Together, these results suggest that the predictive accuracy of some early DBs may be quite good, at least in the context of a multistage screening procedure. In fact, the false-alarm rate was below .5 for four behaviors of opposition-defiance (Behavior 1: defiant), hyperactivity (Behavior 6: restless or hyperactive), and physical aggression (Behaviors 9: fights and 10: attacks) when considering children who not only exhibited these behaviors on a frequent basis at 29 months of age but also at 17 months of age (see Table 4). Further, the proportion of children who at 41 months of age exhibited a particular DB on a frequent basis, but did not do so 1 year earlier (i.e., 1 − hit rate) was less than .3 for two behaviors of hyperactivity (Behaviors 6: restless or hyperactive and 7: fidgets) and less than .5 (but >.4) for two behaviors of opposition-defiance (Behavior 1: defiant) and hyperactivity (Behavior 8: difficulty waiting) for children who had exhibited these behaviors on a frequent basis at 17 months of age. Of course, the predictive accuracy of early DBs may be even better in the context where many DBs assessing a particular disruptive behavior problem are being considered together (Baillargeon & Bégin Galarneau, 2009). Overall, it appears that the predictive accuracy of early DBs is not as limited as was previously thought (Bennett et al., 1999; Bennett, Lipman, Racine, & Offord, 1999). These results suggest that targeted, rather than universal, interventions may be better suited at preventing disruptive behaviors in children before school entry (Tremblay 2010; for a different view, see Bayer, Hiscock, Morton-Allen, Ukoumunne, & Wake, 2007).

Limitations

First, children born to mothers residing in Northern Québec, Cree and Inuit "territory," and on native reserves were *not* part of the target population; however, these exclusions represented only 2.1% of all live births to mothers residing in Québec. Second, we used only one informant—mothers—whose expectations of appropriate behavior may affect perception of their children's DBs. Further, the continuity and discontinuity in DBs over time may reflect, at least to some extent, the continuity and discontinuity in reporting biases; however, there is evidence that the effect of such biases may be relatively small in magnitude at any given point in time (e.g., Zahn-Waxler & Radke-Yarrow, 1982). Third, no reference period was specified at the third wave of data collection, when children were approximately 29 months of age. Even when a 12-month reference period is specified, as for the fourth wave of data collection, the mothers' time frame of reference might be variable (and not exactly the intended one). This limitation is typical of studies using behavior checklists. Fourth, we described the development of specific DBs rather than the development of the different behavior problems (e.g., opposition-defiance, physical aggression, and hyperactivity-impulsivity) that they are often used to assess. However, behaviors and

problems represent complementary levels of analysis, and it is not possible to fully appreciate the latter without knowing about the former. For example, gender differences at the level of a particular behavior problem may or may not be indicative of gender differences at the level of the DBs. In the study by Baillargeon, Zoccolillo et al. (2007), gender differences were found in the proportion of children who, at 17 months of age, experienced a significant physical aggression problem (boy > girl), but not in some physically aggressive behaviors (i.e., fights, attacks). Gender differences in physical aggression in the absence of gender differences in these behaviors revealed a gender paradox, with physically aggressive girls being more likely than are their male counterparts to fight and attack other children.

CONCLUSION

Unlike most previous longitudinal studies of young children's DBs, this prospective population-based cohort study explicitly considered the continuity and discontinuity in the degree to which children in the general population exhibit DBs during toddlerhood and the preschool period. Three largely neglected, but important, developmental issues were investigated. In the end, we were able to show that:

- Starting to exhibit DBs on a frequent basis over time constitutes an important aspect of early DB development. Future research will need to identify not only factors accounting for young children ceasing to exhibit DBs on a frequent basis during toddlerhood and the preschool period but also factors responsible for young children starting to do so over this period.
- Boys and girls differ in their likelihood both of starting and of ceasing to exhibit DBs on a frequent basis over time. Future research will need to identify the factors responsible for the emergence of gender differences in DBs during toddlerhood and the preschool period. Note that the factors accounting for boys being more likely to start exhibiting DBs on a frequent basis may be different from the ones accounting for girls being more likely to stop doing so.
- Consistent with the canalization of behavioral development principle, DBs exhibited during the second half of the second year of life affect the development of the same behaviors during late toddlerhood and the early preschool period. Future research will need to identify the factors operating very early in life that are responsible for the lasting influence of early DBs over the development of the same behaviors later in life. In addition, it would be interesting to determine whether impairment associated with DBs at 17 months of age is affecting the continuity and discontinuity in the degree to which children are reported to exhibit the same behaviors between 29 and 41 months of age.

Acknowledgments

Parts of this article were presented by A.M. at the 2004 biennial meeting of the International Society on Infant Studies (Chicago) and by R.H.B. at the 2010 biennial meeting of the International Society on Infant Studies (Baltimore). Preparation of this article was supported by the Canadian Institutes of Health Research (CIHR) to R.H.B. (Grant MOP-67090) and R.H.B. and K.K. (Grant MOP-89942). Financial support for the preparation of this article also was provided to R.H.B. by the University of Ottawa and the Faculty of Health Sciences, University of Ottawa. We thank Suganthiny Jeyaganth and Gregory D. Sward for their help with some of the preliminary statistical analyses. We also thank Pierre Bertrand for preparing the figure and Jeroen K. Vermunt and Jacques A.

Hagenaars for statistical advice. In addition, we thank Heather Leah King-Andrews and Louise Blais for editorial assistance and Marie-Ève Bégin-Galarneau and Antoine Charbonneau for technical assistance.

References

Achenbach, TM. Manual for the Child Behavior Checklist/2–3 and 1992 Profile. Burlington: University of Vermont, Department of Psychiatry; 1992.

Achenbach TM, Edelbrock CS, Howell CT. Empirically based assessment of the behavioral/emotional problems of 2- and 3-year-old children. Journal of Abnormal Child Psychology. 1987; 15:629–650. [PubMed: 3437096]

Achenbach, TM., Rescorla, LA. Manual for the ASEBA Preschool Forms & Profiles. Burlington: University of Vermont, Research Center for Children, Youth, & Families; 2000.

Baillargeon, RH., Bégin Galarneau, ME. The evolution of physical aggression between 17, 29 and 41 months of age: A prospective population-based cohort study. Paper presented at the meeting of the Society for Research in Child Development; Denver, CO. 2009 Apr.

Baillargeon RH, Normand CL, Séguin JR, Zoccolillo M, Japel C, Pérusse D, et al. The evolution of problem and social competence behaviors during toddlerhood: A prospective population-based cohort survey. Infant Mental Health Journal. 2007; 28:12–38. [PubMed: 28640380]

Baillargeon RH, Sward GD, Keenan K, Cao G. Opposition-defiance in the second year of life: A population-based cohort study. Infancy. 2011; 16:418–434.

Baillargeon, RH., Tremblay, RE., Willms, D. Gender differences in the prevalence of physically aggressive behaviors in the Canadian population of 2- and 3-year-old children. In: Pepler, DJ.Madsen, K.Levene, K., Webster, C., editors. The development and treatment of girlhood aggression. Hillsdale, NJ: Erlbaum; 2005. p. 55-74.

Baillargeon RH, Zoccolillo M, Keenan K, Pérusse D, Boivin M, Côté S, et al. Gender differences in the prevalence of physical aggression: A prospective population-based survey of children before and after two years of age. Developmental Psychology. 2007; 43:13–26. [PubMed: 17201505]

Baron-Cohen, S. The essential difference: The truth about the male and female brain. New York: Basic Books; 2003.

