Work Context and OHS

Studies and Research Projects

REPORT **R-752**

Occupational Health and Safety of Students who Hold Jobs during the School Year

Effects of Concurrent School Activity and Work Constraints

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SUMMARY

The present study falls within the purview of studies published in Quebec since the 1990s that have generated a new field of research on paid work performed by students. These studies are particularly interested in how this work affects their education. However, few researchers have directly addressed the issue of how paid work performed by students poses a potential threat to their health through, amongst other things, accidents, musculoskeletal disorders (MSD) symptoms, psychological distress and fatigue.

While young dropouts are considerably more at risk for occupational injuries than are working students, the increase over the past 20 years in the number of youth combining work and study has heightened our concern regarding this reality. Indeed, in comparison with their counterparts in nine countries of the Organization for Economic Cooperation and Development (OECD), Canadian teens ranked first in terms of the average number of hours per week spent on paid work and unpaid activities during the school week (Marshall, 2007). To better understand the occupational health and safety (OHS) issues related to this growing phenomenon, the present project aims to determine the effects of concurrent school activities and work constraints on the OHS of students who work during their studies; in so doing, it will take into account the fact that they are also a group at risk for problem sleepiness (NIH, 1997).

A total of 94 youth, aged 19 to 21, who worked and studied concurrently were recruited from an ongoing longitudinal survey on educational pathways, lifestyle and OHS. An initial semi-structured interview, conducted at the beginning of the school term, helped to determine the activity profile of these young people, the characteristics of the paid work they performed and the work constraints they faced. These young people then kept a diary and wore an actigraph for 14 consecutive days in order to quantify the concurrent activities and document sleep patterns. They also completed validated questionnaires to assess the presence and severity of various OHS symptoms (MSD, psychological distress, fatigue, sleep problems, etc.). At the end of the school term, a second semi-structured interview documented changes arising during the school term in their activity profile and work constraints, recorded the strategies used by the young people to adapt to those constraints and clarify the relationship between the work characteristics and the OHS symptoms.

Unsurprisingly, the majority of jobs held by students are in sectors traditionally held by younger workers, such as retail trade, accommodation and the food industry. However, our study shows that from the age of 19, some participants began to work in jobs whose technical level was connected to their field of study, jobs that usually require additional qualifications; more often than not this proved to be the case with women working in health care or education. Our study also shows that the profile of the activities making up the work-*cum*-study regime was not stable over time, but fluctuated significantly, particularly in regard to the employment component. In general, students who held one or more jobs did not attempt to lighten their academic burden by reducing, for example, the number of course hours per week. Thus, the hours devoted to paid work were over and above the hours devoted to lectures, homework and study. Here, the situation seemed most worrying for community college (i.e., junior college or CEGEP) students and students completing a vocational diploma (DEP) or enrolled in general education for adults (FGA).

The present study also found that students who held a job or jobs during their studies faced a range of health risks and that job characteristics, working hours and career paths had an impact on various health indicators. In particular, two out of five women and nearly one in five men reported an overall level of fatigue deemed to require medical attention. Specifically, the analyses identified the accumulation of organizational work constraints, in addition to psychological pressures, social support at work, and the fact of having held a large number of jobs since the age of 15 as factors associated with the severity of the work-related chronic fatigue. Although the majority of these working students did not view their workload as too high, one in five still perceived his or her paid work as difficult, tiring, demanding or stressful. Our findings also show that about half of the working students had sleep problems.

In a survey of the same population of working students when they were aged 17-18 years (Ledoux et al., 2008), we noticed that over half of those who reported having experienced pain during the year preceding the survey had also felt it during the previous seven days. Once again, it seems that students who held a paid job during their studies constituted a population struggling with a persistent or chronic perceived musculoskeletal pain, since almost all (91.3%) of those having experienced pain at least somewhere in their body during the 12 months preceding the present study also felt it during the week preceding it. Yet again, the women stood out from the men in the mean number of pain sites reported. Our findings also suggest a link between the number of physical constraints to which the working students were exposed as part of their job(s) and the presence of pain stemming from their paid work. In addition, those who experienced job-related pain were, in general, subjected to greater psychological pressures.

