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PSYCHOPHARMACOLOGY

# Therapeutic Response to Methylphenidate in ADHD: Role of Child and Observer Gender

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## Abstract

**Objective:** This study aims to examine the interaction between the gender of the child and the gender of the observers (teachers, parents) on the therapeutic response (TR) noted with methylphenidate (MPH) in children with ADHD. **Method:** Children with ADHD participated in a two week double-blind, randomized, cross-over clinical trial with MPH and placebo, and the difference between the week of treatment with MPH and placebo was calculated for each measure to obtain the treatment response (TR) with MPH. The TR for differences based on the gender of child and the observer was examined by using a univariate analysis of covariance (ANCOVA). **Results:** 299 children (269-male, 30-female; average age 8.9±1.8 years) were evaluated by 52 male teachers, 212 female teachers; 269 female parents and 30 male parents. For the baseline week, the ANCOVA analysis for teachers yielded a significant teacher's gender x child's gender interaction. For the evaluation of TR, the ANCOVA analysis revealed a significant teacher's gender x child's gender interaction whereas no parent's gender x child's gender interactions were noted, all noted interactions were of a small effect size (eta squared <0.02). **Conclusions:** These results suggest that there are differences in symptom assessment between parents and teachers at baseline and with TR based on the gender of the observer and the child. While clinicians need to be aware of these interactions, it remains unclear if these interactions will be clinically useful due to the small effect sizes.

***Key Words:*** *ADHD, methylphenidate, child gender, observer gender, therapeutic response*

## Résumé

**Objectif:** La présente étude vise à examiner l'interaction entre le sexe de l'enfant et le sexe des observateurs (enseignants, parents) dans le cadre de la réponse thérapeutique (RT) notée au méthylphénidate (MPH) chez les enfants souffrant du trouble de déficit de l'attention avec hyperactivité (TDAH). **Méthode:** Des enfants souffrant du TDAH ont participé à un essai clinique randomisé croisé de deux semaines à double insu avec MPH et placebo, et la différence entre la semaine de traitement avec MPH et celle avec placebo a été calculée pour chaque mesure afin d'obtenir la réponse au traitement (RT) avec MPH. La RT pour les différences basées sur le sexe de l'enfant et de l'observateur a été examinée à l'aide d'une analyse univariée de la variance (ANCOVA). **Résultats:** Deux cent quatre-vingt- dix-neuf enfants (269 garçons, 30 filles; âge moyen 8,9±1,8 ans) ont été évalués par 52 enseignants de sexe masculin, 212 enseignantes de sexe féminin; 269 parents de sexe féminin et 30 parents de sexe masculin. Pour la semaine de départ, l'analyse ANCOVA des enseignants a dégagé une interaction significative entre le sexe de l'enseignant et le sexe de l'enfant. Pour l'évaluation des RT, l'analyse ANCOVA a révélé une interaction significative entre le sexe de l'enseignant et le sexe de l'enfant, alors

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qu'aucune interaction n'a été notée entre le sexe d'un parent et le sexe de l'enfant. Toutes les interactions notées étaient d'une petite taille de l'effet (êta carré < 0,02). **Conclusions:** Ces résultats suggèrent qu'il y a des différences d'évaluation des symptômes entre parents et enseignants au départ, et de la RT selon le sexe de l'observateur et le sexe de l'enfant. Bien que les cliniciens doivent être conscients de ces interactions, il demeure incertain si ces interactions seront utiles sur le plan clinique en raison des petites tailles de l'effet.

***Mots clés:*** TDAH, méthylphénidate, sexe de l'enfant, sexe de l'observateur, réponse thérapeutique

## Introduction

Gender-based differences have been described in children with attention deficit hyperactivity disorder (ADHD) (Biederman & Faraone, 2004). The disorder is more prevalent in boys as compared to girls, and boys tend to have more of the hyperactive/impulsive presentation (Rucklidge, 2010). In addition to differences in cognition and behavioral aspects, differences in longitudinal course and outcome have been described based on the child's gender (Bauermeister et al., 2007; Breen, 1989; Rucklidge, 2010). Further, more boys than girls appear to receive treatment for ADHD (Derks, Hudziak, & Boomsma, 2007). While the clinical and demographic features of ADHD have been well characterized as a function of the child's gender (Arcia & Conners, 1998), there is no available literature looking into the interaction of the gender of the observer and the gender of the child in mediating clinical profiles and treatment outcomes.

