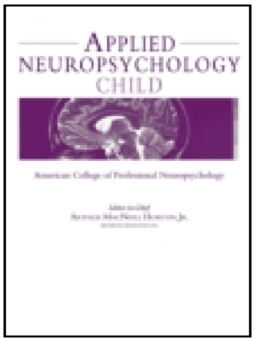

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Assessing Symptoms in Adolescents Following Sport-Related Concussion: A Comparison of Four Different Approaches

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This study compared post-concussion symptom endorsements on the Post-Concussion Symptom Scale (PCSS) between a clinical open-ended interview, clinician-guided PCSS, parent-report PCSS, and computer-based PCSS in youth athletes with sport-related concussion (SRC). Participants included 54 patients aged 13–17 years ($M = 15.19$, $SD = 1.29$, 51.8% male) with a diagnosed SRC seen at a concussion clinic. Participants were administered a computer-based version (COMP) of the PCSS followed by clinical open-ended symptom interview (OPEN) and clinician-guided PCSS (GUIDED). Participants' parents concurrently and independently endorsed their children's symptoms by completing the PCSS in the waiting room (PARENT). Total number of symptoms

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reported and total symptom severity score were analyzed and compared across the four PCSS administration methods. Results revealed significantly lower total number of symptoms for OPEN compared to GUIDED ($p = .002$), PARENT ($p < .001$), and COMP ($p = .006$); and significantly lower total severity score for OPEN compared to GUIDED ($p = .04$) and PARENT ($p < .001$). These data support using the PCSS as a structured method of assessing post-concussion symptoms and question the utility of unstructured interview methods for assessing symptoms in youth athletes with SRC.

Key words: *adolescents, mTBI, post-concussion symptom scale, sport-related concussion, symptoms*

INTRODUCTION

The recommended concussion assessment and management approaches used by today's sports medicine clinicians include sophisticated tools that assess a wide spectrum of cognitive, physical, and emotional functioning. Traditional subjective symptom checklists have been complemented with more objective assessments that include computerized neurocognitive testing, balance and vestibular assessments, and a comprehensive clinical exam. Although these clinical advances certainly have increased the objectivity of concussion management, assessing patient reported symptoms remains the centerpiece of the concussion assessment and management model.

Current concussion consensus statements emphasize that patient-reported symptoms remain an integral part of concussion assessment, management, and return-to-play decisions (Broglio et al., 2014; Guskiewicz et al., 2006; McCrory et al., 2013). There are several concussion symptom scales and checklists available for the sports medicine professional (e.g., Graded Symptom Checklist, Rivermead Post-Concussion Symptom Scale, Post-Concussion Symptom Scale: PCSS). The PCSS is one of the more widely used symptom assessments and has internal consistency ranging from 0.88 to 0.94 (Lovell et al., 2006) and demonstrates construct validity (McLeod & Leach, 2012). The PCSS is often administered as a stand-alone checklist, as part of a sideline or screening battery, or as a complementary part of a computerized neurocognitive testing battery.

The post-concussion symptom assessment, while the foundation of the clinician's patient interview, is limited to the shortcomings and subjectivity of self-reported data. Athletes who are motivated to make an expeditious return to full sport participation from concussion may be dishonest and/or minimize their symptoms throughout the recovery process. Researchers estimate that 30.5% of SRCs go undetected or unreported (Meehan, Mannix, O'Brien, & Collins, 2013), and concussed athletes minimize their concussion symptoms for several reasons that include lack of knowledge of signs and symptoms of concussion (Kaut, DePompei, Kerr, & Congeni, 2003; McCrea, Hammeke, Olsen, Leo, & Guskiewicz, 2004), fear of letting their teammates and coaches down (McCrea et al., 2004), and pressures to play through pain and injury (Chrisman, Quitiquit, & Rivara, 2013). These behaviors increase the difficulty in gathering accurate and reliable symptom data from the concussed athlete and ultimately add complexity to the concussion management process. Therefore, investigating the methods used by clinicians to gather patient symptom-report data is an area of interest, especially when managing concussion (Krol, Mrazik, Naidu, Brooks, & Iverson, 2011).

