Risk Factors for Work-related Fatigue in Students With School-Year Employment

Luc Laberge, Ph.D.a,b,*, Élise Ledoux, Ph.D.c, Julie Auclair, M.Sc.a, Chloé Thuillier, D.E.S.S.c, Michaël Gaudreault, B.Sc.a, Marco Gaudreault, M.A.a, Suzanne Veillette, Ph.D.a, and Michel Perron, Ph.D.a,d

a ÉCOBES Recherche et transfert, Cégep de Jonquière, Jonquière, Québec, Canada
b Département des Sciences de l’éducation et de psychologie, Université du Québec à Chicoutimi, Chicoutimi, Québec, Canada
c Institut de recherche Robert-Sauvé en santé et en sécurité du travail, Montréal, Québec, Canada
d Département des Sciences humaines, Université du Québec à Chicoutimi, Chicoutimi, Québec, Canada

Article history: Received December 18, 2009; accepted July 6, 2010
Keywords: Adolescence; Students; Young workers; Fatigue; Chronic fatigue; Sleep; Physical work factors

A B S T R A C T

Purpose: To explore potential risk factors for acute and chronic work-related fatigue in students working at a paid job while pursuing school studies. Although work-related fatigue was identified as a potential hazard for youth health, academic achievement, and occupational safety, very few studies have specifically addressed its correlates and possible predictors.

Methods: Cross-sectional data from an ongoing prospective cohort study of health risk behaviors in adolescents was used to identify factors associated with increased levels of acute and chronic fatigue in 209 students aged 17–18 years working during the school year. Multiple stepwise regression analyses were performed with acute and chronic fatigue levels as dependent variables, and demographic, work, and health factors as potential explanatory variables.

Results: Average hours worked per week by students was 14.7 hours. It was observed that higher psychological distress, poorer health perception, greater sleep debt, and higher exposure to physical work factors were associated with higher levels of acute fatigue. Also, it was observed that higher psychological distress, poorer health perception, higher exposure to physical work factors, and holding multiple jobs were associated with higher levels of chronic fatigue. The number of hours worked weekly was associated with neither acute nor chronic work-related fatigue.

Conclusions: Findings suggest that prevention strategies devised to minimize work-related fatigue in students should consider exposure to physical work factors. Results also re-emphasize the importance of obtaining sufficient sleep so as to prevent high levels of acute work-related fatigue.

Over the past three decades, it has been noted that students in many countries have increased the amount of time they dedicate to paid work during the school year [1]. In 2004–2005, full-time 18–24-year-old Canadian students were working longer hours than ever before while attending school, with an average of 16.5 hours devoted to paid work per week [2]. Moreover, working while studying is everyday life for a substantial proportion of European university students, varying between 48% in France and 77% in the Netherlands [3]. On an average, these working students dedicate 11 hours per week in paid employment [4]. Among U.S. students enrolled in 4-year schools and in community colleges, 45% and 60%, respectively, work extensive hours, defined as more than 20 hours per week [5].

* Address correspondence to: Luc Laberge, Ph.D., Département des Sciences de l’éducation et de psychologie, Université du Québec à Chicoutimi, Chicoutimi, Québec, Canada G7H 2B1.
E-mail address: luc.laberge@uqac.ca

1054-139X/$ - see front matter Crown copyright © 2011 Published by Elsevier Inc. on behalf of Society for Adolescent Health and Medicine. All rights reserved.
doi:10.1016/j.jadohealth.2010.07.003
There has been a great debate over whether student employment during the school year has mainly advantages, such as financial aid toward a postsecondary education, work experience, increased sense of responsibility, and higher self-esteem; or negative effects, such as increased alcohol, tobacco, and drug use; lack of exercise; increased rates of dropping out of school; and decreased overall attainment [6,7]. An insufficiently acknowledged factor of why employment may prove detrimental to the academic achievement and health of students who work extensive hours is sleep curtailment [8]. Indeed, the dual duty of attending school and working places these students at higher risk of cumulative sleep deprivation, daytime sleepiness, and fatigue. In addition to the numerous socio-environmental social factors (such as paid work), a developmental delay of circadian phase contributes to the delay of sleeping times in adolescence, making the putative average sleep need of 9.25 hours per night difficult to fulfill for a majority of students [9]. Accordingly, adolescents and young adults (age, 12–25 years) have been identified as a population at high-risk for problem related to sleepiness [10]. This lack of sufficient sleep and excessive sleepiness may thus put students at risk for cognitive and emotional difficulties, low academic performance, and injuries [9,11].