ADHD is the most commonly diagnosed psychiatric disorder in childhood and various biopsychosocial mechanisms have been implicated in the observed gender-based differences among children with ADHD (Silverthorn, Frick, Kuper, & Ott, 1996). Biological factors include hormonal, genetic, epigenetic, and other biological differences based in neural circuitry (Balint et al., 2009; Faraone et al., 1995). Psychological factors such as impulsivity, self-inhibition, and reward-related behavior have been implicated in ADHD. Environmental factors such as maternal smoking during pregnancy (MSDP) have been correlated with ADHD development, and differential effects of environmental adversity in ADHD have been described based on gender (Biederman, Faraone, & Monuteaux, 2002). Sociological factors such as gender-role and school-related expectations have been thought to play a role in the observed differences in the prevalence of ADHD across the world (Greene et al., 2001).

Similar to the biopsychosocial approach towards understanding the heterogeneity in the ADHD clinical phenotype, a biopsychosocial approach has been employed to appreciate the variability in therapeutic response (TR) noted with stimulant medications such as methylphenidate (MPH). Gender-based differences in pharmacokinetics attributed to the ADME (absorption, distribution, metabolism, excretion) mechanisms such as liver enzyme and body fat distribution have been extensively reported (Soldin, Chung, & Mattison, 2011). Psychological factors such as increased aggression and oppositional behavior among boys could impact the TR observed with MPH (Rucklidge, 2008). Further, the increased co-morbidity noted among male children with ADHD could contribute to a heterogeneous TR profile based on gender. Finally, social factors such as gender-role based expectations could lead to differences in TR (Rucklidge, 2008).

Unlike adult psychiatric disorders, the assessment of ADHD is based on reports of the child's behavior as noted by observers such as parents and teachers which could contribute to greater variability in TR (Brock & Clinton, 2007). Stimulants such as MPH have been demonstrated in clinical trials to reduce inattention and hyperactivity and enhance educational outcomes in children with ADHD (Storebo et al., 2018). The diagnosis and management of ADHD by the clinician is based on information obtained from parents and teachers and from clinical interviews. This information is used to begin stimulant treatments. Further titration to achieve optimal TR with minimal side effects, is based on feedback from parents and teachers, and clinical observations of the child (Offord et al., 1996). While biopsychosocial factors intrinsic to the child could contribute to the observed heterogeneity, factors unique to the observer could interact in dynamic ways with that of the child to account for some of the variability in TR (Havey, Olson, McCormick, & Cates, 2005).

In the context of examining gender-based differences in ADHD, there are several studies looking into the clinical phenotype (Rucklidge, 2010), fewer studies that examine the TR, and no studies that examine gender interaction in TR. This project aims to delineate the interaction between the gender of teacher/parent with the child's gender in determining symptoms of ADHD and response to MPH. Given the complex biopsychosocial aspects that come into play when a child with ADHD of a specific gender is evaluated by an observer of a specific gender, we hypothesized that gender-based interactions would vary based on the observational setting.

# Methods

## Subjects

The Clinical and Pharmacogenetic Study of ADHDis an ongoing study at the Douglas Mental Health Research Institute (DMHUI) in Montreal, funded by the Canadian Institutes of Health Research (https://clinicaltrials.gov/ct2/show/NCT00483106). The current study included a subset of all the subjects in this ongoing study as all the required measures were not available on all subjects. The protocol for the research study was approved by the Research Ethics Board of DMHUI. Children are referred to DMHUI by family doctors, teachers, community social workers, and pediatricians. These children were evaluated at the Disruptive Behavior Disorders Program and pediatric outpatient clinics. Children diagnosed at these clinics with ADHD between the ages of 6 and 12 were recruited to the study. Following a detailed explanation of the study, parents provide written consent. Similarly, children gave their assent to participate in the study.

The clinical diagnosis of ADHD is made by experienced psychiatrists. The diagnosis is based on Diagnostic and Statistical Manual (DSM)-IV-TR criteria (American Psychiatric Association, 2000) dependent on clinical interviews of the child and requires information provided to the clinician from at least one parent to be available at the time of the clinical interview. The Diagnostic Interview Schedule for Children-version IV, (DISC-IV) is a structured clinical interview of parents and is used to substantiate the clinical diagnosis (Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000). In addition, the DISC-IV also serves to diagnose the presence of comorbid disorders such as oppositional defiant disorder, conduct disorder, anxiety disorders and mood disorders. Children with a history of Tourette's syndrome, IQ lower than 70 on the Wechsler Intelligence Scale for Children-III/IV (Wechsler, 1991), pervasive developmental disorder or psychosis were excluded from the study. Children with a previous history of intolerance or allergic reaction to MPH were also excluded from the study. When children were on medication prior to the inclusion to the trial, all medications where titrated down and stopped during a variable period of time, depending on the nature of the pharmacological treatment. Once all medications were stopped, children were kept with no medication for a period of one week and then the trial was initiated.