In previous studies, the number of reported symptoms has been linked to the method used to assess symptoms by the clinician (Iverson, Brooks, Ashton, & Lange, 2010; Krol et al., 2011; Nolin, Villemure, & Heroux, 2006). Structured methods (i.e., using a symptom questionnaire or inventory) for obtaining post-concussion symptom reports are associated with a higher total number and greater symptom severity endorsements when compared to unstructured (i.e., open recall/spontaneous generation) interview methods at pre-injury (Krol et al., 2011) and post-injury time periods (Gerber & Schraa, 1995; Iverson et al., 2010; Nolin et al., 2006). Iverson et al. reported that 44% of mTBI patients endorsed four or more symptoms using an open-ended interview method, whereas 92% of patients reported symptoms when using a structured symptom checklist (British Columbia Postconcussion Symptom Inventory: BC-PSI). Athletes commonly reported moderate to severe symptomatology when assessed with the BC-PSI, and in contrast did not endorse these same symptoms when assessed with open-ended methods (Iverson et al., 2010). In a sample of adult mTBI patients, Nolin et al. documented significantly greater symptom endorsements when assessing symptoms with a structured list versus asking the patients to spontaneously recall their mTBI symptoms. Edmed and Sullivan (2012) revealed that symptom reports were also significantly higher when using a symptom inventory (BC-PSI) compared to a structured and open-ended interview format in a sample of nonconcussed university students. These studies demonstrate the value of using a structured method for assessing concussion symptoms versus a spontaneous/free recall of how the athlete is feeling.

Structured symptom questionnaires and inventories have also been incorporated into computerized neurocognitive testing batteries. Theoretically, using a computer-based administration of a structured symptom questionnaire should also minimize any interviewer effects (e.g., gender discrepant reporting). The post-concussion symptom assessment, whether conducted by a human or a computer, has limitations in younger athlete populations, and likely requires other corroborating sources of information. Assessing post-concussion symptoms in children and adolescents can be problematic due to their potential lack of understanding and/or insight to accurately verbalize their symptoms (Gioia, Collins, & Isquith, 2008; Gioia, Schneider, Vaughan, & Isquith, 2009; McCrea et al., 2004; McKinlay, Ligteringen, & Than, 2014). As a result, parents are commonly used to corroborate the symptom reports of children and adolescents. In previous studies, researchers have documented the consistency of parent and child symptom reports as "modest at-best" (Hajek et al., 2011), with correlation coefficients ranging from .25 to .65 (Achenbach, McConaughy, & Howell, 1987; Gioia et al., 2008; Sady, Vaughan, & Gioia, 2014).

Assessing post-concussion symptoms is one of the hallmarks of concussion assessment and management (McCrory et al., 2013). As such, gathering accurate symptom data from adolescent patients and their parents is critical to this process. No research to date has however, compared symptom reporting via a computer with symptom reports gathered by a human, and researchers have yet to compare the post-concussion symptom endorsements between clinical open-ended interview, clinician-guided, parent-report, and computer-based symptom assessment methods. Therefore, the consistency of available methods used to assess symptoms in concussed athletes remains unclear. The primary purpose of this study was to compare post-concussion symptom reports between an open-ended interview, clinician-guided PCSS, parent-report PCSS, and computer-based PCSS in youth athletes with sport-related concussion (SRC).

METHODS

Design

A posttest-only, between-subjects research design was used for the current study.

Participants

Fifty-four patients (28 males and 26 females) ranging in age from 13–17 years ($M = 15.19$, $SD = 1.29$ years) seeking medical care for SRC were recruited to participate in the study Patients were recruited from a clinic specializing in the management of SRC. All patients were seen within 30 days of their injury and the total sample reported .42 previous concussions (Range 0–4). In order to be included in the study patients had to have sustained a SRC within the previous 30 days prior to participating. Patients were recruited as part of their normal scheduled follow-up visit. All patients previously completed a clinical visit to the clinic and were confirmed having a concussion by standard clinical diagnostic criteria: 1) presence of on-field signs (e.g., post-traumatic amnesia, loss of consciousness) and symptoms (e.g., dizziness, headache) as determined by a sports-medicine professional trained to identify concussions (i.e., a referring high school's athletic trainer), and 2) decrease in at least one post-concussion neurocognitive score and an increase in post-concussion symptoms determined by reliable change estimates (RCE) or comparisons to normative data (Iverson, Brooks, Collins, & Lovell, 2006). Any patient with a history of brain surgery, neurological disorder, treatment for substance abuse, and/or psychiatric disorder was excluded from the study. Patients were also excluded from the study if they were seeking medical clearance from concussion and presented without symptomatology.