Moreover, recent studies have documented the predictors of persistent or prolonged fatigue in a substantial proportion of adolescents [12,13]. However, no study has been conducted to identify the predictors of occupational or work-related fatigue in young workers despite the fact that this has repeatedly been identified as a potential hazard for their occupational safety and health [14–16]. Indeed, young workers in most industrialized countries are known to have higher rates of workplace injuries than older workers [7,14,17]. In adult workers, prospective results from the Maastricht Cohort Study of “Fatigue at Work” indicated that both acute and prolonged fatigue are independent risk factors for occupational injuries and that physical and psychological demands at work, including low decision latitude, predict the onset of fatigue [18,19]. Additional research is thus warranted to explore the correlates of work-related fatigue in adolescents who work during the school year.

Methods

Sample and Procedure

Cross-sectional data used in this study were collected from an ongoing longitudinal survey designed primarily to provide estimates of the prevalence of health risk behaviors such as school dropout, low self-esteem, psychological distress, and drug use. In 2002, a representative sample of 1,400 students aged 14 years, attending all public and private high schools of the Saguenay–Lac-Saint-Jean region (northern Quebec), was selected by the Ministère de l’Éducation, du Loisir et du Sport du Québec, to complete a questionnaire survey under the auspices of the regional public health authorities. In 2002, a nonrepresentative subset of 615 students aged 14 years completed the questionnaire at school and constituted the initial longitudinal sample. For the second wave of data collection that took place in 2004, a total of 408 participants completed the questionnaire either at school under the supervision of trained professionals or online. For the third wave of data collection that took place in 2006, a total of 413 participants completed the questionnaire at school or through postal mail. It must be specified that education is compulsory up to the age of 16 in the province of Quebec.

Before the third wave of data collection, questions pertaining to employment, work schedule, working conditions, physical work factors, psychosocial job characteristics, and other occupational health problems were added to the survey instrument by the Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSSST) (Québec’s OHS Institute). At the time of the third wave, 209 participants (84 boys, 125 girls) were attending school and had one or more jobs. This sample of student workers aged 17–18 years is the focus of the present cross-sectional analyses. This study was approved by the Comité d’éthique de santé publique du Ministère de la Santé et des Services sociaux, and informed consent was obtained from all participants.

Measures

Dependent variable

The Occupational Fatigue Exhaustion/Recovery (OFER) scale has been developed specifically to measure and distinguish between acute and chronic fatigue traits associated with work [20,21]. Its acute and chronic fatigue subscales (five items; range, 0–100) identify and distinguish between acute end-of-shifts states and chronic work-related traits (Table 1). Acute work-related fatigue is described as a state of reduced capacity and/or willingness to engage in further activity as a direct consequence of engagement in previous work activity. Chronic work-related fatigue refers to a global and enduring condition of reduced motivation, depression, and enduring incapacity to continue with work activity in a general way without great effort. Theoretically, persistent low recovery from high levels of acute fatigue determines higher levels of chronic fatigue [21]. The OFER scale possesses robust, gender-bias, free psychometric characteristics [20,21]. The reliability of both subscales in this sample was acceptable (α = .79) (Table 1).