## Study protocol

The core aspect of the study is a two week, double-blind, randomized, cross-over clinical trial with MPH and placebo. The MPH and matching placebo pills were prepared by a pharmacist who was not involved in the study and the randomization was ensured by a research psychologist who did not have any patient contact. The random sequence generation was done by a computer algorithm and envelopes were used for allocation concealment. Following an initial week of baseline assessments, during which children are not taking any medication, children received either placebo or 0.5 mg/kg of body weight of MPH divided into two equal doses (morning and noon) daily over a one week period and crossed over during the second week. Side-effects are monitored by the clinicians and by parents who fill out a side-effects (SE) rating scale during each week of treatment..

During each week of the clinical trial, a battery of ecological, behavioral and laboratory measures were carried out and repeated during the following week. Teachers assessed the behavior at school by filling out the Conners' Global Index-Teacher's version (Conners'-T) (Conners, Sitarenios, Parker, & Epstein, 1998a), and parents assessed behavior at home by completing the Conners' Global Index-Parent's version (Conners'-P) (Conners, Sitarenios, Parker, & Epstein, 1998b). The T-scores of the Conners' scale takes into account the age and gender of the child (Conners, 1995). While teachers assessed the behavior during the school day, parents assessed behavior during the weekend after the child received the medication. Both Conners'-P and Conners'-T examine the frequency of ten types of ecologically relevant behavior and the results are organized into total scores (TS) dimensions, with two factors: emotional labile (EL) and restless-impulsive (RI). Further details regarding the study protocol have been described in earlier papers (Grizenko, Bhat, Schwartz, Ter-Stepanian, & Joober, 2006).

## Statistical methods

The initial analysis examined demographic parameters among children with ADHD, followed by the examination of gender-based differences in these demographic parameters using analysis of variance (ANOVA) or chi-squared methods depending on whether the data was continuous or categorical in nature. The demographic data were then examined for any differences based on the gender of the parent and the teacher using an ANOVA. Any significant demographic variables were then used as covariates in subsequent analysis of covariance (ANCOVA) analyses. The difference between the test scores obtained during the MPH and placebo weeks was used to calculate the therapeutic response (TR). The Conners'-T, Conners'-P were then separately examined for baseline and TR scores for differences based on the gender of the child and the observer by using a ANCOVA.

The ANCOVA used the Conners' score (parents or teacher) as the continuous outcome variable and gender of the child (male or female) and gender of the observer (male or female) as the two independent factors. Prior to every analysis, the data were examined for assumptions of parametric methods. This included visual examination of the data for outliers, homogeneity of variance, independence of predictor and covariate, and ensuring that the deviations from normality were minimal. The analysis was done using the statistical software package SPSS version 24.

**Table 1. Demographic and Clinical Characteristics of the Sample of Children with ADHD Included in the Study**

| | Overall (299) | Male (269) | Female (30) | Statistic | *P* Value |
|---|---|---|---|---|---|
| Age | 8.9 (1.8) | 8.9 (1.8) | 9.1 (1.8) | $F_{1,297} = 0.3$ | 0.58 |
| Annual Household Income (%)[a] | 1.6%/10.3%/12.8% | 2.0%/11.3%/11.3% | 0.0%/5.9%/11.0% | $X^2$10.7, *df* = 5 | 0.06 |
| Weeks of gestation | 38.8 (2.3) | 38.8 (2.3) | 39.1 (2.1) | $F_{1,297} = 1.4$ | 0.23 |
| CBCL Total Score | 68.1 (8.3) | 68.4 (8.1) | 67.3 (9.2) | $F_{1,297} = 1.7$ | 0.19 |
| CBCL Internalizing | 63.5 (9.9) | 63.7 (9.5) | 62.6 (11.5) | $F_{1,297} = 1.2$ | 0.28 |
| CBCL Externalizing | 67.3 (9.9) | 67.6 (9.7) | 66.1 (10.5) | $F_{1,297} = 2.0$ | 0.15 |
| DISC Inattentive | 7.0 (2.2) | 6.9 (2.2) | 7.2 (2.1) | $F_{1,297} = 2.1$ | 0.15 |
| DISC Hyperactive | 5.4 (2.6) | 5.6 (2.6) | 4.8 (2.7) | $F_{1,297} = 9.3$ | <0.01 |
| DISC Impulsive | 1.0 (1.0) | 2.1 (1) | 1.9 (1.1) | $F_{1,297} = 3.3$ | 0.07 |
| DISC Total | 12.4 (3.8) | 12.5 (3.8) | 12.0 (3.7) | $F_{1,297} = 1.6$ | 0.20 |
| Any comorbidity Present | 239 (88.8%) | 213 (79.5%) | 26 (86.6%) | $X^2$ 6.4 , *df* =1 | 0.09 |
| Conduct Disorder Present (N/Y) | 250 (92.9%) | 224 (83.3%) | 26 (86.6%)/ | $X^2$5.4, , *df* =1 | 0.12 |
| ODD Present (N/Y) | 133 (49.4%) | 117 (43.5%) | 16 (53.3%) | $X^2$1.3, , *df* =1 | 0.24 |
| Wisc-FIQ | 96.6 (13.5) | 96.8 (13.9) | 95.8 (11.9) | $F_{1,297} = 0.4$ | 0.51 |