Bayer JK, Hiscock H, Morton-Allen E, Ukoumunne OC, Wake M. Prevention of mental health problems: Rationale for a universal approach. Archives of Disease in Childhood. 2007; 92:34–38. [PubMed: 16920756]

Behar L, Stringfield S. A behavior rating scale for the preschool child. Development Psychology. 1974; 10:601–610.

Bell RQ. A reinterpretation of the direction of effects in studies of socialization. Psychological Review. 1968; 75:81–95. [PubMed: 4870552]

Bennett KJ, Lipman EL, Brown S, Racine Y, Boyle MH, Offord DR. Predicting conduct problems: Can high-risk children be identified in kindergarten and grade 1? Journal of Consulting and Clinical Psychology. 1999; 67(4):470–480. [PubMed: 10450617]

Bennett KJ, Lipman EL, Racine Y, Offord DR. Annotation: Do measures of externalising behaviour in normal populations predict later outcome?: Implications for targeted interventions to prevent conduct disorder. Journal of Child Psychology and Psychiatry. 1998; 39(8):1059–1070. [PubMed: 9844977]

Bjorklund, DF., Pellegrini, AD. The origins of human nature: Evolutionary developmental psychology. Washington, DC: American Psychological Association; 2002.

Bollen, KA. Structural equations with latent variables. New York: John Wiley; 1989.

Boyle MH, Offord DR, Hofmann HG, Catlin GP, Byles JA, Cadman DT, et al. Ontario Child Health Study I. Methodology. Archives of General Psychiatry. 1987; 44(9):826–831. [PubMed: 3632257]

Brownell, CA., Kopp, CB. Socioemotional development in the toddler years: Transitions and transformations. New York: Guilford Press; 2007.

Bussey K, Bandura A. Social-cognitive theory of gender development and differentiation. Psychological Review. 1999; 106:676–713. [PubMed: 10560326]

Cairns, RB., Kroll, A. Developmental perspective on gender differences and similarities. In: Rutter, M., Hay, DF., editors. Development through life: A handbook for clinicians. Oxford, England: Blackwell Scientific; 1994. p. 350-372.

Campbell, SB. Behavior problems in preschool children: Clinical and developmental issues. New York: Guilford Press; 1990.

Campbell, SB. Behavior problems in preschool children: Clinical and developmental issues. 2. New York: Guilford Press; 2002.

Carter AS, Briggs-Gowan MJ, Jones SM, Little TD. The Infant–Toddler Social and Emotional Assessment (ITSEA): Factor structure, reliability, and validity. Journal of Abnormal Psychology. 2003; 31:95–514.

Caspi, A., Moffitt, TE. The continuity of maladaptive behavior: From description to understanding in the study of antisocial behavior. In: Cicchetti, D., Cohen, D., editors. Developmental psychopathology. Vol. 2. New York: Wiley; 1995. p. 472-511.

Clogg CC. Some latent structure models for the analysis of Likert-type data. Social Science Research. 1979; 8:287–310.

Clogg, CC., Shihadeh, ES. Statistical models for ordinal variables. Thousand Oaks, CA: Sage; 1994.

Cohen, J. Statistical power analysis for the behavioral sciences. 2. Hillsdale, NJ: Erlbaum; 1988.

Costello CG. Research on symptoms versus research on syndromes. Arguments in favor of allocating more research time to the study of symptoms. British Journal of Psychiatry. 1992; 160:304–308. [PubMed: 1562857]

Cressie N, Read TRC. Multinomial goodness-of-fit tests. Journal of the Royal Statistical Society, Series B. 1984; 46:440–464.

Crowther JH, Bond LA, Rolf JE. The incidence, prevalence, and severity of behavior disorders among preschool-aged children in day care. Journal of Abnormal Child Psychology. 1981; 9:23–42. [PubMed: 7217536]

Desrosiers, H. Family, child care and neighborhood characteristics. Québec, Canada: Institut de la statistique du Québec; 2000. Longitudinal Study of Child Development in Québec (ELDEQ 1998–2002; Vol. 1, No. 2). Retrieved January 24, 2011, from http://www.jesuisjeserai.stat.gouv.qc.ca/bebe/bebe_no2_an.htm

DiPietro JA. Rough and tumble play: A function of gender. Developmental Psychology. 1981; 17:50–58.

Dunn, J. The beginnings of social understanding. Cambridge, MA: Harvard University Press; 1988.

Dunn J, Kendrick C. Studying temperament and parent–child interaction: Comparison of interview and direct observation. Developmental Medicine and Child Neurology. 1980; 22:484–496. [PubMed: 7409339]

Earls F. Prevalence of behavior problems in 3-year-old children: A cross-national replication. Archives of General Psychiatry. 1980a; 37:1153–1157. [PubMed: 7425799]

Earls F. The prevalence of behavior problems in 3-year-old children: Comparison of the reports of fathers and mothers. Journal of the American Academy of Child Psychiatry. 1980b; 19:439–452. [PubMed: 7410751]

Else-Quest NM, Hyde JS, Goldsmith HH, Van Hulle CA. Gender differences in temperament: A meta-analysis. Psychological Bulletin. 2006; 132:33–72. [PubMed: 16435957]

Eme RF. Sex differences in child-onset, life-course-persistent conduct disorder. A review of biological influences. Clinical Psychology Review. 2007; 27:607–627. [PubMed: 17331630]

Fagen, R. Animal play behavior. New York: Oxford University Press; 1981.

Fienberg, SE. The analysis of cross-classified categorical data. 2. Cambridge, MA: MIT Press; 1980.

Forman, DR. Autonomy, compliance, and internalization. In: Brownell, CA., Kopp, CB., editors. Socioemotional development in the toddler years: Transitions and transformations. New York: Guilford Press; 2007. p. 285-319.

Fowler PC, Park RM. Factor structure of the preschool behavior questionnaire in a normal population. Psychological Reports. 1979; 45:599–606.

Galindo-Garre F, Vermunt JK. Testing loglinear models with inequality constraints : A comparison of asymptotic, bootstrap, and posterior predictive p-values. Statistica Neerlandica. 2005; 59:82–94.

Galindo-Garre F, Vermunt JK, Croon MA. Likelihood-ratio tests for order-restricted loglinear models: A comparison of asymptotic and bootstrap methods. Metodologa de las Ciencias del Comportamiento. 2002; 4:1–18.

Garai JE, Scheinfeld A. Sex differences in mental and behavioral traits. Genetic Psychology Monographs. 1968; 77:169–299.

Geary, DC. Male, female: The evolution of human sex differences. Washington, DC: American Psychological Association; 1998.

Gindhart PS. Growth standards for the tibia and radius in children aged one month through eighteen years. American Journal of Physical Anthropology. 1973; 39:41–48. [PubMed: 4351576]

Goodman LA. Simple models for the analysis of association in cross-classifications having ordered categories. Journal of the American Statistical Association. 1979; 74:537–552.

Goodman R. A modified version of the Rutter parent questionnaire including extra items on children's strengths: A research note. Journal of Child Psychology and Psychiatry. 1994; 35:1483–1494. [PubMed: 7868642]

Goodman R. The Strengths and Difficulties Questionnaire: A research note. Journal of Child Psychology and Psychiatry. 1997; 38:581–586. [PubMed: 9255702]

Gottlieb G. Experiential canalization of behavioral development: Theory. Developmental Psychology. 1991; 27:4–13.