Independent variables

Work measures. Job decision latitude was measured using the nine-item decision latitude scale developed by Robert Karasek for which psychometric qualities have been demonstrated [22–24]. Scores ranged from 24 to 96. The decision latitude reflects opportunities for learning, autonomy, and participation in the decision-making process. Participants with decision latitude score ≤72 were considered as having low decision latitude [25]. Reliability for decision latitude in this sample was high (α = .82). The intensity of work was measured by hours of paid work per week. Participants were asked to provide data on the number of jobs they held by responding to the following question: “How

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Occupational Fatigue Exhaustion Recovery (OFER) Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute Fatigue Subscale Items (Cronbach’s alpha = .79)</strong></td>
<td></td>
</tr>
<tr>
<td>After a typical work period I have little energy left</td>
<td></td>
</tr>
<tr>
<td>I usually feel exhausted when I get home from work</td>
<td></td>
</tr>
<tr>
<td>My work drains my energy completely every day</td>
<td></td>
</tr>
<tr>
<td>I usually have lots of energy to give to my family and friends</td>
<td></td>
</tr>
<tr>
<td>I usually have plenty of energy left for my hobbies and other activities after I finish work</td>
<td></td>
</tr>
<tr>
<td><strong>Chronic Fatigue Subscale Items (Cronbach’s alpha = .79)</strong></td>
<td></td>
</tr>
<tr>
<td>I often feel I am at the end of my rope with my work</td>
<td></td>
</tr>
<tr>
<td>I often dread waking up to another day of my work</td>
<td></td>
</tr>
<tr>
<td>I often wonder how long I can keep going at my work</td>
<td></td>
</tr>
<tr>
<td>I feel that most of the time I am just “Living to work” Too much is expected of me in my work</td>
<td></td>
</tr>
</tbody>
</table>
many jobs do you currently have?" Work schedule was assessed by asking participants the following question: "Considering your current job(s), which of the following situation best describes your usual work schedule? day shifts, evening shifts, night shifts, alternating day/evening shifts, alternating day/night shifts, alternating day/evening/night shifts, split shifts, irregular shifts, on-call schedules, miscellaneous." Finally, participants answered questions about the frequency of exposure (never, rarely, often, always) to physical work factors at work, including repetitive work, high-speed work, handling of heavy loads, strain from using tools and machinery, postural constraints, articular constraints, thermal constraints, noise, vibrations, and handling of dangerous substances [26].

Health measures. Psychological distress was measured using the Indice de DÊtresse Psychologique de l’EnquÊte SantÊ QuÊbec (IDPESQ), an adaptation of the Psychiatric Symptom Index [27]. Its 14 items record symptoms of anxiety, depression, aggressiveness, and cognitive impairments. Symptom intensity is rated on a 4-point Likert scale. Scores ranging between 14 and 56 are transformed into scores from 0 to 100 by linear transformation. A high level of psychological distress was defined as symptom ratings falling into the highest quintile. The IDPESQ has considerable internal consistency and construct validity [28]. Reliability in this sample was high (α = .88).

Health perception was assessed by asking participants the following question: "In general, is your health excellent, very good, good, fair or poor?" Body mass index (BMI) was computed following question: "In general, is your health excellent, very good, good, fair or poor?" Body mass index (BMI) was computed following the Indice de DÊtresse Psychologique de l’EnquÊte SantÊ QuÊbec (IDPESQ), an adaptation of the Psychiatric Symptom Index [27]. Its 14 items record symptoms of anxiety, depression, aggressiveness, and cognitive impairments. Symptom intensity is rated on a 4-point Likert scale. Scores ranging between 14 and 56 are transformed into scores from 0 to 100 by linear transformation. A high level of psychological distress was defined as symptom ratings falling into the highest quintile. The IDPESQ has considerable internal consistency and construct validity [28]. Reliability in this sample was high (α = .88).

Health perception was assessed by asking participants the following question: "In general, is your health excellent, very good, good, fair or poor?" Body mass index (BMI) was computed by using self-reported weight and height. Subjects were categorized as nonobese (BMI <25 kg/m²) or obese (BMI ≥25 kg/m²). Sleep debt was defined as total sleep time participants estimated they needed to be at their best minus self-reported interval between habitual bedtime and wake time [29]. Insomnia symptoms were defined as having difficulty initiating sleep and/or maintaining sleep.