Measures

Post-Concussion Symptom Scale (PCSS): The PCSS includes 22 concussion symptoms (e.g., headache, nausea, dizziness, etc.; see Table 1) for which the patient endorses the presence or absence (e.g., 0 = none) of each symptom and, when present, indicates current severity on a 6-point Likert scale (e.g., 1 = mild, 6 = severe). Outcome scores for the PCSS are the total number of reported symptoms (0–22) and total symptom severity score (0–132). This scale can be completed independently by the patient or administered (i.e., read aloud) to a patient by a sports medicine professional. The PCSS is also frequently administered on a computer or personal media device (i.e., iPad) as a component of computerized neurocognitive testing battery. The internal consistency for the PCSS ranges from .88–.94 (Lovell et al., 2006).

PCSS Administration Methods: 1) Computer-based administration (COMP): The patient completed the PCSS on a computer as part of a computerized neurocognitive test. 2) Parent-report (PARENT): The patient's parent, accompanying their child to their clinical visit, completed the PCSS on paper in the waiting room prior to the start of the clinical visit. Parents were instructed to endorse their child's symptoms based on their observations and what their child had reported to them in the past 24 hours. 3) Open-ended, (OPEN) clinical interview: The clinician asked the patient, "Please tell me how you have been feeling?" and for each of the symptoms generated by the patient the clinician asked the patient to endorse the severity of each symptom on a scale of 1–6. The researcher observed the patient responses and completed the PCSS as the patient reported symptoms in response to the clinician's interview. All symptoms that were not reported by the patient were recorded as zero rather than missing data. 4) PCSS-guided, (GUIDED) clinical interview: The clinician used the PCSS as a guide and asked if the patient was experiencing each symptom on the PCSS and the severity (e.g., Likert scale: 1–6) for each endorsed symptom. The clinician recorded all symptom endorsements on the PCSS.

Procedures

This study received University IRB approval. At the beginning of the clinical visit, patients completed PCSS on a computer as part of the ImPACT neurocognitive test battery (COMP). Parents completed the PCSS independently (i.e., without consulting child), based on their observations or reports regarding their child's current symptoms (PARENT). During the clinical evaluation, the clinician elicited the spontaneous generation of the patient's symptoms (OPEN) (i.e., "Please tell me how you have been feeling?" and "How severe is your symptom on a scale of 1–6?"). The researcher recorded the open-ended responses reported by the patient. When the patient could no longer spontaneously generate symptoms, the clinician asked the patient each symptom item on the PCSS and asked the patient to quantify symptom severity on a 1–6 scale for each of the 22 symptoms (GUIDED). The COMP, PARENT, OPEN, and GUIDED order of administration were fixed due to the structure of the clinic scheduling and could not be modified. The two clinicians that allowed the researchers access to their patients were male.

Data Analysis

Descriptive analyses (means, SDs, frequencies) were documented for demographic and outcome variables. To compare the internal consistency of the four methods of PCSS administration, Cronbach's alpha was calculated for the OPEN, GUIDED, COMP, and PARENT methods for PCSS total symptom severity score (i.e., the sum of Likert scale scores for each endorsed symptom). In addition, Pearson product-moment correlations and one-way ANOVAs were conducted for examining differences among the OPEN, GUIDED, COMP, and PARENT methods for the total number of reported symptoms (i.e., total count of symptoms) on the PCSS, as well as total symptom severity score (Bonferroni corrected alpha level for six pairwise comparisons set to $p < .008$). Chi-square analyses were conducted to identify differences in likelihood of endorsing each symptom by assessment method (Bonferroni corrected alpha level for 22 DVs set to $p < .002$). A repeated-measures multivariate analysis of variance (MANOVA) was conducted to identify multivariate differences in symptom severity scores between the OPEN, GUIDED, COMP, and PARENT methods; post-hoc analyses were conducted using Bonferroni method, which automatically corrects for multiple comparisons. All analyses were conducted with SPSS 21.0 (IBM Corp., 2012).