Halverson CF, Waldrop MF. The relations of mechanically recorded activity level to varieties of preschool play behavior. Child Development. 1973; 44:678–681.

Haviland, JJ., Malatesta, CZ. The development of sex differences in nonverbal signals: Fallacies, facts, and fantasies. In: Mayo, C., Henley, NM., editors. Gender and nonverbal behavior. New York: Springer-Verlag; 1981. p. 183-208.

Hay, DF. The beginnings of aggression in infancy. In: Tremblay, RE.Hartup, WW., Archer, J., editors. Developmental origins of aggression. New York: Guilford Press; 2005. p. 107-132.

Hay DF. The gradual emergence of sex differences in aggression: Alternative hypotheses. Psychological Medicine. 2007; 37:1527–1537. [PubMed: 17335642]

Hay DF, Ross HS. The social nature of early conflict. Child Development. 1982; 53:105–113. [PubMed: 7060416]

Heinstein, M. Behavior problems of young children in California. Berkeley: State of California, Department of Public Health, Bureau of Maternal and Child Health; 1969.

Hoffman ML. Developmental synthesis of affect and cognition and its implications for altruistic motivation. Developmental Psychology. 1975; 11:607–622.

Hoffman ML. Sex differences in empathy and related behaviors. Psychological Bulletin. 1977; 84:712–722. [PubMed: 897032]

Hoffman ML. Is altruism part of human nature? Journal of Personality and Social Psychology. 1981; 40:121–137.

Hutt, C. Sex differences in human development. In: Hetherington, EM., Parke, RD., editors. Contemporary readings in child psychology. New York: McGraw Hill; 1977. p. 233-241.

Jacklin CN, Maccoby EE. Social behavior at thirty-three months in same-sex and mixed-sex dyads. Child Development. 1978; 49:557–569.

Jenkins S, Bax M, Hart H. Behaviour problems in pre-school children. Journal of Child Psychology and Psychiatry. 1980; 21:5–17. [PubMed: 7358804]

Jenkins S, Owen C, Bax M, Hart H. Continuities of common behavior problems in preschool-children. Journal of Child Psychology and Psychiatry. 1984; 25:75–89. [PubMed: 6607263]

Jetté, M. Survey description and methodology (Part I: Logistics and longitudinal data collections). Québec, Canada: Institut de la statistique du Québec; 2002. Québec Longitudinal Study of Child Development (QLSCD 1998–2000, Vol. 2, No. 1). Retrieved January 24 2005, from http://www.jesuisjeserai.stat.gouv.qc.ca/bebe/bebe_v2no1_an.htm

Jetté, M., Des Groseilliers, L. Survey description and methodology. Québec, Canada: Institut de la statistique du Québec; 2000. Longitudinal study of child development in Québec (ELDEQ 1998–2000, Vol. 1, No. 1). Retrieved January 24, 2011, from http://www.jesuisjeserai.stat.gouv.qc.ca/bebe/bebe_no1_an.htm

Kagan, J. Continuity and change in the opening years of life. In: Emde, RN., Harmon, RJ., editors. Continuities and discontinuities in development. New York: Plenum Press; 1984. p. 15-39.

Kagan, J., Moss, HA. A study in psychological development. New York: Wiley; 1962. Birth to maturity.

Keenan K, Shaw D. Developmental and social influences on young girls' early problem behavior. Psychological Bulletin. 1997; 121:95–113. [PubMed: 9000893]

Koot HS, Verhulst FC. Prevalence of problem behavior in Dutch children aged 2–3. Acta Psychiatrica Scandinavica. 1991; 83(Suppl 367):1–37. [PubMed: 2011948]

Kuo, Z-Y. The dynamics of behavior development: An epigenetic view. New York: Random House; 1967/1976.

La Freniere P, Strayer FF, Gauthier R. The emergence of same-sex affiliative preferences among preschool peers: A developmental/ethological perspective. Child Development. 1984; 55:1958–1965.

Lewis, M. Challenges to the study of developmental psychopathology. In: Lewis, M., Miller, SM., editors. Handbook of developmental psychopathology. New York: Plenum Press; 1990. p. 29-40.

Lewis, M. Toward a development of psychopathology: Models, definitions, and prediction. In: Sameroff, AJ.Lewis, M., Miller, SM., editors. Handbook of developmental psychopathology. 2. New York: Kluwer Academic/Plenum Press; 2000. p. 3-22.

Lippa, RA. Gender, nature, and nurture. 2. Mahwah, NJ: Erlbaum; 2005.

Loeber R. The stability of antisocial and delinquent child behavior: A review. Child Development. 1982; 53:1431–1446. [PubMed: 6756808]

Loeber, R., Hay, DF. Developmental approaches to aggression and conduct problems. In: Rutter, M., Hay, DF., editors. Development through life: A handbook for clinicians. Oxford, England: Blackwell Scientific; 1994. p. 488-516.

Lollis S, Ross H, Leroux L. An observational study of parents' socialization of moral orientation during sibling conflicts. Merrill–Palmer Quarterly. 1996; 42:475–494.

Luk SL, Leung PWL, Bacon-Shone J, Lieh-Mak F. The structure and prevalence of behavioral problems in Hong Kong preschool children. Journal of Abnormal Child Psychology. 1991; 19:219–232. [PubMed: 2056164]

Lytton H, Romney DM. Parents' differential socialization of boys and girls: A meta-analysis. Psychological Bulletin. 1991; 109:267–296.

Maccoby EE. Gender as a social category. Developmental Psychology. 1988; 24:755–765.

Maccoby, EE. Perspectives on gender development. In: Hartup, WW., Silbereisen, RK., editors. Growing points in developmental science: An introduction. New York: Psychology Press; 2002. p. 202-222.

Martin JL, Ross HS. Sibling aggression: Sex differences and parents' reactions. International Journal of Behavioral Development. 2005; 29:129–138.

Mathiesen KS, Sanson A. Dimensions of early childhood behavior problems: Stability and predictors of change from 18 to 30 months. Journal of Abnormal Child Psychology. 2000; 28:15–31. [PubMed: 10772347]

Mcfarlane, JW., Allen, L., Honzik, MP. A developmental study of behavior problems in normal children. Berkeley: University of California Press; 1954.

McGuinness, D., Pribram, KH. The origins of sensory bias in the development of gender differences in perception and cognition. In: Bortner, M., editor. Cognitive growth and development. NewYork: Brunner/Mazel; 1979. p. 3-56.

Mojtabai R, Rieder RO. Limitations of the symptom-oriented approach to psychiatric research. British Journal of Psychiatry. 1998; 173:198–202. [PubMed: 9926093]

NICHD Early Child Care Research Network. Trajectories of physical aggression from toddlerhood to middle childhood: Predictors, correlates, and outcomes. Monographs of the Society for Research in Child Development. 2004; 69(4):1–146. [PubMed: 15566544]

Offord DR, Boyle MH, Szatmari P, Rae-Grant NI, Links PS, Cadman DT. Ontario Child Health Study. II. Six-months prevalence of disorder and rates of service utilization. Archives of General Psychiatry. 1987; 44(9):832–836. [PubMed: 3498458]

Offord, DR., Lipman, EL. Human Resources and Skills Development Canada and Statistics Canada. Growing up in Canada: National longitudinal survey of children and youth. Ottawa: Statistics Canada; 1996. Emotional and behavioral problems; p. 119-126.