Data Analysis

Bivariate correlations were computed for all potential explanatory variables, with acute and chronic work-related fatigue being the dependent variables. Stepwise multiple regressions were conducted to verify whether some combination of independent variables would increase the proportion of variance accounted for and to determine what the R² change would be for additional variables entering into the regression equation. Because little research exists on the predictors of work-related fatigue in adolescents, potential explanatory work and health variables were identified on the basis of prior studies on fatigue in adolescents and work-related fatigue in adults. Gender, work intensity, BMI, health perception, sleep debt, insomnia symptoms, psychological distress, multiple job holding, physical work factors, work schedule, and decision latitude were used as independent variables in the regression. Gender and intensity of work, considered as control variables, were forced into the equation first. Other work and health variables were introduced one at a time in the model to see the incremental gain. Stepwise criteria were a probability of fixed factor (F) to enter ≤.05 and a probability of fixed factor (F) to remove ≥.25. The sample size for the fully adjusted model was 187 (74 boys, 113 girls). Statistical analyses were performed using SPSS version 15.0 for Windows (SPSS, Chicago, IL).

Table 2

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females, % (n)</td>
<td>60.4 (113)</td>
</tr>
<tr>
<td>Age in years, mean (SD)</td>
<td>17.9 (.3)</td>
</tr>
<tr>
<td>Work intensity in hours, mean (SD)</td>
<td>14.7 (7.6)</td>
</tr>
<tr>
<td>Multiple concurrent jobs, % (n)</td>
<td>18.7 (35)</td>
</tr>
<tr>
<td>Number of physical work factors, mean (SD)</td>
<td>6.0 (2.9)</td>
</tr>
<tr>
<td>Non-daytime shifts, % (n)</td>
<td>18.7 (35)</td>
</tr>
<tr>
<td>Low decision latitude, % (n)</td>
<td>73.3 (137)</td>
</tr>
<tr>
<td>Health perception, % (n)</td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>27.8 (52)</td>
</tr>
<tr>
<td>Very good</td>
<td>36.4 (68)</td>
</tr>
<tr>
<td>Good</td>
<td>24.1 (45)</td>
</tr>
<tr>
<td>Fair</td>
<td>10.2 (19)</td>
</tr>
<tr>
<td>Poor</td>
<td>1.6 (3)</td>
</tr>
<tr>
<td>Sleep debt, % (n)</td>
<td>48.7 (91)</td>
</tr>
<tr>
<td>Insomnia symptoms, % (n)</td>
<td>56.1 (105)</td>
</tr>
<tr>
<td>Obesity, % (n)</td>
<td>17.1 (32)</td>
</tr>
<tr>
<td>High psychological distress, % (n)</td>
<td>16.0 (30)</td>
</tr>
</tbody>
</table>

Results

Characteristics of Working Students

The mean (SD) acute and chronic work-related fatigue scores were 32.4 (19.1) and 29.2 (19.8), respectively. Table 2 presents demographic, work, and health factors of students. Mean (SD) age of the participants was 17.9 (.3) years. The proportion of participants who were in high school and who had undertaken postsecondary education were 17.1% and 82.9%, respectively. Finally, the following four types of jobs accounted for more than 60% of the occupations most often held by the participants: cashiers (23.0%), salesmen/saleswomen (22.5%), amusement and recreational services (12.8%), and food service (10.2%).

Correlates of Acute and Chronic Work-related Fatigue

Table 3 presents the stepwise multiple regression results for acute work-related fatigue (adjusted R² = .35, p < .001). Significant factors associated with higher acute fatigue levels were higher psychological distress (p < .001), poorer health perception (p < .001), exposure to a greater number of physical work factors (p < .05), and a greater number of physical work factors (p < .05). Table 4 presents the stepwise multiple regression results for chronic work-related fatigue (adjusted R² = .35, p < .001). Significant factors associated with higher chronic fatigue levels were higher psychological distress (p < .001), poorer health perception (p < .001), exposure to a greater number of physical work factors (p < .01), and holding multiple jobs (p < .05).