RESULTS

Results for Total Symptom Severity Score

Descriptive statistics for total symptom severity scores and total number of reported symptoms across the COMP, PARENT, OPEN, and GUIDED methods are provided in Table 1. Cronbach's alpha for the PARENT (.94), COMP (.91), and GUIDED (.91) administration methods of the PCSS demonstrated excellent internal consistency. However, the reliability for the OPEN method (.66) was below accepted standards (Bowling, 2002). All six pairwise correlations were significant for total symptom severity scores. More specifically, COMP was significantly correlated with PARENT ($r = .74$, $p < .001$), OPEN ($r = .77$, $p < .001$), and GUIDED ($r = 0.89$, $p < .001$) methods. The PARENT method was correlated with OPEN ($r = .71$, $p < .001$) and GUIDED ($r = .78$, $p < .001$) methods, while positive relationships between OPEN and GUIDED methods were also supported ($r = .83$, $p < .001$).

Results from a one-way ANOVA for total symptom severity scores revealed several significant differences between symptom assessment methods ($F(3,212) = 8.10$, $p < .001$). The OPEN method yielded a significantly lower symptom severity score compared to PARENT ($p < .001$) and GUIDED methods ($p = .04$), although there were no significant differences among any of the other comparisons (see Figure 1).

Chi-squared analyses revealed that respondents were significantly less likely to endorse balance problems,

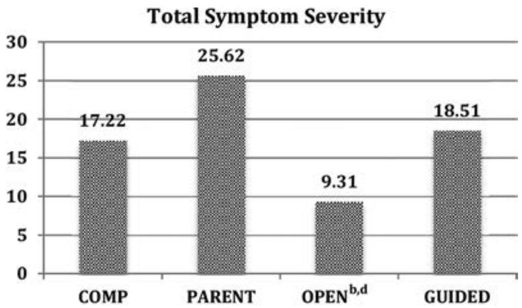

FIGURE 1 Mean comparisons for total symptom severity score for the COMP, PARENT, OPEN, and GUIDED interview methods ($n = 54$).

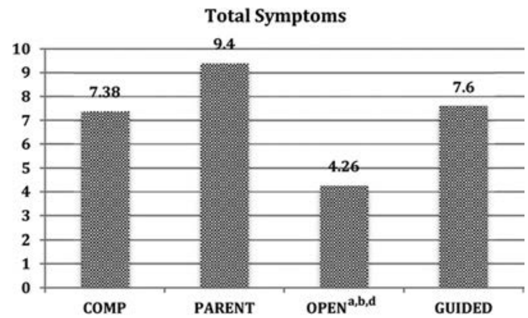

FIGURE 2 Mean comparisons of the total number of symptoms reported for the COMP, PARENT, OPEN, and GUIDED methods ($n = 54$).

fatigue, drowsiness, irritability, sadness, feeling slowed down, and feeling mentally foggy in the OPEN condition than on the COMP, GUIDED, and PARENT conditions, whereas parents of respondents were more likely to endorse irritability in their children in the PARENT condition than were respondents in the OPEN condition (Table 2).

Results for Total Number of Reported Symptoms

All six pairwise correlations were significant for the total reported post-concussion symptom score. The COMP method was significantly correlated with PARENT ($r = .71$, $p < .001$), OPEN ($r = .76$, $p < .001$), and GUIDED ($r = 0.92$, $p < .001$) methods. The PARENT method was correlated with the OPEN ($r = .53$, $p < .001$) and GUIDED ($r = .64$, $p < .001$) methods, while positive relationships between OPEN and GUIDED methods were also supported ($r = .76$, $p < .001$).

Results from a one-way ANOVA for total number of symptoms revealed significant differences among the methods ($F(3,212) = 10.91$, $p < .001$). The OPEN method resulted in significantly lower total number of symptoms reported compared to the COMP ($p = .006$), PARENT ($p < .001$), and GUIDED ($p = .002$) methods (see Figure 2).