Patterson, GR. Coercive family process. Vol. 3. Eugene, OR: Castalia; 1982. A social learning approach.

Persons JB. The advantages of studying psychological phenomena rather than psychiatric diagnoses. American Psychologist. 1986; 41:1252–1260. [PubMed: 3813184]

Power TG, Parke RD. Patterns of early socialization: Mother–and father–infant interaction in the home. International Journal of Behavioral Development. 1986; 9:331–341.

Radke-Yarrow, M., Zahn-Waxler, C. Roots, motives, and patterns in children's prosocial behavior. In: Staub, E.Bar-Tal, D.Karylowski, J., Reykowski, J., editors. Development and maintenance of prosocial behavior: International perspectives on positive morality. New York: Plenum Press; 1984. p. 81-99.

Richman, N., Stevenson, JE., Graham, PJ. Preschool to school: A behavioural study. London: Academic Press; 1982.

Ross, DM., Ross, SA. Hyperactivity: Research, theory, and action. New York: Wiley; 1976.

Ross H, Tesla C, Kenyon B, Lollis S. Maternal intervention in toddler peer conflict: The socialization of principles of justice. Developmental Psychology. 1990; 26:994–1003.

Rutter, M. Continuities and discontinuities in socioemotional development: Empirical and conceptual perspectives. In: Emde, RN., Harmon, RJ., editors. Continuities and discontinuities in development. New York: Plenum Press; 1984. p. 41-68.

Rutter M. Pathways from childhood to adult life. Journal of Child Psychology and Psychiatry. 1989; 30:23–51. [PubMed: 2647779]

Schlichting, C., Pigliucci, M. Phenotypic evolution: A reaction norm perspective. Sunderland, MA: Sinauer; 1998.

Sroufe LA. The coherence of individual development: Early care, attachment, and subsequent developmental issues. American Psychologist. 1979; 34:834–841.

Sroufe, LA. Emotional development: The organization of emotional life in the early years. Cambridge, United Kingdom: Cambridge University Press; 1995.

Sroufe LA, Rutter M. The domain of developmental psychopathology. Child Development. 1984; 55:17–29. [PubMed: 6705619]

Stifter, CA., Wiggins, CN. Assessment of disturbances in emotion regulation and temperament. In: DelCarmen-Wiggins, R., Carter, A., editors. Handbook of infant, toddler, and preschool mental health assessment. New York: Oxford University Press; 2004. p. 79-103.

Tanner, JM. Growth at adolescence. 2. London: Blackwell; 1962.

Task Force on Research Diagnostic Criteria: Infancy and Preschool. Research diagnostic criteria for infants and preschool children: The process and empirical support. Journal of the American Academy of Child and Adolescent Psychiatry. 2003; 42(12):1504–1512. [PubMed: 14627886]

Tesla C, Dunn J. Getting along or getting your own way: The development of young children's use of argument in conflicts with mother and sibling. Social Development. 1992; 1:107–121.

Thissen D, Steinberg L, Gerrard M. Beyond group-mean differences: The concept of item bias. Psychological Bulletin. 1986; 99:118–128.

Thomas SL, Heck RH. Analysis of large-scale secondary data in higher education research: Potential perils associated with complex sampling designs. Research in Higher Education. 2001; 42:517–540.

Tremblay, RE. Why socialization fails: The case of chronic physical aggression. In: Lahey, BB.Moffitt, TE., Caspi, A., editors. Causes of conduct disorder and juvenile delinquency. New York: Guilford Press; 2003. p. 182-224.

Tremblay, RE. Prévenir la violence dès la petite enfance [Preventing violence starting in infancy]. Paris: Odile Jacob; 2008.

Tremblay RE. Developmental origins of disruptive behaviour problems: The "original sin" hypothesis, epigenetics and their consequences for prevention. Journal of Child Psychology and Psychiatry. 2010; 51:341–367. [PubMed: 20146751]

Tremblay, RE., Boulerice, B., Harden, PW., McDuff, P., Pérusse, D., Pihl, RO., Zoccolillo, M. Human Resources Development Canada and Statistics Canada. Growing up in Canada: National Longitudinal Survey of Children and Youth. Ottawa: Statistics Canada; 1996. Do children in Canada become more aggressive as they approach adolescence?; p. 127-137.

Tremblay RE, Japel C, Pérusse D, McDuff P, Boivin M, Zoccolillo M, Montplaisir J. The search for the age of "onset" of physical aggression: Rousseau and Bandura revisited. Criminal Behaviour and Mental Health. 1999; 9:8–23.

van Zeijl J, Mesman J, Stolk MN, Alink LRA, van IJzendoorn MH, Bakermans-Kranenburg MJ, Juffer F, Koot HM. Terrible ones? Assessment of externalizing behaviors in infancy with the Child Behavior Checklist. Journal of Child Psychology and Psychiatry. 2006; 47:801–810. [PubMed: 16898994]

Vermunt, JK. lEM: A general program for the analysis of categorical data [computer program]. Tilburg University; Tilburg, The Netherlands: Sep 18. 1997

Willoughby JA, Haggerty RJ. A simple behavior questionnaire for preschool children. Pediatrics. 1964; 34:798–806. [PubMed: 14243468]

Zahn-Waxler, C., Radke-Yarrow, M. The development of altruism: Alternative research strategies. In: Eisenberg, N., editor. The development of prosocial behavior. New York: Academic Press; 1982. p. 109-137.

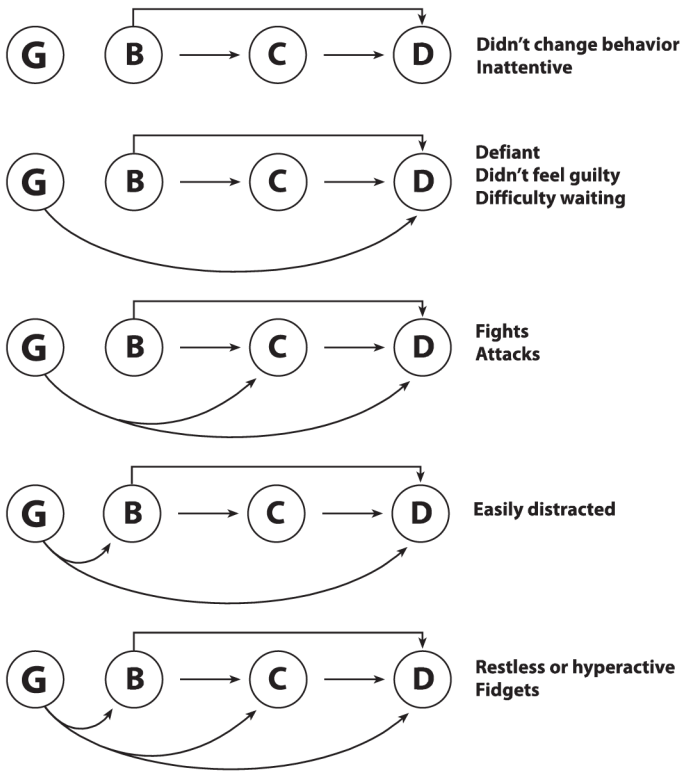

Figure 1.

The relationships between a particular disruptive behavior at 17, 29, and 41 months of age and the child's gender. B, C, and D refer to the disruptive behavior at 17, 29, and 41 months of age, respectively. G refers to the child's gender.