Discussion

To our knowledge, the present study is the first to investigate factors associated with work-related fatigue in adolescents working at a paid job while attending school, a population at risk of sleep deprivation, sleepiness, fatigue, and occupational injuries [7–10,14,17]. This cohort [26] is comparable with Canadian student workers of the same age group as they are mainly employed in two sectors of the economy, retail and wholesale trade, as well as accommodation and food services [2], and in terms of average weekly hours worked [2].
added that occupationally induced fatigue should not be a work demands and potential health problems. Sluiter et al found a causal string of events that is assumed to exist between adverse fatigue. In their view, work-related fatigue is the link in the subjective health complaints, including chronic or prolonged limitations, and have also shown, on the basis of prospective data, work-related fatigue in 3,820 adult workers with different occupations, and have also shown, on the basis of prospective data, the prognostic value of acute work-related fatigue in relation to subjective health complaints, including chronic or prolonged fatigue. In their view, work-related fatigue is the link in the causal string of events that is assumed to exist between adverse work demands and potential health problems. Sluiter et al further added that occupationally induced fatigue should not be a problem if sufficient recovery time is available between work periods [34]. Meijman [35] earlier established that chronic or prolonged fatigue is not easily reversible and not task specific as compared with acute fatigue; the compensating mechanisms that are useful in reducing acute fatigue are no longer effective. In this regard, a recent study by Oginska and Pokorski found no relationship between chronic sleep reduction and chronic fatigue in school children, university students, and young employees [36]. Our finding which shows an association between sleep debt and acute fatigue but not with chronic fatigue is in keeping with these results. Also, in this study, multiple job holders exhibited significantly higher levels of chronic work-related fatigue. Data from the Second European Workforce Survey suggested that holding multiple concurrent jobs may partially explain that precarious employees report greater fatigue [37].

Multiple sources of evidence demonstrated that workers aged 24 or younger are exposed to higher levels of physical work demands [17,38] and suffer work-related injury at a much higher rate [7,14,17] than those aged 25 and older. An analysis of the relationship between exposure to physical work demands and incidence of workplace injuries by Gervais et al revealed that the rate of injury increases proportionally to the number of physical work factors, even more so in young workers [38]. In this line of evidence, Frone had previously identified exposure to physical hazards, heavy workloads, and boring job tasks as significant predictors of occupational injuries in employed adolescents aged 16–19 years. He hypothesized that such environmental conditions may increase injury rates through elevations in such factors as fatigue or distraction [39]. In sum, knowing about the physical work demands in the work environment of adolescents may help to prevent occupational injuries indirectly through reduction of work-related fatigue.

Table 3
Stepwise multiple regression predicting acute work-related fatigue in students who work during the school year

<table>
<thead>
<tr>
<th></th>
<th>B (SE)</th>
<th>R²</th>
<th>ΔR²</th>
<th>F change</th>
<th>Sign. F change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td>1.9 (8.3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>2.9 (2.4)</td>
<td>.038</td>
<td>.038</td>
<td>7.27</td>
<td>.008</td>
</tr>
<tr>
<td>Work intensity</td>
<td>1.2 (2)</td>
<td>.046</td>
<td>.088</td>
<td>1.51</td>
<td>.221</td>
</tr>
<tr>
<td><strong>Stepwise</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychological distress</td>
<td>4.2 (1.2)</td>
<td>.296</td>
<td>.051</td>
<td>13.15</td>
<td>.000</td>
</tr>
<tr>
<td>Health perception</td>
<td>2.7 (9)</td>
<td>.337</td>
<td>.041</td>
<td>11.28</td>
<td>.001</td>
</tr>
<tr>
<td>Sleep debt</td>
<td>1.1 (4)</td>
<td>.361</td>
<td>.024</td>
<td>6.80</td>
<td>.010</td>
</tr>
<tr>
<td>Physical work factors</td>
<td>4.9 (2.7)</td>
<td>.370</td>
<td>.009</td>
<td>2.44</td>
<td>.120</td>
</tr>
<tr>
<td>Multiple concurrent jobs</td>
<td>3.5 (2.4)</td>
<td>.376</td>
<td>.006</td>
<td>1.81</td>
<td>.180</td>
</tr>
<tr>
<td>Decision latitude</td>
<td>1.3 (5)</td>
<td>.381</td>
<td>.005</td>
<td>1.44</td>
<td>.232</td>
</tr>
</tbody>
</table>

