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Base Rates of Post-concussive Symptoms in a Nonconcussed Multicultural Sample

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Abstract

The purpose of this preliminary study was to investigate differences in base rates of post-concussion syndrome (PCS) symptomatology in healthy individuals separated by cultural identity and language. In this study, we sought to determine if differences exist in terms of base-rate endorsement of PCS symptomatology in healthy individuals and whether culture and language-based specific clusters of PCS symptomatology exist in healthy individuals. A total of 151 participants, consisting of 33 Caucasians, 49 Chinese, Filipinos, and Southeast Asians, 43 Arabs, West Asians, and South Asians, and 26 participants of African descent completed four questionnaires and two subtests of a test of verbal ability. We found that the occurrence of PCS symptoms did not differ by culture and language-based groups in general, but that there were differences between groups in the base rates of individual symptom endorsement. Our preliminary findings illustrate that cultural and linguistic background may play a moderating role in the endorsement of PCS symptomatology and that false-positive conclusions may be reached disproportionally between groups. Our results underscore the importance of considering the influence of culture and language, in conjunction with a growing list of factors that can influence, maintain, and/or mimic persistent PCS.

Keywords: Head injury; Traumatic brain injury; Post-concussive syndrome; Base rates; Cross cultural/minority

Introduction

The constellation of symptomatology following mild-traumatic brain injury (mTBI) is vast and encompasses a broad range of non-specific complaints. Early sequelae include headache, dizziness, irritability, sleep disturbance, fatigability, sensitivity to noise and light, nausea, neuropsychological impairment, and emotional distress (Gasquoine, 1997). Cumulative research on the outcome of a single, uncomplicated mTBI illustrates however that concussive symptoms may persist for up to 3 months, but the norm is full recovery with no long-term residual deficits (McCrea *et al*., 2009). When symptoms persist beyond this benchmark for expected recovery, the term post-concussion syndrome (PCS) is often applied (Bigler, 2008). The estimated frequency of PCS after 1-year post-injury range from 7% to more than 40% (Alves, Macciocchi, & Barth, 1993).

Persisting PCS complaints may be explained by many factors including chronic pain disorders (Iverson & McCracken, 1997), stress, or emotional distress at the time of injury onset (Alexander, 1995), depression (Garden & Sullivan, 2010), premorbid personality characteristics (Garden, Sullivan, & Lange, 2010), and symptom exaggeration or malingering (Lange, Iverson, Brooks, & Ashton-Rennison, 2010). The misinterpretation of normal pre-injury everyday "symptomatology" may also be contributory in the instance of persisting PCS complaints. In fact, there exist a growing number of base-rate studies that demonstrate the presence of PCS complaints in healthy non-concussed populations (Chan, 2001; Gouvier, Uddo-Crane, & Brown, 1998; Iverson & Lange, 2003; Iverson, Lange, Brooks, & Rennison, 2010; Lee-Haley & Brown, 1993; Wang, Chan, & Deng, 2006).

To date, however, cultural differences have yet to be investigated. This may be important to examine because there may exist systematic differences as a function of cultural norms and mores, including linguistic factors, that contribute to and influence symptom endorsement. To this end, research demonstrates that culture and language can influence pain perception,

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experience, and behavior (e.g., Rabow & Dibble, 2005), as well as the manifestation of stress (e.g., Treiber, Kabuku, Davis, Pollock, & Pollock, 2002) and mood disorders (e.g., Riolo, Nguyen, Greden, & King, 2005). Given that PCS complaints are common in healthy persons and that there exist cultural factors that influence the incidence of these symptoms, we sought to investigate the base rates of PCS complaints in healthy individuals separated by cultural identity and language.

Methods

Participants

A total of 151 university student participants were included in the current study. Ethics approval was granted by way of the University of Toronto IRB review board. Signed informed consent was garnered from all participants. All subjects were fluent in English. Individuals were excluded if they reported having any history of psychiatric, psychological, or neurologic illness, were currently taking psychotropic medications, or had ever sustained a TBI of any severity in their lifetime. Table 1 illustrates the demographic composition of the participants. Participants did not statistically differ between groups in terms of age, gender, and education nor in terms of Wide Range Achievement Test (WRAT) reading and sentence comprehension test scores.