TABLE 1

Estimates of the Percentage of Children Who Exhibited Disruptive Behaviors at 17, 29, and 41 months of Age

Disruptive Behavior	Age (in months)	Never		Sometimes		Often	
		Boy	Girl	Boy	Girl	Boy	Girl
Opposition-Defiance							
1. Was defiant or refused to comply with adults' requests or rules (*n* = 961/963) Reliability = .76/.62	17	47.4 (.016)	47.9 (.016)	41.4 (.016)	43.4 (.016)	11.2 (.010)	8.7 (.009)
	29	15.8 (.012)	16.2 (.012)	67.8 (.015)	68.5 (.015)	16.4 (.012)	15.3 (.012)
	41	6.5 (.008)	6.8 (.008)	65.5 (.015)	71.6 (.015)	28.0 (.014)	21.6 (.013)
2. Didn't seem to feel guilty after misbehaving (*n* = 948/946) Reliability = .53/.56	17	57.1 (.016)	61.1 (.016)	25.3 (.014)	24.4 (.014)	17.6 (.012)	14.6 (.012)
	29	54.3 (.016)	54.5 (.016)	33.7 (.015)	34.4 (.016)	12.0 (.011)	11.2 (.010)
	41	51.2 (.016)	58.9 (.016)	42.5 (.016)	37.2 (.016)	6.3 (.008)	3.9 (.006)
3. Punishment didn't change his/her behavior (*n* = 947/951) Reliability = .57/.55	17	44.3 (.016)	47.9 (.016)	41.0 (.016)	41.3 (.016)	14.8 (.012)	10.7 (.010)
	29	48.2 (.016)	51.3 (.016)	41.7 (.016)	40.6 (.016)	10.1 (.010)	8.1 (.009)
	41	41.9 (.016)	46.1 (.016)	50.0 (.016)	49.0 (.016)	8.1 (.009)	4.9 (.007)
Inattention							
4. Was inattentive (*n* = 960/961) Reliability = .60/.70	17	62.0 (.016)	67.9 (.015)	36.3 (.016)	30.1 (.015)	1.8 (.004)	2.0 (.005)
	29	53.3 (.016)	56.4 (.016)	43.8 (.016)	41.9 (.016)	2.9 (.005)	1.7 (.004)
	41	27.8 (.014)	32.0 (.015)	66.6 (.015)	64.0 (.016)	5.6 (.007)	4.0 (.006)
5. Was easily distracted, had trouble sticking to any activity (*n* = 955/958) Reliability = .64/.58	17	57.6 (.016)	63.6 (.016)	35.6 (.015)	31.8 (.015)	6.7 (.008)	4.6 (.007)
	29	52.3 (.016)	55.9 (.016)	43.1 (.016)	38.9 (.016)	4.7 (.007)	5.1 (.007)
	41	32.3 (.015)	39.9 (.016)	58.0 (.016)	54.5 (.016)	9.7 (.010)	5.6 (.007)
Hyperactivity							
6. Could not sit still, was restless or hyperactive (*n* = 961/962) Reliability = .79/.7 4	17	28.6 (.015)	36.0 (.016)	46.6 (.016)	45.0 (.016)	24.8 (.014)	19.0 (.013)
	29	24.9 (.014)	32.3 (.015)	50.1 (.016)	50.7 (.016)	25.1 (.014)	17.0 (.012)
	41	18.2 (.012)	26.5 (.014)	55.8 (.016)	58.4 (.016)	26.0 (.014)	15.1 (.012)
7. Couldn't stop fidgeting (*n* = 960/963) Reliability = .83/.80	17	26.9 (.014)	32.2 (.015)	35.7 (.015)	39.3 (.016)	37.4 (.016)	28.5 (.015)
	29	33.1 (.015)	39.5 (.016)	36.2 (.016)	39.1 (.016)	30.7 (.015)	21.5 (.013)
	41	34.8 (.015)	40.8 (.016)	46.0 (.016)	47.2 (.016)	19.2 (.013)	12.0 (.011)
8. Had difficulty waiting for his/her turn in games (*n* = 920/921) Reliability = .69/.62	17	40.4 (.016)	41.8 (.016)	40.6 (.016)	42.4 (.016)	19.0 (.013)	15.8 (.012)
	29	30.3 (.015)	35.4 (.016)	51.6 (.016)	49.6 (.017)	18.1 (.013)	15.0 (.012)
	41	21.9 (.014)	25.5 (.014)	57.1 (.016)	61.9 (.016)	21.0 (.013)	12.7 (.011)

Disruptive Behavior	Age (in months)	Never		Sometimes		Often	
		Boy	Girl	Boy	Girl	Boy	Girl
	Physical Aggression						
9. Got into fights (*n* = 961/961) Reliability = .77/.72	17	83.1 (.012)	85.1 (.012)	14.4 (.011)	13.8 (.011)	2.6 (.005)	1.1 (.003)
	29	68.2 (.015)	74.5 (.014)	27.7 (.014)	22.9 (.014)	4.1 (.006)	2.6 (.005)
	41	51.0 (.016)	62.3 (.016)	41.2 (.016)	32.7 (.015)	7.9 (.009)	5.1 (.007)
10. Physically attacked people (*n* = 957/959) Reliability = .75/.73	17	81.1 (.013)	82.4 (.012)	17.0 (.012)	16.2 (.012)	1.9 (.004)	1.4 (.004)
	29	74.1 (.014)	79.8 (.013)	24.4 (.014)	18.7 (.013)	1.5 (.004)	1.4 (.004)
	41	63.0 (.016)	70.0 (.015)	34.4 (.015)	28.7 (.015)	2.6 (.005)	1.3 (.004)

Note. These estimates are based on the observed frequencies. Numbers in parentheses refer to the number of boys (before the slash) and girls who had no missing data in the second, third, and fourth waves of data collection.

*SE*s of the estimate of the conditional probability of a randomly selected child in the general population exhibiting a particular disruptive behavior appear in parentheses in columns 3–8. Reliability refers to the coefficient of determination (Bollen, 1989) estimate for boys and girls, respectively, derived from a one-common factor model of the same disruptive behavior measured at 17, 29, and 41 months of age. All parameter estimates have a coefficient of variation smaller than 33.4%.

TABLE 2

Estimates of the Percentage of Children Who Started or Stopped Exhibiting Disruptive Behaviors Between 29 and 41 Months of Age

	Starting (%)		Stopping (%)		1 − Hit Rate		False-Alarm Rate	
Disruptive Behavior	**Boy**	**Girl**	**Boy**	**Girl**	**Boy**	**Girl**	**Boy**	**Girl**
Opposition-Defiance								
1. Defiant	18.1	14.6	6.4	8.3	0.64	0.67	0.39	0.54
2. Didn’t feel guilty	4.4	2.4	10.0	9.7	0.69	0.62	0.84	0.87
3. Didn’t change behavior	6.2	3.3	8.2	6.5	0.77	0.67	0.81	0.80
Inattention								
4. Inattentive	4.9	3.6	2.1	1.3	0.87	0.91	0.74	0.78
5. Easily distracted	8.1	4.6	3.0	4.2	0.83	0.82	0.65	0.81
Hyperactivity								
6. Restless or hyperactive	11.8	7.5	10.9	9.4	0.45	0.50	0.43	0.55
7. Fidgets	5.4	5.8	18.9	13.2	0.33	0.39	0.58	0.66
8. Difficulty waiting	11.1	14.0	10.8	11.1	0.66	0.64	0.61	0.70
Physical Aggression								
9. Fights	6.1	4.2	2.4	1.7	0.78	0.82	0.57	0.65
10. Attacks	2.1	1.0	1.0	1.1	0.83	0.77	0.71	0.80

Note. These estimates are based on the observed frequencies. “1 − Hit Rate” refers to the proportion of children who, at 41 months of age, exhibited a particular DB on a frequent basis but had not done so one year earlier. The false-alarm rate refers to the proportion of children who, at 29 months of age, had exhibited a particular DB on a frequent basis, but did not do so one year later.