Final model: $R^2 = .38; R^2 \text{adjusted} = .35; F(9,177) = 12.11^*$.  
** Gender: 0 = female, 1 = male.  
* Higher scores indicate higher number of hours worked per week.  
* Higher scores indicate greater psychological distress.  
* Lower scores indicate better health.  
* Higher scores indicate greater sleep debt.  
* Higher scores indicate exposition to a larger number of physical work factors.  
* Multiple job holding: 0 = no, 1 = yes.  
* Higher scores indicate greater severity of insomnia symptoms.  
* Higher scores reflect greater job decision latitude.

Consistent with the previous findings obtained in adult workers [30,31], the stepwise multiple regression analyses revealed a positive relationship between fatigue and psychological distress in these young workers aged 17–18 years. More particularly, psychological distress was the strongest associated factor for both acute and chronic work-related fatigue. In addition, the stepwise regression models revealed a substantial association between fatigue and a second health variable, namely self-rated health status. Students reporting a poorer health status had higher levels of both acute and chronic fatigue as compared with those reporting a better health status. In a random general population sample of British adolescents [32], both anxiety and depression were prospectively showed to predict fatigue and chronic fatigue. Whether emotional difficulties, such as psychological distress, constitute a vulnerability factor for work-related fatigue in adolescents who work during the school year is an important question for which a longitudinal study design is needed.

The present results also suggest that work characteristics such as physical work demands may be more important than the average number of hours worked per week as regards work-related fatigue. This is consistent with several studies of adult workers that have documented relationships between high physical workload or high work demands and high levels of fatigue [30,31,33]. More importantly, Sluiter et al [34] have found strong associations between work demands and acute work-related fatigue in 3,820 adult workers with different occupations, and have also shown, on the basis of prospective data, the prognostic value of acute work-related fatigue in relation to subjective health complaints, including chronic or prolonged fatigue. In their view, work-related fatigue is the link in the causal string of events that is assumed to exist between adverse work demands and potential health problems. Sluiter et al further added that occupationally induced fatigue should not be a problem if sufficient recovery time is available between work periods [34]. Meijman [35] earlier established that chronic or prolonged fatigue is not easily reversible and not task specific as compared with acute fatigue; the compensating mechanisms that are useful in reducing acute fatigue are no longer effective. In this regard, a recent study by Oginska and Pokorski found no relationship between chronic sleep reduction and chronic fatigue in school children, university students, and young employees [36]. Our finding which shows an association between sleep debt and acute fatigue but not with chronic fatigue is in keeping with these results. Also, in this study, multiple job holders exhibited significantly higher levels of chronic work-related fatigue. Data from the Second European Workforce Survey suggested that holding multiple concurrent jobs may partially explain that precarious employees report greater fatigue [37].

Multiple sources of evidence demonstrated that workers aged 24 or younger are exposed to higher levels of physical work demands [17,38] and suffer work-related injury at a much higher rate [7,14,17] than those aged 25 and older. An analysis of the relationship between exposure to physical work demands and incidence of workplace injuries by Gervais et al revealed that the rate of injury increases proportionally to the number of physical work factors, even more so in young workers [38]. In this line of evidence, Frone had previously identified exposure to physical hazards, heavy workloads, and boring job tasks as significant predictors of occupational injuries in employed adolescents aged 16–19 years. He hypothesized that such environmental conditions may increase injury rates through elevations in such factors as fatigue or distraction [39]. In sum, knowing about the physical work demands in the work environment of adolescents may help to prevent occupational injuries indirectly through reduction of work-related fatigue.