Multivariate analysis of variance revealed a significant effect of reporting method on the severity of symptoms reported ($F(66,571) = 2.34$, $p < .001$). Respondents endorsed lower levels of symptom severity in the OPEN condition than all other conditions for balance problems and feeling mentally foggy. Respondents endorsed lower levels of symptom severity in the OPEN condition than the PARENT condition for fatigue, trouble falling asleep, sleeping more/less than usual, sensitivity to noise, sadness, feeling more emotional, numbness or tingling, and vision problems. Respondents also endorsed lower levels of symptom severity in the OPEN condition than the PARENT and CLOSED conditions for feeling slowed down (Table 3).

DISCUSSION

The primary purpose of this study was to compare the consistency of four methods commonly used to gather post-concussion symptoms in a sample of concussed high school athletes. The main findings of this study demonstrate that the COMP, GUIDED, and PARENT symptom report assessments are similar for both total number and severity symptom endorsements. However, the OPEN method yielded significantly fewer total symptoms compared to the other three methods, and lower total severity of symptoms compared to PARENT and GUIDED methods. Although not statistically significant, PARENT reports of their child's concussion symptom total and symptom severity were the highest out of all the methods. The OPEN method demonstrated an internal consistency below the accepted standard; whereas GUIDED, PARENT, and COMP all demonstrated excellent internal consistency.

Overall, the findings in the current study support the use of structured methods when assessing post-concussion symptoms. The structured methods in the current study (e.g., GUIDED and COMP) resulted in higher symptom endorsements for frequency and severity. This finding is consistent with previous studies in which researchers (Iverson et al., 2010) reported that structured methods were associated with greater number and severity of reported symptoms.

One of the key findings in this study was the lack of consistency among the two structured methods (COMP and GUIDED) compared to the unstructured method (OPEN) of assessing symptoms. It is the experience of the clinical members of our research team that concussed athletes typically underreport their symptoms during unstructured clinical interviews (e.g., "So how are you feeling today?") in comparison to more structured methods of assessing symptoms (e.g., computerized version of symptom assessment). As a result, the sports medicine professional is then left to contemplate whether the athlete was intentionally minimizing their symptoms in the open interview or inflating their symptom scores on the computer version. It is plausible that concussed athletes perceive open interview as having a more substantial influence on their return to participation. In the current sample, the athletes were adolescents and their parents were in the room during the OPEN method of symptom assessment, which also may bias responses toward underreporting. Another plausible explanation for the lower symptom reports in the OPEN condition was that the concussed athletes may have assumed that the clinician already knew their symptoms from the COMP condition and intentionally underreported their symptoms in the OPEN condition or lack the ability to spontaneously generate their symptoms. The computer version may be perceived as less important to their return-to-play expectations. Athletes may also unintentionally inflate their symptom scores on the computer version because they are prompted with a severity scale of 0–6, which may have reduced the perceived importance of reporting a low level symptom severity. Nonetheless, there is a lack of research comparing differences in patient responses obtained via a computer to an in-person interview, and further research is warranted to explore the current finding and its etiology.

Parent reports of their child's concussion symptoms were correlated to their child's symptom reporting on the structured COMP and GUIDED methods. Previous research has demonstrated that the strength of the relationship between parent and child symptom reports varies from small ($r = .25$) to large ($r = .65$) (Gioia et al., 2008, 2009; Hajek et al., 2011). However, the relationship of parent's reports to their child's symptom reports in the current study were generally higher ($r = .53$–$.78$) than those previously reported (Hajek et al., 2011). Contrasting previous research with the current study reveals differences in sample age, which could explain the greater strength of association in the current study. Specifically, the average age for the current study was 15.19 years (Range = 13–17 years), while Hajek et al. used a wider age range of younger children (8–15 years). These younger athletes may have difficulty describing and/or understanding their concussion symptomatology (Hajek et al., 2011), whereas older athletes may communicate their concussion symptoms to their parents more frequently and explicitly (e.g., "School gave me a headache today.") (Sady et al., 2014).