TABLE 3

Likelihood-Ratio Chi-Square Statistic Associated With Four Hierarchical Loglinear Models

	Model 1		Model 2				Model 3		Model 4
	Association With Gender and the Same Behavior at 17 Months of Age (i.e., BD, CD, GD)		Null Association With Gender (i.e., BD, CD)				Null Association With the Same Behavior at 17 Months of Age (i.e., CD, GD)		Equiprobability
Disruptive Behavior	L^2	*p*	L^2	*p*	L^2 (2) − L^2 (1)	*p*	L^2	*p*	L^2
				Opposition-Defiance					
1. Defiant	35.44	.062	45.24	.011	9.80	.007	67.70	.000	1486.19
2. Didn't feel guilty	17.09	.845	30.24	.258	13.16	.001	37.63	.106	1114.58
3. Didn't change behavior	25.29	.390	32.02	.193	6.73	.035	57.62	.001	1011.28
				Inattention					
4. Inattentive	31.95	.128	35.36	.104	3.42	.181	78.88	.000	1475.17
5. Easily distracted	37.73	.037	53.00	.001	15.28	.000	72.91	.000	1035.79
				Hyperactivity					
6. Restless or hyperactive[a]	25.74	.018	62.28	.000	36.54	.000	108.96	.000	1030.04
7. Fidgets	29.80	.192	37.02	.075	7.22	.027	54.65	.002	762.05
8. Difficulty waiting	21.56	.606	39.89	.040	18.33	.000	64.66	.000	827.11
				Physical Aggression					
9. Fights	24.73	.420	41.85	.025	17.11	.000	105.03	.000	1295.49
10. Attacks	26.45	.331	34.53	.122	8.08	.018	80.59	.000	1782.70

Note. There were 24, 26, and 28 *df*s for Models 1, 2, and 3, respectively; therefore, 2 *df*s for the comparison between Models 1 and 2. L^2 = Likelihood-ratio chi-square test statistic. BD, CD, and GD refer to the main effect of the same behavior at 17 and 29 months of age, and of the child's gender, respectively.

[a]Model 1 is CD, BGD with 20 *df*s.

TABLE 4

ates of the Conditional Probability of a Randomly Selected Boy and Girl in the General Population Exhibiting Disruptive Behaviors—Never (N), imes (S), or Often (O)—at 41 Months of Age, Given the Degree to Which He or She Exhibited the Same Behaviors at 29 and 17 Months of Age

1. Defiant

41 Months of Age

	Boy				**Girl**		
nths	**Never**	**Sometimes**	**Often**	**29 Months**	**Never**	**Sometimes**	**Often**
	.187/.094/.211 (.028/.022/.058)	.718/.776/.615 (.031/.031/.057)	.095/.130/.175 (.018/.025/.038)	N	.192/.097/.222 (.029/.022/.061)	.739/.807/.648 (.030/.028/.059)	.069/.095/.130 (.014/.019/.030)
	.069/.031/.072 (.011/.007/.021)	.719/.705/.568 (.020/.021/.041)	.213/.264/.360 (.018/.020/.040)	S	.073/.034/.080 (.012/.007/.024)	.767/.765/.636 (.018/.018/.040)	.160/.201/.284 (.015/.018/.037)
	.027[a]/.011[a]/.022[a] (.012/.005/.010)	.470/.420/.296 (.038/.035/.038)	.504/.569/.681 (.039/.035/.040)	O	.031[a]/.013[a]/.028[a] (.013/.006/.013)	.552/.505/.371 (.038/.035/.043)	.417/.482/.601 (.038/.036/.045)

2. Didn't Feel Guilty

41 Months of Age

	Boy				Girl		
nths	Never	Sometimes	Often	29 Months	Never	Sometimes	Often
	.646/.570/.526 (.020/.028/.034)	.314/.398/.418 (.020/.028/.034)	.040/.032/.056 (.008/.009/.015)	N	.713/.640/.602 (.019/.027/.034)	.264/.340/.364 (.018/.027/.033)	.024/.019/.034 (.005/.006/.010)
	.460/.382/.341 (.026/.029/.032)	.480/.572/.581 (.026/.030/.034)	.060/.046/.078 (.013/.013/.020)	S	.537/.454/.414 (.025/.030/.035)	.426/.517/.536 (.025/.031/.036)	.038/.029/.050 (.009/.009/.014)
	.377/.319/.267 (.038/.038/.035)	.450/.547/.521 (.039/.043/.045)	.173/.134/.213 (.035/.035/.044)	O	.465/.396/.344 (.040/.041/.040)	.422/.516/.510 (.038/.043/.044)	.113/.089/.146 (.026/.026/.035)

3. Didn't change behavior

41 Months of Age

nths	Never	Sometimes	Often
	.621/.489/.508 (.019/.023/.038)	.350/.473/.434 (.018/.023/.036)	.030/.038/.058 (.006/.008/.015)
	.396/.277/.290 (.023/.019/.031)	.542/.652/.601 (.023/.020/.034)	.062/.071/.109 (.011/.011/.023)
	.369/.256/.252 (.042/.035/.039)	.476/.567/.492 (.042/.041/.048)	.155/.177/.256 (.032/.034/.048)

4. Inattentive

41 Months of Age

nths	Never	Sometimes	Often
	.459/.283/.270[a] (.017/.023/.102)	.521/.699/.678 (.017/.024/.100)	.020/.018/.053[a] (.005/.005/.026)

Infant Ment Health J. Author manuscript; available in PMC 2016 December 20.

1. Defiant

41 Months of Age

	Boy				**Girl**		
nths	**Never**	**Sometimes**	**Often**	**29 Months**	**Never**	**Sometimes**	**Often**
	.205/.109/.095[a] (.017/.012/.044)	.716/.830/.738 (.019/.016/.072)	.079/.061/.167[a] (.012/.012/.064)				
	.199[a]/.113[a]/.079[a] (.068/.044/.048)	.563/.693/.494 (.080/.070/.121)	.238/.195/.427 (.068/.062/.130)				

5. Easily distracted

41 Months of Age

	Boy				Girl		
nths	Never	Sometimes	Often	29 Months	Never	Sometimes	Often
	.463/.337/.310 (.022/.026/.055)	.496/.607/.580 (.022/.026/.055)	.042/.057/.110 (.008/.012/.030)	N	.532/.402/.379 (.021/.028/.061)	.445/.565/.555 (.021/.028/.059)	.023/.033/.066 (.005/.008/.020)
	.269/.178/.151 (.021/.017/.033)	.622/.689/.609 (.024/.023/.051)	.109/.134/.241 (.017/.019/.049)	S	.333/.227/.203 (.024/.021/.041)	.601/.689/.639 (.024/.024/.050)	.066/.084/.158 (.012/.015/.039)
	.231/.147/.108 (.049/.035/.034)	.518/.555/.425 (.058/.059/.070)	.252/.298/.467 (.054/.059/.078)	O	.305/.203/.162 (.057/.045/.046)	.533/.597/.497 (.058/.055/.070)	.162/.201/.341 (.039/.046/.073)