Values are mean (+/-SD) unless otherwise indicated.
[a] < $6,000, $6 - $10,000, $10 - $20,000, $20 - $30,000, $30 - $40,000,> $40,000 Child Behaviour Checklist (CBCL), Diagnostic Interview Schedule (DISC), e Wechsler Intelligence Scale for Children- Full scale Intelligence Quotient (WISC-FIQ), Oppositional Defiant Disorder (ODD)

**Table 2. Observed effect size for interaction terms**

| Teacher x Child Gender Interaction | | | | |
|---|---|---|---|---|
| Interaction terms | Baseline (F/p value) | Partial Eta Squared | TR(F/p value) | Partial Eta Squared |
| RI | 6.61/0.01 | 0.01 | 3.77/0.05 | 0.02 |
| EL | 8.80/0.00 | 0.02 | 3.03/0.06 | 0.01 |
| TS | 7.68/0.00 | 0.02 | 3.44/0.06 | 0.01 |
| **Parent x Child Gender Interaction** | | | | |
| Interaction terms | Baseline (F/p value) | Partial Eta Squared | TR(F/p value) | Partial Eta Squared |
| RI | 0.49/0.48 | 0.00 | 0.09/0.76 | 0.00 |
| EL | 0.09/0.77 | 0.00 | 0.04/0.83 | 0.00 |
| TS | 0.32/0.57 | 0.00 | 0.00/0.95 | 0.00 |

RI- Restless Impulsive; EL-Emotional Labile; TS-Total scores; TR-Therapeutic Response

## Results

More than ninety percent of the children invited to participate in the study by research assistants agreed to participate. 299 children (269 male, 30 female) with ADHD participated in the study: average age of 8.9 (±1.8) years, BMI of 18.5 (± 4.0), an average IQ of 97 (±13.5), and total Child Behavioral Checklist (CBCL) score of 68.1 (± 8.3). Boys had more of the hyperactive/impulsive presentation (p=0.01). No differences were noted among the other demographic parameters between males and females in the study group (clinical and demographic characteristics summarized in Table 1). The Conners'-T included information from 52 male teachers, 212 female teachers, and the Conners'-P had information from 269 female parents and 30 male parents.

Children with ADHD by teacher's gender demonstrated gender-based differences for children being slightly older, having lower household family incomes, increased prevalence of conduct disorder and having lower weeks of gestation under male teachers. The demographics of children with ADHD by parent's gender did not demonstrate

gender-based differences apart from age. A significant effect was noted for TR for Conners'-T (p=0.01), Conners'-P (p=0.01).

Figure 1 presents the two factors (RI, EL) and total scores (TS) of the Conners'-T scores in boys and girls separated by the gender of the teacher performing the evaluation at baseline (Panels A1, A2 and A3) and with TR (panels B1, B2 and B3). The ANCOVA included ADHD presentations, age, weeks of gestation, income and conduct disorder as covariates. For baseline evaluations, significant gender-based interactions for RI (p=0.01). EL (p=0.01) and the TS score was noted (p=0.01). Post-hoc analysis revealed that for the RI dimension, when comparing female teachers with male teachers, girls were observed to be rated more severely; for the EL dimension, male teachers found boys to be more severe. The overall TS effect stemmed from a combination of male teachers finding boys more severe and female teachers noting that girls were more severe. For TR, the EL factor (p=0.04) and TS (p=0.04) showed main effects of the child's gender but no interaction between the child and the teacher's gender. Boys were found to have greater improvement overall, when compared to girls. Notably, there was a significant interaction between the gender of the child and the gender of the teacher in the RI dimensions (p = 0.05). Post-hoc analysis revealed that male teachers found boys improved more with MPH. All significant interactions were of a small effect size (partial eta squared =0.02), the details are presented in Table 2.