Table 4
Stepwise multiple regression predicting chronic work-related fatigue in students who work during the school year

<table>
<thead>
<tr>
<th></th>
<th>B (SE)</th>
<th>R²</th>
<th>ΔR²</th>
<th>F change</th>
<th>Sign. F change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td>–6.6 (7.4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>1.7 (2.5)</td>
<td>.013</td>
<td>.013</td>
<td>2.42</td>
<td>.121</td>
</tr>
<tr>
<td>Work intensity</td>
<td>1.2 (2)</td>
<td>.026</td>
<td>.030</td>
<td>2.50</td>
<td>.115</td>
</tr>
<tr>
<td><strong>Stepwise</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychological distress</td>
<td>4.2 (1.3)</td>
<td>.307</td>
<td>.079</td>
<td>20.64</td>
<td>.000</td>
</tr>
<tr>
<td>Physical work factors</td>
<td>1.2 (4)</td>
<td>.336</td>
<td>.029</td>
<td>8.04</td>
<td>.005</td>
</tr>
<tr>
<td>Multiple concurrent jobs</td>
<td>6.6 (2.8)</td>
<td>.362</td>
<td>.026</td>
<td>7.26</td>
<td>.008</td>
</tr>
<tr>
<td>Sleep debt</td>
<td>1.1 (9)</td>
<td>.369</td>
<td>.007</td>
<td>1.96</td>
<td>.163</td>
</tr>
<tr>
<td>Insomnia symptoms</td>
<td>3.2 (2.5)</td>
<td>.375</td>
<td>.005</td>
<td>1.35</td>
<td>.214</td>
</tr>
<tr>
<td>Daytime shifts</td>
<td>4.0 (3.1)</td>
<td>.380</td>
<td>.006</td>
<td>1.62</td>
<td>.204</td>
</tr>
<tr>
<td>Obesity</td>
<td>3.7 (3.2)</td>
<td>.385</td>
<td>.005</td>
<td>1.33</td>
<td>.250</td>
</tr>
</tbody>
</table>

Final model: $R^2 = .39; R^2 \text{adjusted} = .35; F(10,176) = 11.01^*$.  
** Gender: 0 = female, 1 = male.  
* Higher scores indicate higher number of hours worked per week.  
# Higher scores indicate greater psychological distress.  
* Lower scores indicate better health.  
* Higher scores indicate exposition to a larger number of physical work factors.  
* Multiple job holding: 0 = no, 1 = yes.  
* Higher scores indicate greater sleep debt.  
* Higher scores indicate greater severity of insomnia symptoms.  
* Daytime shifts: 0 = no, 1 = yes.  
* Obese: 0 = no, 1 = yes.  
* Daytime shifts: 0 = no, 1 = yes.  
* Male.  
** p < .001.  
*** p < .01.  
**** p < .05.
Our findings should be interpreted with caution. First, both the independent and dependent variables were assessed using self-reported measures and are thus subject to accuracy of recall. Also, one main disadvantage of cross-sectional research designs is that they preclude the determination of a cause and effect relationship. Longitudinal studies are thus needed to compare, for example, different exposure to physical work factors under the same work schedule studied systematically in terms of how they contribute to acute and chronic work-related fatigue. Finally, generalizability of the results may be limited to similar populations of students.

A major contribution of this study is the identification of potentially modifiable risk factors that may diminish the levels of acute and chronic work-related fatigue in adolescents aged 17–18 years attending school and working at a paid job. The relationship between self-rated health, psychological distress, and work-related fatigue suggests that interventions designed to prevent fatigue in student workers should address emotional well-being. Moreover, health providers must inform adolescent patients and their parents about the elevated injury risk faced by young workers and risks associated with work-related fatigue, exposure to high physical demands at work, and multiple job holding. Finally, the importance of getting enough sleep and having recovery periods should be reemphasized as a means to safeguard the health and well-being of students who work while attending school.

Acknowledgments

This work was supported by the Programme d’aide à la recherche sur l’enseignement et l’apprentissage (PAREA) of the Ministère de l’Éducation, du Loisir et du Sport du Québec, the Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST), and the Syndicat des chargés et des chargées de cours de l’Université du Québec à Chicoutimi (SCCCUQAC). We express our appreciation to the adolescents for their generous participation in this study. Finally, technical support from Robert Dôle is gratefully acknowledged.

References

[35] Meijman TF. Over vermeidelijkheid: Arbeidspsychologische studies naar de beleving van belastingseffecten [Fatigue: Studies on the perception of...
workload effects]. Amsterdam, the Netherlands: University of Amsterdam, 1991.