6. Restless or hyperactive

41 Months of Age

	Boy				Girl		
nths	Never	Sometimes	Often	29 Months	Never	Sometimes	Often
	.515/.277/.285 (.036/.033/.054)	.432/.616/.590 (.034/.034/.052)	.053/.107/.121 (.012/020/.026)	N	.532/.418/.302 (.032/.035/.054)	.445/.537/.568 (.031/.034/.052)	.023/.045/.129 (.007/.010/.028)
	.245/.102/.100 (.028/.014/.024)	.618/.685/.654 (.032/.024/.035)	.137/.213/.240 (.024/.021.030)	S	.266/.184/.112 (.027/.020/.025)	.671/.710/.631 (.029/.023/.039)	.063/.107/.257 (.015/.015/.035)
	.115/039/.039 (.027/.010/.011)	.450/.407/.369 (.048/.035/.035)	.435/.554/.592 (.053/.037/.037)	O	.154/.092/.040 (.033/.020/.012)	.600/.548/.346 (.050/.040/.040)	.246/.360/.615 (.049/.040/.043)

7. Fidgets

41 Months of Age

	Boy				Girl		
nths	Never	Sometimes	Often	29 Months	Never	Sometimes	Often
	.613/.521/.505 (.027/.029/.034)	.350/.421/.415 (.026/.028/.032)	.036/.058/.081 (.008/.012/.017)	N	.635/.546/.533 (.025/.028/.034)	.340/.413/.410 (.024/.027/.033)	.025/.041/.057 (.006/.009/.013)
	.384/.297/.279 (.030/.024/.025)	.534/.583/.559 (.030/.012/.028)	.083/.120/.162 (.016/.017/.022)	S	.409/.321/.307 (.029/.024/.027)	.533/.592/.575 (.030/.025/.029)	.059/.087/.119 (.012/.013/.018)

Infant Ment Health J. Author manuscript; available in PMC 2016 December 20.

1. Defiant

41 Months of Age

	Boy				**Girl**		
nths	**Never**	**Sometimes**	**Often**	**29 Months**	**Never**	**Sometimes**	**Often**
	.248/.171/.146 (.031/.022/.017)	.462/.450/.391 (.040/.033/.027)	.290/.378/.463 (.043/.036/.030)	O	.284/.203/.178 (.034/.025/.021)	.495/.499/.447 (.039/.034/.030)	.221/.298/.376 (.038/.034/.033)

8. Difficulty Waiting

41 Months of Age

	Boy				Girl		
nths	Never	Sometimes	Often	29 Months	Never	Sometimes	Often
	.451/.359/.204 (.029/.030/.035)	.454/.536/.620 (.028/.030/.039)	.096/.105/.176 (.015/.017/.029)	N	.477/.382/.225 (.028/.029/.037)	.467/.555/.666 (.027/.029/.038)	.057/.063/.109 (.010/.011/.020)
	.216/.159/.078 (.021/.017/.015)	.599/.653/.652 (.025/.023/.032)	.185/.188/.270 (.021/.019/.032)	S	.239/.177/.090 (.022/.018/.018)	.646/.706/.734 (.024/.021/.029)	.115/.117/.176 (.015/.015/.025)
	.125/.090/.040 (.024/.018/.010)	.508/.543/.487 (.038/.037/.039)	.368/.367/.473 (.039/.038/.041)	O	.151/.109/.051 (.028/.022/.013)	.599/.641/.609 (.037/.035/.039)	.250/.249/.341 (.033/.032/.039)

9. Fights

41 Months of Age

	Boy				Girl		
nths	Never	Sometimes	Often	29 Months	Never	Sometimes	Often
	.652/.424/.130 (.018/.039/.079)	.319/.515/.581 (.017/.038/.096)	.029/.060/.289 (.005/.015/.083)	N	.738/.527/.187[a] (.016/.039/.107)	.242/.428/.560 (.015/.038/.106)	.020/.046/.253 (.004/.012/.081)
	.323/.155/.030 (.025/.022/.020)	.571/.680/.479 (.027/.034/.096)	.106/.165/.492 (.018/.031/.098)	S	.419/.218/.046[a] (.029/.028/.031)	.496/.641/.493 (.029/.035/.100)	.084/.141/.461 (.016/.029/.102)
	.285/.125/.015 (.067/.038/.012)	.422/.460/.204[a] (.068/.074/.072)	.293/.415/.781 (.064/.078/.075)	O	.382/.183/.024[a] (.078/.052/.018)	.379/.449/.218[a] (.069/.074/.079)	.240/.369/.758 (.060/.077/.084)

10. Attacks

41 Months of Age

	Boy				Girl		
nths	Never	Sometimes	Often	29 Months	Never	Sometimes	Often
	.747/.555/.504 (.015/.035/.104)	.244/.424/.393 (.015/.034/.094)	.010/.021[a]/.103[a] (.003/.009/.054)	N	.792/.618/.584 (.014/.033/.101)	.203/.371/.359 (.014/.033/.094)	.005[a]/.011[a]/.057[a] (.002/.005/.034)
	.450/.256/.202 (.030/.029/.067)	.516/.687/.555 (.030/.032/.095)	.034[a]/.058[a]/.242[a] (.011/.020/.093)	S	.516/.310/.268 (.031/.033/.082)	.466/.656/.579 (.031/.034/.094)	.018[a]/.034[a]/.153[a] (.008/.014/.074)

Infant Ment Health J. Author manuscript; available in PMC 2016 December 20.

1. Defiant							
41 Months of Age							
Boy				Girl			
nths	Never	Sometimes	Often	29 Months	Never	Sometimes	Often
	.249[a]/.116[a]/.053[a] (.098/.054/.036)	.557/.608/.282[a] (.108/.103/.133)	.195[a]/.277[a]/.665 (.090/.102/.151)	O	.319[a]/.160[a]/.089[a] (.114/.070/.057)	.562/.659/.375[a] (.112/.094/.151)	.120[a]/.182[a]/.537 (.063/.079/.174)

ese parameter estimates come from a loglinear model that includes a main effect of each independent variable (i.e., Model 1 from Table 3), except for two behaviors of opposition-defiance
or 3: didn't change behavior) and inattention (Behavior 4: inattentive). For these two disruptive behaviors, the loglinear model did not include a main effect of the child's gender (i.e., Model 2 from
. The first, second, and third values (separated by slashes) refer to the conditional probability given that a randomly selected child had exhibited never, sometimes, and often, respectively, the
in question at 17 months of age. *SE*s of the parameter estimates appear in parentheses.

ter estimate with a coefficient of variation greater than 33.3%.

Infant Ment Health J. Author manuscript; available in PMC 2016 December 20.