Participants were separated into four groups: Caucasians ($n = 33$), Chinese, Filipinos, and Southeast Asians ($n = 49$), Arabs, West Asians, and South Asians ($n = 43$), and participants of African descent ($n = 26$). Groups were formed *a priori* based on the predominant language family and self-reported ethnicity of each participant. We chose to separate the groups based on ethnicity and language rather than country of birth because participants identified their peer groups and sense of belonging and personal group affiliation as a function of ethnicity and language spoken, and not place of birth while also recognizing that ethnicity and language are correlated. We moreover note that while our participants may all have been exposed to English in childhood, this did not strip them of their distinct cultural affiliations given that there exist very complex political-economic reasons why foreign governments (such as Canada where this research was conducted) promote their citizen's acquisition of English. To add, even "bilinguals" identify themselves as belonging to particular cultural groups. That our participants might have learned English from childhood therefore does not negate the fact that they also strongly identified with a particular cultural group.

Accordingly, the Caucasian participant group represents those whose country of origin's predominant language is in the Indo-European language family. The Chinese, Filipino, and South East Asian participant group represents those who came from regions in which the predominant language is from the Sino-Tibetan or Austronesian language family. Similarly, the

Table 1. Demographic characteristics of participants

Ethnic group	Caucasian ($n = 33$)	Chinese, Filipino, and Southeast Asian ($n = 49$)	Arab and West and South Asian ($n = 43$)	African ($n = 26$)
Demographic variables				
Men (%)	45.5	34.7	27.9	26.9
Age (mean [*SD*])	19.2 (1.8)	19.0 (1.9)	18.7 (2.6)	20.3 (2.6)
Year of university studies (mean [*SD*])	1.9 (1.4)	1.7 (1.3)	1.6 (1.1)	2.1 (1.2)
Age when learned English (mean [*SD*])	3.3 (4.8)	4.7 (4.0)	3.0 (3.2)	1.1 (1.9)
Hours of work per week (mean [*SD*])	9.3 (17.0)	3.6 (6.9)	3.9 (6.3)	8.4 (10.3)
Father completed university (%)	63.6	42.9	48.8	37.5
Mother completed university (%)	45.5	49.0	37.2	38.5
Annual family income > $60 000 (%)	57.6	32.7	27.9	26.9
Clinical Test Scores (mean [*SD*])				
RPQ-3	1.2 (1.8)	1.4 (2.0)	2.0 (2.7)	2.5 (2.0)
RPQ-13	10.0 (6.6)	11.4 (9.2)	12.0 (9.1)	10.1 (7.7)
RPQ total score	11.2 (8.0)	12.8 (10.6)	14.0 (10.9)	12.6 (9.0)
BDI total score	8.3 (5.7)	11.9 (7.3)	11.9 (6.8)	9.9 (7.0)
BAI total score	8.4 (8.0)	8.7 (6.3)	10.1 (8.6)	6.7 (4.2)
WRAT reading	62.6 (3.1)	61.8 (4.5)	61.2 (3.2)	62.8 (3.9)
WRAT sentence comprehension	44.4 (4.3)	42.8 (6.0)	44.2 (3.9)	44.1 (2.5)

third participant group, consisting of South Asians, West Asians, and Arabs, is distinguished from the other groups by the predominating Dravidian and Indo-Iranian languages in their regions. Finally, the African participant group consists of those coming from regions where Afro-Asiatic languages are spoken.

Procedure

Participants each individually completed all tests. Instructions to participants followed test administration procedures outlined in each respective test manual and were strictly adhered to. The test measures administered included the *Rivermead Post-Concussion Symptoms Questionnaire* (RPQ; King, Crawford, Wenden, Moss, & Wade, 1995), the *Beck Depression Inventory-II* (BDI-II; Beck, Steer, & Brown, 1996), *The Beck Anxiety Inventory* (BAI; Beck & Steer, 1993), and the WRAT-4 (Wilkinson & Robertson, 2006) word-reading and reading comprehension subtests to ensure that minimum requisite English reading and comprehension levels were met as per test manual criteria so as to circumvent spurious responding based on linguistic factors. With respect to the RPQ scoring system as utilized in the present investigation, we note that it has been modified in recent years to produce two RPQ scores using two item groups. The first group, RPQ-3, consists of the first three items and is associated with the early symptom cluster of PCS. The second group, RPQ-13, contains the next 13 items and is associated with the later symptom cluster of PCS as well as with greater severity of PCS and impact on daily functioning. These two separate scales show good test-retest reliability (0.89 for RPQ=13 and 0.72 for RPQ-3) as well as good external construct reliability (correlations with the Rivermead Head Injury Follow-up Questionnaire is 0.83 for RPQ-13 and 0.62 for RPQ-3).