There were several limitations to this study that should be acknowledged. The current study did not record the gender of the parent, which may influence the frequency and severity of the parent reports of their child's symptoms. The posttest only, cross-sectional design used in this study did not allow for within subject pre-injury or multiple comparisons across time. The sample included patients seen within a wide time frame of up to 30 days post injury. This time period encompasses patients in both acute (within 7 days) and sub-acute (8 days to 3 months) phases following concussion. As a result, differences in symptom reporting during these two time periods may have been obfuscated. In addition, the sample did not include patients in the chronic (3 + months) phase of injury, thereby delimiting the findings only to patients in the early phases of the injury. This study followed the assumption that an athlete's symptoms did not change during the clinical evaluation. However, it is possible that repeated methods used in such close temporal proximity might have exacerbated certain symptoms during the course of the research protocol, which has been observed in previous studies (Chrisman, Rivara, Schiff, Zhou, & Comstock, 2013). Finally, the order of the administration of the symptom assessment methods—1) COMP, 2) OPEN, and 3) GUIDED—was consistent across patients. The potential carry-over effects of the fixed order of PCSS administration (i.e., COMP, PARENT, OPEN, GUIDED) may have confounded the symptom reporting across the COMP, OPEN, and GUIDED methods. However, the findings do not support this assertion, as the two structured interview methods resulted in higher numbers of reported symptoms and symptom severity scores than the unstructured method- even though participants completed the structured (e.g., COMP) PCSS inventory first.

Future studies should attempt to correct for the previously mentioned limitations. By increasing the time between methods—potentially testing methods at different clinical visits—the constraint of symptom exacerbation could be eliminated. Additionally, although our findings demonstrated consistency across guided-interview, parent reporting, and computer based administration within a single setting, future studies should retest participants at subsequent post-injury time points in order to examine the temporal changes measured using each of these symptom reporting methods. Future studies should also compare differences between paper-and-pencil and computer administrations of the PCSS. Also there is a need to examine sex and age differences among these symptom reporting methods. Finally, additional research should consider differences in the parent rating of their children's symptom between parent genders, and the interaction between the gender of the clinician and gender of the patient on symptom reporting.

From a clinical perspective, the current results indicate that guided methods, parent reports, and computer administrations (i.e., structured methods) of obtaining symptom reports provide comparable evaluations of adolescent patients' post-concussion symptoms. This finding supports consensus statements that identify patient report as an integral component of post-concussion evaluation (Broglio et al., 2014; McCrory et al., 2013). The results indicate that open-methods are a less than ideal method of symptom reporting and suggest that clinicians should not rely solely on this method for assessing post-concussion symptoms in adolescent patients.

ACKNOWLEDGMENTS

M.W. Collins is a part owner and co-founder of ImPACT Applications, the company that distributes the ImPACT program and has the PCSS as part of the test battery.

TABLE 1
Descriptive Statistics for the COMP, PARENT, OPEN, and GUIDED Interview Methods for Total Symptom Severity and Total Symptom Number ($n = 54$)

	COMP		*PARENT*		*OPEN*		*GUIDED*	
	M	*SD*	M	*SD*	M	*SD*	M	*SD*
Total symptom severity score	17.22	16.78	25.63	23.34	9.31	7.19	18.54	17.73
Total symptom number score	7.38	5.09	9.52	6.15	4.24	2.57	7.69	4.98

TABLE 2
Percentage and Frequency of Endorsing Each Symptom on the Post-Concussion Symptom Scale (PCSS) between the COMP, OPEN, GUIDED, and PARENT Administration Methods ($n = 54$)