TABLE 5

Estimates of the Odds Ratios Describing the Association Between Disruptive Behaviors at 41 Months of Age, and the Same Behaviors at 17 Months of Age, and the Child's Gender

	Child's Gender		Disruptive Behavior at 17 Months of Age	
Disruptive Behavior	**Odds Ratio[†] [99% CI]**	**%of Variance Explained/Effect Size/PAF**	**Odds Ratio[‡] [99% CI]**	**%of Variance Explained/ Effect Size**
		Opposition-defiance		
1. Defiant	1.42 [1.06, 1.90]^{b*}	0.7/.07/.14	1.43 [1.18, 1.74]^{abd}	2.2/.19
2. Didn't feel guilty	1.34 [1.09, 1.65]^{a*b*}	1.2/.09/.22	1.28 [1.10, 1.49]^{acd}	1.8/.13
3. Didn't change behavior	1.60 [0.97, 2.65]^{b*}	0.7/.06/.25	1.65 [1.32, 2.07]^{ad}	3.3/.13
		Inattention		
4. Inattentive	1.17 [0.92, 1.48]^{a*b*}	0.2/.06/.13	2.15 [1.80, 2.56]^{ad}	3.2/.21
5. Easily distracted	1.36 [1.10, 1.67]^{a*b*}	1.5/.10/.22	1.76 [1.37, 2.27]^{ad}	3.4/.20
		Hyperactivity		
6. Restless or hyperactive	1.68 [1.21, 2.34]^{b*}	2.0/.14/.27	Boy: 2.85 [1.76, 4.62]^{a}	Boy: 8.6/.31
			Girl: 1.76 [1.40, 2.21]^{abcd}	Girl: 7.6/.35
7. Fidgets	1.44 [1.003, 2.06]^{b*}	0.9/.10/.23	1.41 [1.18, 1.68]^{abd}	3.4/.26
8. Difficulty waiting	1.75 [1.24, 2.45]^{b*}	2.2/.11/.25	1.57 [1.30, 1.88]^{acd}	5.2/.21
		Physical Aggression		
9. Fights	1.51 [1.17, 1.95]^{a*}	1.3/.11/.19	2.89 [2.07, 4.03]^{acd}	6.2/.31
10. Attacks	1.30 [1.02, 1.67]^{a*b*}	0.4/.08/.26	2.26 [1.69, 3.03]^{abd}	3.1/.27

Note. The percentage of variance due to gender after taking into account gender differences in the same behavior at 17 and 29 months of age was estimated as [L^2(BD, CD) − L^2(BD, CD, GD)]/L^2(equiprobability model). Similarly, the percentage of variance due to the same behavior at 17 months of age after taking into account the association between the behavior in question at 29 and 41 months of age was estimated as [L^2(GD, CD) − L^2(BD, CD, GD)]/L^2(equiprobability model). In both formulas, the equiprobability model was used as a benchmark. Under this model, the response categories—never, sometimes and often—are equiprobable. Effect size was estimated using Cohen's (1988) *w* statistic. PAF refers to the population attributable fraction for the child's gender. It was estimated as the proportion of male children who exhibit a particular disruptive behavior on a frequent basis, minus the proportion of female children who do so, over the proportion in question among all children in the population.

^{a*}Refers to the boy/girl ratio of the odds of exhibiting a particular disruptive behavior *sometimes* rather than *never*;

^{b*}Refers to the boy/girl ratio of the odds of exhibiting a particular disruptive behavior *often* rather than *sometimes*;

^{a}Refers to the odds of exhibiting a particular disruptive behavior at 41 months of age *sometimes* rather than *never* for children who did exhibit the same behavior *sometimes* rather than *never* at 17 months of age;

^{b}Refers to the odds of exhibiting a particular disruptive behavior at 41 months of age *often* rather than *sometimes* for children who did exhibit the same behavior *sometimes* rather than *never* at 17 months of age;

^{c}Refers to the odds of exhibiting a particular disruptive behavior at 41 months of age *sometimes* rather than *never* for children who did exhibit the same behavior *often* rather than *sometimes* at 17 months of age;

^{d}Refers to the odds of exhibiting a particular disruptive behavior at 41 months of age *often* rather than *sometimes* for children who did exhibit the same behavior *often* rather than *sometimes* at 17 months of age.

†These estimates were obtained from a restricted version of the selected baseline hierarchical loglinear model. Six restricted versions were considered using a coding scheme (Galindo-Garre, Vermunt, & Croon, 2002; see also Galindo-Garre & Vermunt, 2005) wherein equality restrictions were imposed between the three local log-odds ratios a*, b*, and c* in the 2 × 2 subtables formed by considering, respectively, the *never* and *sometimes*, the *sometimes* and *often*, and the *never* and *often* rating categories. More specifically, three restricted models were obtained by imposing equality restrictions between pairs of log-odds ratios (i.e., a* = b*; a* = c*, equivalent to b* = 0; b* = c*, equivalent to a* = 0) and three other models were obtained by imposing equality restrictions between one log-odds ratio and the inverse of another log-odds ratio (i.e., a* = 1/b*, equivalent to c* = 0; a* = 1/c*; b* = 1/c*). [Note that these models included, as special cases, the loglinear models (i.e., uniform and row-effect) proposed by L.A. Goodman (1979) for the analysis of association in cross-classifications having ordered categories.] The restricted model with the smallest likelihood-ratio chi-square statistic was chosen. Note that this restricted model did not represent a statistically significant decrease in fit over the selected baseline model.

‡These estimates were obtained from a restricted version of the selected baseline hierarchical loglinear model. Many restricted versions were considered using the same coding scheme described earlier wherein equality (including equality to 0) restrictions were imposed between the four local log-odds ratios, *a*, *b*, *c*, and *d* in the 2 × 2 subtables formed from adjacent rating categories (Clogg & Shihadeh, 1994). The log-odds ratio *a* involved *never* and *sometimes* for both time points. Similarly, the log-odds ratio *d* involved *sometimes* and *often* for both time points. The log-odds ratio *b* involved *never* and *sometimes* at 17 months of age, and *sometimes* and *often* at 41 months of age. The contrary was true for the log-odds ratio *c*. More specifically, 10 restricted models were obtained by imposing one equality restriction (i.e., a = b; a = c; a = d; b = c; b = d; c = d; a = 0; b = 0; c = 0; d = 0). Twenty-five restricted models were obtained by imposing two equality restrictions (i.e., a = b = 0; a = c = 0; a = d = 0; b = c = 0; b = d = 0; c = d = 0; a = b & c = d; a = c & b = d; a = d & b = c; a = b = c; a = b = d; a = c = d; b = c = d; a = 0 & b = c; a = 0 & b = d; a = 0 & c = d; b = 0 & a = c; b = 0 & a = d; b = 0 & c = d; c = 0 & a = b; c = 0 & a = d; c = 0 & b = d; d = 0 & a = b; d = 0 & a = c; d = 0 & b = c). Finally, 15 other models were obtained by imposing three equality restrictions (i.e., a = b & c = d = 0; a = c & b = d = 0; a = d & b = c = 0; b = c & a = d = 0; b = d & a = c = 0; c = d & a = b = 0; a = b = c & d = 0; a = b = d & c = 0; a = c = d & b = 0; b = c = d & a = 0; a = b = c = d; a = b = c = 0; a = b = d = 0; a = c = d = 0; b = c = d = 0) [Note that these models included, as special cases, some of the loglinear association models (i.e., uniform, row-effect, and column-effect) proposed by L.A. Goodman, 1979.] For each set of models, the restricted model with the smallest L^2 was chosen, and the resulting three models were compared among themselves to find the most parsimonious model for the data. Note that this restricted model did not represent a statistically significant decrease in fit over the selected baseline model.