Figure 2 presents the two factors (RI, EL) and total scores (TS) of the Conners'-P scores in boys and girls separated by the gender of the parent performing the evaluation at baseline (Panels A1, A2 and A3) and with TR (Panels B1, B2 and B3). For baseline evaluations, significant main effects of the gender of the child were revealed for RI (p=0.01), EL (P=0.01) subtypes, and TS (p=0.01). Parents noted higher scores for female children (p=0.01). No interaction was noted between gender of parent and child. For TR, there were no main or interaction effects.

## Discussion

While there is extensive literature on gender differences in ADHD, to our knowledge, the present study is the first attempt to examine the interaction between the gender of parent/teacher and the gender of child in TR in ADHD. The demographic differences based on teachers' gender suggest that among children with ADHD, male teachers appeared to be assigned to slightly older boys with lower family incomes, and more severe conduct disorder. In addition, the weeks of gestational age at birth is less under male teachers which could partly be due to the noted lower family incomes and higher comorbidity. While these findings could be a feature specific to this study, it would be interesting to query if schools tend to make student assignments that take particular demographics of the child into account.

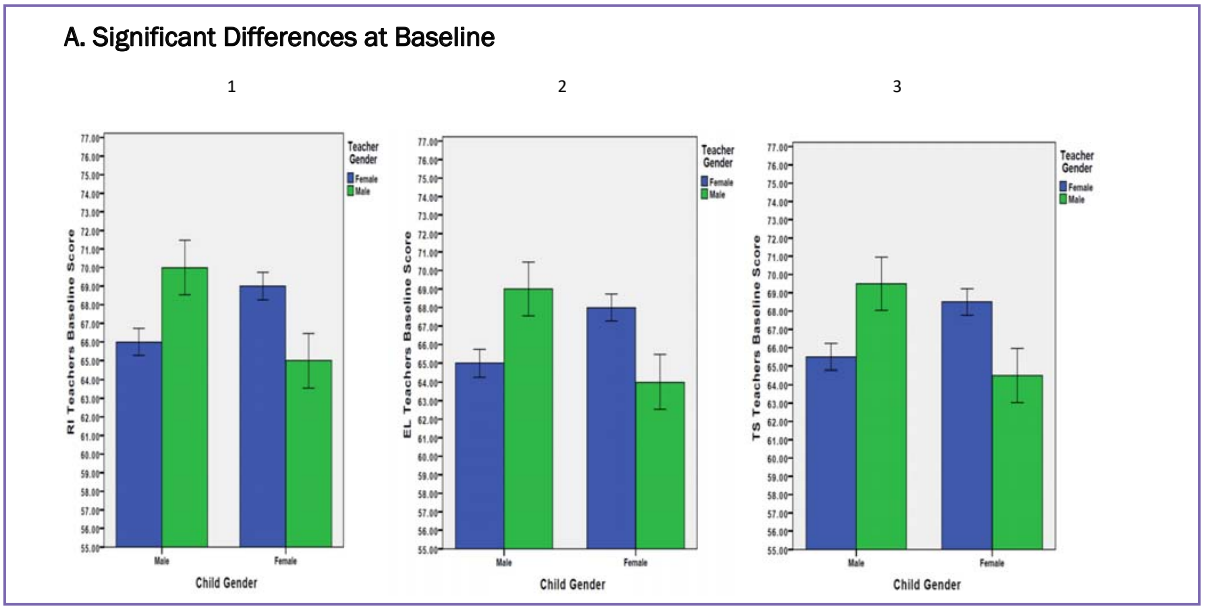
For the baseline analysis, there are differences in symptom assessment between parents and teachers with interactions between the gender of the observer and the gender of the child noted only for teachers suggesting that some aspects of the symptoms might be assessed differently (Reid et al., 2000). For all dimensions (RI, EL,TS), female teachers found girls to be more severe, and male teachers found boys to be more severe. Teachers could have limited contact with children as compared to parents who have known the child since birth. Further, parents could have alternate explanatory models for ADHD based on gender (Bussing, Gary, Mills, & Garvan, 2003). Gender-based differences have been reported in the achievement goals of children with ADHD (Dunn & Shapiro, 1999). Many of the children (more than two-thirds) had previously been on medication prior to the washout period which could contribute to some of the study observations, especially by teachers who might be biased by prior history of response to MPH. In addition, in the presence of large class sizes, teachers might have limited contact with children (De Los Reyes & Kazdin, 2005).