Symptom	*COMP*	*PARENT*	*OPEN*	*GUIDED*
Headache	70.4% (38)	74.1% (40)	83.3% (45)	70.4% (38)
Nausea	16.7% (9)	22.2% (12)	18.5% (10)	22.2% (12)
Vomiting	0% (0)	1.9% (1)	0% (0)	0% (0)
Balance Problems	31.5% (17)	35.2% (19)	*5.6% (3)	35.2% (19)
Dizziness	35.2% (19)	42.6% (23)	44.4% (24)	48.1% (26)
Fatigue	53.7% (29)	68.5% (37)	*27.8% (15)	55.5% (30)
Trouble Falling Asleep	42.6% (23)	55.6% (30)	24.1% (13)	29.6% (19)
Sleeping More than Usual	25.9% (14)	*51.8% (28)	20.4% (11)	25.9% (14)
Sleeping Less than Usual	16.7% (9)	24.1% (13)	3.7% (2)	16.7% (9)
Drowsiness	44.4% (24)	44.4% (24)	*1.9% (1)	50.0% (27)
Sensitivity to Light	50.0% (27)	57.4% (31)	37.0% (20)	46.3% (25)
Sensitivity to Noise	50.0% (27)	50.0% (27)	22.2% (12)	40.7% (22)
Irritability	37.0% (20)	**63.0% (34)	*14.8% (8)	42.6% (23)
Sadness	18.5% (10)	35.2% (19)	*0% (0)	16.7% (9)
Nervousness	14.8% (8)	25.9% (14)	3.7% (2)	16.7% (9)
Feeling More Emotional	31.5% (17)	38.9% (21)	11.1% (6)	18.5% (10)
Numbness or Tingling	5.6% (3)	11.1% (6)	0% (0)	5.6% (3)
Feeling Slowed Down	22.2% (12)	42.6% (23)	*3.7% (2)	35.2% (19)
Feeling Mentally Foggy	46.3% (25)	50.0% (27)	*14.8% (8)	48.1% (26)
Difficulty Concentrating	59.3% (32)	63.0% (34)	42.6% (23)	64.8% (35)
Difficulty Remembering	40.7% (22)	57.4% (31)	27.8% (15)	53.7% (29)
Visual Problems	22.2% (12)	38.9% (21)	16.7% (9)	20.4% (11)

Note. *Denotes statistically significant difference between ($p < .05$) OPEN and all other conditions.
**Denotes statistically significant difference between ($p < .05$) OPEN and PARENT conditions.

TABLE 3
Means and Standard Deviations for Symptom Severity on PCSS Items among the COMP, OPEN, GUIDED, and PARENT Administration Methods ($n = 54$)

	COMP		*PARENT*		*OPEN*		*GUIDED*	
Symptom	M	SD	M	SD	M	SD	M	SD
Headache	2.09	1.75	2.32	1.78	2.22	1.55	2.04	1.81
Nausea	0.46	1.14	0.50	1.08	0.24	0.55	0.37	0.78
Vomiting	0.00	0.00	0.02	0.14	0.00	0.00	0.00	0.00
Balance Problems*	0.65	1.23	0.74	1.23	0.09	0.40	0.63	1.03
Dizziness	0.89	1.45	1.04	1.41	1.02	1.41	0.96	1.33
Fatigue**	1.17	1.41	1.90	1.78	0.74	1.31	1.30	1.50
Trouble Falling Asleep**	0.96	1.44	1.43	1.71	0.43	0.84	0.81	1.35
Sleeping More than Usual**	0.74	1.42	1.59	1.93	0.50	1.08	0.80	1.68
Sleeping Less than Usual**	0.39	1.04	0.66	1.32	0.06	0.30	0.50	1.21
Drowsiness*	1.02	1.41	1.07	1.55	0.04	0.27	1.30	1.71
Sensitivity to Light	1.06	1.45	1.39	1.61	0.70	1.04	1.08	1.53
Sensitivity to Noise**	1.15	1.58	1.22	1.60	0.43	0.90	1.07	1.62
Irritability**	1.00	1.60	1.85	1.90	0.35	0.93	1.15	1.66
Sadness**	0.33	0.78	0.91	1.50	0.00	0.00	0.26	0.68
Nervousness**	0.30	0.82	0.56	1.13	0.06	0.30	0.33	0.97
Feeling More Emotional**	0.59	1.04	1.17	1.80	0.28	0.83	0.43	1.06
Numbness or Tingling**	0.06	0.23	0.24	0.75	0.00	0.00	0.07	0.33
Feeling Slowed Down***	0.54	1.13	1.11	1.61	0.07	0.43	0.72	1.22
Feeling Mentally Foggy*	0.96	1.39	1.39	1.76	0.26	0.68	1.01	1.46
Difficulty Concentrating	1.39	1.64	1.78	1.82	0.98	1.39	1.64	1.79
Difficulty Remembering	1.06	1.71	1.61	1.94	0.76	1.47	1.56	2.08
Visual Problems**	0.43	1.04	1.13	1.78	0.43	1.06	0.48	1.14

Note. *Denotes statistically significant difference between ($p < .05$) OPEN and all other conditions.
**Denotes statistically significant difference between ($p < .05$) OPEN and PARENT conditions.
***Denotes statistically significant difference between ($p < .05$) OPEN and both PARENT and CLOSED conditions.

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