Title: The impact of insomnia on quality of life in individuals with multiple sclerosis.

Multiple sclerosis (MS) is a degenerative neurological disorder affecting approximately 95,000 Canadians (Statistics Canada, 2011). Patients with MS commonly report decreased quality of life, in part due to the myriad of physical health problems experienced during the course of the disease, such as disability, pain, and fatigue (Kes et al., 2013). However, little research has examined the impact of sleep disturbances on quality of life, despite this being one of the most prevalent symptoms associated with MS (Fleming & Pollak, 2005). To date, two studies have assessed the relationship between insomnia and reduced quality of life in patients with MS (Veauthier, Gaede, Radbruch, Wernecke, & Paul, 2015; Viana et al., 2015). The current study directly examined the impact of insomnia, above and beyond common MS related physical symptoms, using a multidimensional quality of life tool designed and validated for MS patients.

Participants with MS (N=95) in the Toronto area were recruited from both clinical and community settings. Participants completed questionnaires assessing demographic information and MS symptom severity: Pain was measured using the MOS Pain Effect Scale; urinary and fecal incontinence were measured using the ICIQ-Urinary Incontinence Short Form and the Revised Faecal Incontinence Scale; and fatigue was measured using the Fatigue Impact Scale. The Insomnia Severity Index assessed if participants met criteria for insomnia, and the Multiple Sclerosis Quality of Life-54 questionnaire was used to determine both physical and mental quality of life outcomes. Physical quality of life outcomes assessed health perceptions, energy level, pain, and sexual and social function. Mental quality of life outcomes assessed emotional functioning, health distress, cognitive functioning. *T*-tests were first performed to determine whether individuals who met criteria for insomnia differed from individuals who did not on both physical and mental quality of life outcomes, followed by a three stage hierarchical regression to assess the impact of insomnia on quality of life above and beyond other physical symptoms typically related to reduced quality of life outcomes in MS patients. In the hierarchical regression, age, gender, and months since diagnosis were entered in step one; MS related symptoms (fecal and urinary incontinence, pain and fatigue) were entered in step two; and insomnia was entered in step three.

The *t*-test demonstrated significant differences in physical quality of life, $t(91.41) = 4.18$, $p < .001$, between individuals who met criteria for insomnia, $M = 40.53$, $SD = 15.09$, 95% CI [35.73, 45.33], and those who did not, $M = 55.58$, $SD = 19.92$, 95% CI [50.41, 60.75]. Furthermore, the results from the *t*-test for mental quality of life also showed significant differences, $t(96) = 4.51$, $p < .001$, between individuals who met criteria for insomnia, $M = 48.52$, $SD = 18.30$, 95% CI [42.70, 54.34], and those who did not, $M = 65.90$, $SD = 18.76$, CI [61.15, 70.65], indicating that participants who met criteria for insomnia had significantly worse physical and mental quality of life outcomes than those who did not meet criteria for insomnia.

For physical quality of life, the overall model in step one of the hierarchical regression analysis was not significant, $F(3,83) = .61$, $p > .05$, indicating demographic variables were not significantly associated with physical quality of life outcomes. The overall model in step two was significant, $F(7,79) = 22.16$, $p < .001$. Specifically pain ($\beta = -.66$, $p < .001$) and fatigue ($\beta = -.25$, $p = .001$) were significantly associated with poorer physical quality of life outcomes. The overall model in step three was significant, $F(8,78)$

= 20.37, $p < .001$. However, insomnia did not significantly predict physical quality of life outcomes ($\beta = -.14$, $p = .072$), indicating insomnia did not account for a significant impact on physical quality of life above and beyond the MS related physical symptoms. The total model accounted for 64.3% of the variance in physical quality of life.

For mental quality of life, the overall model in step one of the hierarchical regression analysis was not significant, $F(3,88) = .87$, $p > .05$, indicating demographic variables were not significantly associated with MCS. The overall model in step two was significant, $F(7,84) = 8.37$, $p < .001$. Specifically pain ($\beta = -.38$, $p < .001$) and fatigue ($\beta = -.35$, $p < .001$) were significantly associated with poorer mental quality of life outcomes. The overall model in step three was significant, $F(8,83) = 8.93$, $p < .001$. Insomnia ($\beta = -.28$, $p < .01$) was associated with poorer mental quality of life, independently predicting an additional 5.2% of the variance in mental quality of life outcomes, $F(1,83) = 7.98$, $p < .01$. The total model accounted for 41.1% of the variance in mental quality of life.

Insomnia was associated with worse mental quality of life outcomes above and beyond the myriad of negative physical symptoms commonly experienced by patients with multiple sclerosis. However, insomnia was not associated with physical quality of life outcomes. This may be due to the type of questions designed to assess physical quality of life outcomes in this patient population. Specifically, the questions assessed every day functional tasks, such as ability to run errands, use the stairs, and maintain personal hygiene. These physical tasks are not likely to be significantly impaired by the presence of insomnia alone. They are a better measure of physical disability due to neurological impairment. Overall, the findings indicate that insomnia, in addition to the physical health symptoms associated with MS, can contribute to reduced mental quality of life in patients with MS. Interventions that incorporate treatment for insomnia may be beneficial in increasing MS patients quality of life. Specifically, patients with MS who are also suffering from insomnia may benefit from sleep training or cognitive-behavioural techniques designed to treat insomnia.

References

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