The TR with MPH was consistently observed in all observation settings suggesting that MPH improved symptomatic outcomes. This includes consistent and statistically significant TR in every observation setting suggesting that a true response was noted irrespective of the observer. It firmly supports the hypothesis that there are shared elements of commonality that observers attribute to TR irrespective of the observation setting.

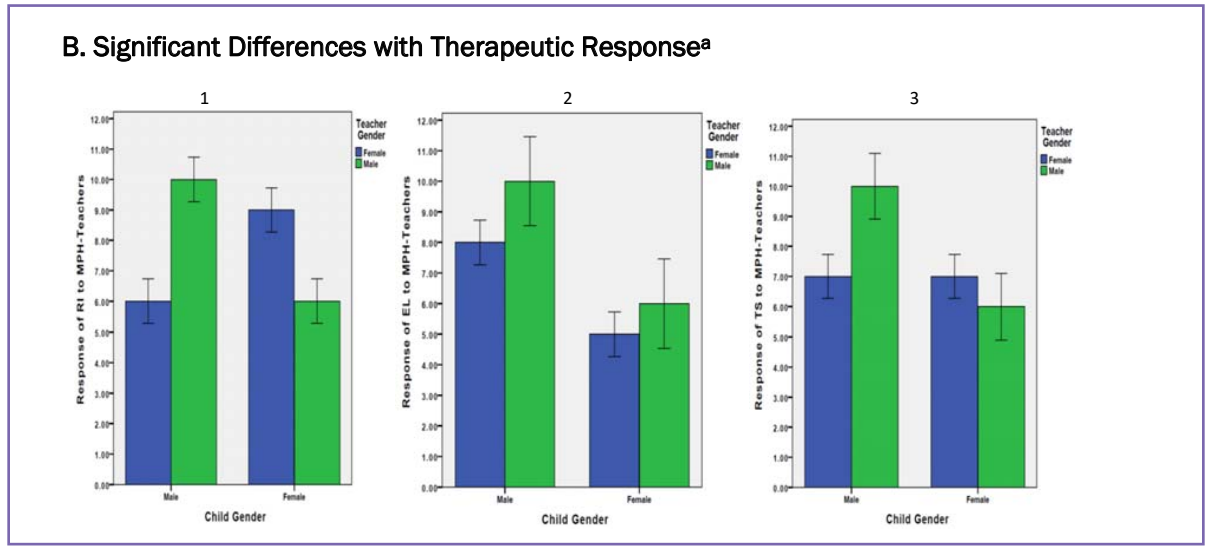
For the TR analysis, there are differences in symptom assessment between parents and teachers with interactions noted only for teachers when children have more severe RI dimension scores, and male teachers observe that boys show more improvement than girls. Gender-based differences have been described in educational assessments in classroom settings (Abikoff et al., 2002), which could be amplified in ADHD and in response to treatments for ADHD (Whalen, Henker, & Dotemoto, 1980). In the presence of comorbidities such as intellectual disability and oppositional defiant disorder which are more commonly seen among male children, gender-differences can influence teacher assessments (Achenbach, McConaughy, & Howell, 1987). Importantly, various internalized gender roles and expectations could lead to variations ascribed to TR.

Interestingly, teachers (irrespective of teacher gender) find that boys demonstrate greater overall TR than girls. Cross-cultural differences have also been noted in teacher perceptions of classroom interventions (behavioral vs pharmacological) in ADHD in the United States and New Zealand, and interactions have been demonstrated between student gender, nationality, and intervention preference (Curtis, Pisecco, Hamilton, & Moore, 2006). Moreover, teacher expectations have been shown to vary, and teachers have been shown to rate children with ADHD, and children with ADHD stimulant treatment labels less favourably

**Figure 1. Conners'-Teacher Scores at Baseline and with Therapeutic Response Separated by Teacher's and Child's Gender**