Results

Pearson's *r* coefficient was computed to measure the degree that the RPQ-3, RPQ-13, and RPQ total scores were related to BDI and BAI scores in all participants and within the ethnic subgroups. The RPQ-3 and the BDI scores were found to be significantly related ($p < .005$). There was also a significant correlation between the RPQ-13 and the BDI scores ($p < .005$), and the total RPQ score and BDI scores ($p < .005$). Similarly, the BAI scores were significantly ($p < .005$) correlated with the RPQ-3, RPQ-13, and total RPQ scores. The BDI and BAI scores of the Caucasian participant group, Chinese, Filipino, and Southeast Asian participant group, and Arab and West and South Asian participant group were significantly correlated with the RPQ-3, RPQ-13, and total RPQ scores at the .01 level.

Overall, participants did not endorse a high rate of the early symptom cluster of PCS (e.g., headache, dizziness, and nausea). The mean score on the RPQ-3 was 1.71/12 ($SD = 2.21$). More participants endorsed the cluster of symptoms that appear to characterize the later course of mTBI, such as cognitive impairment and emotional distress. The mean score of the RPQ-13 was 11.02 ($SD = 8.4$). The overall endorsement of PCS symptoms seems to be moderate, with a mean total RPQ score of 12.74/64 ($SD = 10$) and a median of 11. Participants reported, however, a relatively high endorsement of individual items. The most commonly reported symptoms were fatigue (78.8%), poor concentration (64.2%), taking longer to think (59.6%), sleep disturbance (57.6%), and feeling frustrated (56.4%). The least reported symptoms were double vision (8.0%), light sensitivity (16.5%), nausea (19.2%), and noise sensitivity (19.2%).

One-way ANOVAs were used to compare the RPQ-3, RPQ-13, and total RPQ scores between the four ethnic groups. There were no differences between all four ethnic groups in RPQ-3, RPQ-13, and total RPQ scores. Comparison of the mean rating of each RPQ item between the ethnic groups using Kruskal–Wallis ANOVA, however, illustrates that the rating for the first item of the RPQ, presence of headaches, was significantly different between the four ethnic groups, $p < .05$. *Post hoc* comparisons by way of a Mann–Whitney *U*-test showed that the participants of African descent endorsed more frequently the presence of headaches than the Caucasian participant group, $p < .01$, or the Chinese, Filipino, and Southeast Asian participant group, $p < .05$. Moreover, the African participant group reported relatively more severe headaches than the Caucasian participant group or the Chinese, Filipino, and Southeast Asian participant group.

With regard to individual symptoms, a higher proportion of participants from the African group reported headaches (88.5%) and poor concentration (76.9%), whereas a higher proportion of Chinese, Filipinos, and Southeast Asian participants endorsed dizziness. The rate of sleep disturbance also appears to be higher in the Caucasian participant group (72.7%). In general, however, the non-Caucasian participant groups appear to report more PCS symptoms when compared with the Caucasian participant group. They endorsed higher rates of headaches, forgetfulness, dizziness, noise and light sensitivity, poor concentration, and depressed mood. Table 2 illustrates that PCS symptom endorsement separated by a cultural group as per the present study findings with the notation of previous study findings that did not consider culture as a moderating variable as a basis of comparison.

Table 2. Comparison of symptom endorsement reported by participants without brain injury in different studies (frequency, %)

Symptoms	The Present Study ($N = 151$) Ethnicity group				Lee-Haley & Brown (1993) ($N = 50$)	Chan (2001) ($N = 85$)	Iverson and Lange (2003) ($N = 104$)	Wang and colleagues (2006) ($N = 124$)
	Caucasian ($n = 33$)	Chinese, Filipino, and Southeast Asian ($n = 49$)	Arab and West and South Asian ($n = 43$)	African ($n = 26$)				
Headache	34.4	44.9	51.2	88.5	62	40.0	52.4	35.5
Forgetfulness	39.4	55.1	55.8	53.8	20	58.9	50.5	45.5
Dizziness	21.2	42.9	30.2	38.5	26	31.8	41.7	32.2
Noise sensitivity	15.1	16.3	25.6	23.0		2.4	39.8	33.9
Light sensitivity	12.1	20.4	14.0	23.0		35.3		20.7
Poor concentration	57.6	63.3	67.4	76.9	26	58.9	61.2	58.7
Blurred vision	15.1	22.4	27.9	15.3	22	41.2		28.1
Fatigue	84.8	81.6	74.4	76.9	58	53.5	75.7	76.9
Frustration	56.3	51.0	62.8	53.8	36	42.3	53.4	46.3
Irritable	51.5	55.1	62.8	26.9	38	43.6	71.8	42.1
Longer time to think	54.5	67.3	55.8	61.5	16	65.9		60.3
Sleep disturbance	72.7	51.0	55.8	53.8	52	50.6	62.1	50.4
Depressed or tearful	36.4	44.9	44.2	53.8	32	31.8	61.2	37.2
Nausea or vomiting	15.1	16.3	25.6	23.0	34	13	37.9	14.9

Discussion

Given that the symptomatology that characterizes PCS is common in healthy persons and that there may exist cultural factors that influence the incidence of these symptoms, we sought to investigate the base rates of PCS symptomatology in healthy individuals separated by cultural identity. Our findings illustrate that there indeed exists a high base rate of PCS symptoms in healthy individuals which is consistent with the previous base-rate studies of PCS symptoms in the normal population without brain injury (Chan, 2001; Gouvier et al., 1998; Iverson & Lange, 2003; Iverson *et al*., 2010; Lee-Haley & Brown, 1993; Wang et al., 2006).

We also found, more specifically, that symptomatology of depression and anxiety was significantly related to all RPQ scores regardless of cultural identity. This suggests that depression and anxiety might moderate PCS regardless of cultural identity. Our results moreover also suggest that there may be no cultural differences in the overall occurrence of PCS symptomatology, as defined by the symptoms associated with the early course of PCS, or in keeping with the symptomatology that characterizes the later course of PCS. These findings suggest that temporal symptom clusters in PCS may be unique to those individuals who indeed have PCS and do not misattribute pre-existing symptomatology in an iatrogenic manner.

At the individual symptom level, however, our findings demonstrate a higher base rate of specific PCS symptomatology between cultures. We found that participants of African descent reported more severe and frequent headaches than individuals from other ethnicities. The African participant group also reported a higher incidence of poor concentration, whereas the Caucasian participant group endorsed a higher incidence of sleep disturbance. With respect to sleep disturbance, our findings are also consistent with large-scale population-based incidence rates, illustrating that Asian participants report the least complaints, and participants of African descent report fewer complaints than Caucasians (Grandner *et al*., 2010). In general, however, non-Caucasian participants demonstrate a higher endorsement rate of PCS symptoms. Collectively, our finding suggests that there are cultural differences at the individual symptom level implies that some PCS symptoms may be more commonly reported by individuals belonging to specific cultures. The onset and/or temporal stability of specific PCS symptomatology in some cultural groups may, therefore, be less related (or have no relation) to PCS and, instead, reflect a high base rate in the population secondary to misattribution of common everyday symptoms.

Additional research will need to address limitations of the present study that include a limited sample size, an age-specific sample, and acculturation. It may also be of interest to researchers to explore gender differences. That is, although we did not find any statistically significant differences between groups in terms of gender, large differences in gender composition are recognized, and it may be that gender influenced some of the relatively high endorsement of individual items such as headache. Indeed, epidemiological studies conducted in the general population point to average headache prevalence rates in western Europe and North America between 5% and 9% in men, and between 12% and 25% in women (Manzoni & Stovner, 2010). In addition, differences in demographic characteristics between cultural groups should also be further explored. For example, it has been shown that differential exposure to financial strain may explain some differences in population health in African Americans (Szanton, Thorpe, & Whitfield, 2010). Longitudinal research to understand the temporal stability of

PCS complaints in non-concussed healthy individuals is also essential. Our preliminary findings do, however, illustrate that the practice of clinical neuropsychology may be exceptionally prone to false-positive conclusions about the presence of PCS where the base rates of symptom endorsement are high in non-concussed healthy individuals, and that false-positive conclusions regarding specific symptoms may be reached disproportionally between cultural groups.

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