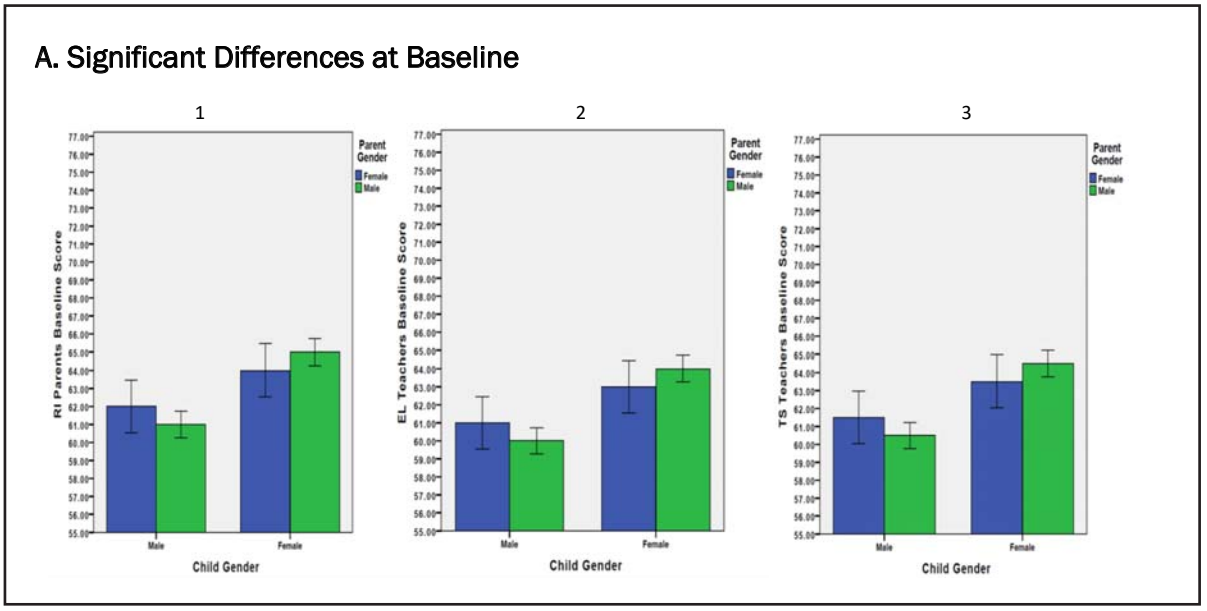

1. Conners' Teacher's Restless Impulsive Baseline Scores, Child's gender x teacher's gender (F=6.6 p=0.01)
2. Conners' Teacher's Emotional Labile Baseline Scores, Child's gender x teacher's gender (F=8.8, p=0.01)
3. Conners' Teacher's Total Scores, Child's gender x teacher's gender (F =7.7, p=0.01)



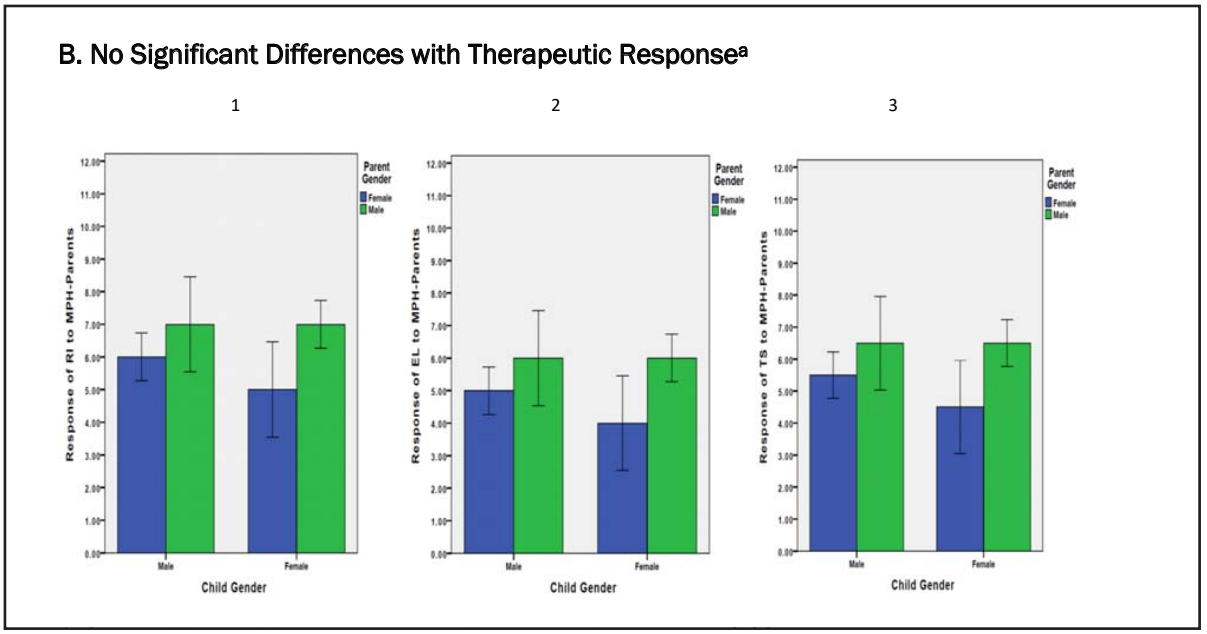

1. Conners' Teacher's Restless Impulsive Therapeutic Response, Child's gender x teacher's gender (F= 3.8, p=0.05)
2. Conners' Teacher's Emotional Labile Therapeutic Response, Child's gender (F= 4.3, p=0.04)
3. Conners' Teacher's Total Therapeutic Response, Child's gender (F=4.2, p=0.04); Teacher's gender (F=6.1, p=0.01)

[a] Baseline values taken as covariate

**Figure 2. Conners'-Parent Scores at Baseline and with Therapeutic Response Separated by Parent's and Child's Gender**




1. Conners' Parents' Restless Impulsive Baseline Scores, Child's gender (F = 22.2, p=0.01)
2. Conners' Parents' Emotional Labile Baseline Scores, Child's gender (F = 17.0, p=0.01)
3. Conners' Parents's Total Baseline Scores (F=20.0, p=0.01)




1. Conners' Parents' Restless Impulsive Therapeutic Response (p=0.09)
2. Conners' Parents' Emotional Labile Therapeutic Response (p=0.10)
3. Conners' Parents's Total Therapeutic Response (p=0.09)

a Baseline values taken as covariate

than children with no labels (Batzle, Weyandt, Janusis, & DeVietti, 2010). The results support previous literature examining psychometric properties of the parent and teacher ADHD rating scale suggesting that parents and teachers have different frames of reference when rating ADHD symptoms, with evidence for differential item functioning across gender and age for specific items within subscales (DuPaul, 1991).

In comparison to results across observation settings, the observation that teachers note a gender-based TR interaction while parents do not suggests that TR is observed differently based on requirements of observed settings. While teachers assess TR during the week, parents assess TR at the end of the week and this could have an impact as teachers might note the immediate effects of the medications. Disruptive behaviours have been shown to have an impact on the agreement between parents and teachers (Antrop, Roeyers, Oosterlaan, & Van Oost, 2002). However, the finding that teachers observe interactions with TR while parents observe only main effects at baseline suggests that there are differences between parent and teacher evaluations that contribute to heterogeneity in treatment response, and that parents and teachers might have gender-based expectations of child behavior and TR. Further, the gender of the child may affect interactions as a female child with ADHD may interact differently with a male versus female teacher.

In sum, the observed interaction between gender of the observer and the observed that differs at baseline and with TR suggests that there might be a complex interplay of bias, particularly for the RI dimension. An alternate possibility is that the observer indeed induces a change in the behavior of the observed as a function of each other's gender. However, the fact that only teachers note the interaction and not parents, as a function of their gender makes this a less likely possibility.

## Strengths and Limitations

The study had a preponderance of male children which would be expected based on epidemiological estimates that ADHD among children is three times more common in boys than girls (St Sauver et al., 2004). In addition, the clinical and demographic characteristics are in line with known population prevalence estimates (Polanczyk, Willcutt, Salum, Kieling, & Rohde, 2014). The small effect size noted for the significant interactions suggests that large sample sizes are required to note the significant difference. Thus, while clinicians need to be aware of these interactions, it remains unclear if these interactions will be clinically useful in individual cases.

The study had information from more female teachers and parents but had a sizeable number of reports from male teachers and parents. While this study represents the largest study of its nature to date, it would have been ideal to have equal gender distribution among parents, teachers, and children for questions relating to statistical comparisons. However, with 52 male teachers, 212 female teachers, and 269 female parents and 30 male parents, and 269 male and 30 female children, the sample sizes are reasonably powered to draw conclusions. Moreover, the gender distributions of parents, teachers, and subjects with ADHD follows expected population estimates in gender distribution. Elements of the study such as unequal numbers by gender are practical difficulties in any study design for a project of a similar nature. This study is the first to demonstrate interactions between gender of teacher and child, it would also be important for future studies to examine the reasons for the observed heterogeneity in TR, including gender role and expectations of parents and teachers.

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