Finally, our study shows that the young people often reported discomfort, injury or other difficulties following an accident. In many cases, these short-term effects did not translate into workplace absenteeism, since in part-time work (PTW) the period between two workdays often provides enough time to recover from these effects. Thus, one can readily understand the potential limits of an indicator judging the severity of an occupational injury based on the length of the absence when PTW is involved. Furthermore, our findings suggest that the occurrence of an initial work-related accident early in the young person’s career, often during adolescence, increases the risk of having another accident later. Finally, our report terminates with the presentation of several avenues for intervention and research.

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1. INTRODUCTION

Research on prevention of occupational injuries among youth 15 to 24 years of age is increasingly focusing on sub-groups within this population in order to better understand the phenomenon and target prevention efforts more effectively. Some studies highlight the greater vulnerability of young dropouts (Breslin, 2008, Godin et al., 2009). Others focus on young people whose studies and paid work are concurrent during the school year (Dundes and Marx, 2006; Cheng and Alcántara, 2007; Lee and Staff, 2007; Marshall, 2007; Singh et al., 2007; Holmes, 2008; Ledoux et al., 2008; Roy, 2008). In the latter case, while student workers (working students) seem less at risk for occupational injury than dropouts (Godin et al., 2009), over the last 20 years the increase in Canada in studies and paid work undertaken concurrently (Marshall, 2007) justifies being concerned about this particular population. Indeed, in comparison with their counterparts in nine OECD countries, Canadian teens ranked first in terms of average time per week spent on paid and unpaid work (OCDE, 2008). In Quebec, the labour-market participation of young students is increasing (Institut de la statistique du Québec, 2007). In a recent survey of 3,500 young Quebecers attending high school, over 50% of the students reported having held paid employment during the school year (Gaudreault et al., 2009). Also, the most recent studies report rates of around 70-80% among junior college (also referred to as community college) students (Roy et al., 2005, Veillette et al., 2007, Ledoux et al., 2008; Gaudreault et al., 2009). A qualitative study of junior college students identified the quest for financial independence and the attractions and values of the consumer society as factors influencing the decision to engage in paid work during the year school (Roy, 2008). Furthermore, a regression analysis on data from a longitudinal survey, the *Enquête longitudinale auprès des élèves saguenéens et jeannois âgés de 14 ans en 2002* (ELESJ-14), found that the number of hours per week spent on school work at age 17, as well as the number of hours per week spent on paid work at age 17, were factors associated with their changing their junior college program (Veillette et al., 2007). More and more students viewed paid work as part of their lifestyle or as one activity among others (Sales, 2001), which for a number of them likely contributed to their extending the length of their studies.

To this social change, which views performing paid work while studying as a way of life for most students, one must add changes that have come about in the world of work itself. Indeed, due to labour market developments in recent decades, the career paths of today's young workers are very different from those of their parents (Zeman et al., 2004; Charbonneau, 2006). These developments include: restructuring of the economy, longer opening hours for retail businesses, an increase in the number of service sector jobs, deregulation of child labour, job flexibility and insecurity, competition and performance. These contemporary realities of the labour market can also damage the health and safety of workers (Quinlan et al., 2001).

The present research has been conducted in the wake of works published in Quebec since the 1990s that have contributed to the rise of a new field of research on paid work performed by students (Vigneault, 1993; Bourdon, 1994; Terrill and Ducharme, 1994). These works are particularly interested in the impact of work on their studies and certain aspects of their health. However, few researchers have directly addressed injuries linked to the paid work performed by students, especially work accidents, musculoskeletal disorders (MSD) symptoms, psychological distress and fatigue.

While students generally view paid work in a positive light (Roy, 2008, Gingras and Terrill, 2006), several studies suggest that young people who engage in study and paid work concurrently may be running the risk of harmful effects, particularly when too many hours per week are devoted to the paid work (Carskadon et al., 1989; Carskadon, 1990, Dumont, 2007). These effects involve, on the one hand, students' academic and educational success and, on the other hand, certain types of behaviour relating to their health and psychological well-being, such as use of tobacco and alcohol, degree of self-esteem, and anxiety, stress and fatigue. Note also that the National Institutes of Health (NIH), the principal U.S. federal health agency, have identified adolescents and young adults (12-25 years of age) as a population at risk for problem sleepiness (NIH, 1997), for reasons related to this population's lifestyle and to changes in their biological clock.

In terms of occupational injuries, the Central and Regional Data Warehouse (*Dépôt de données central et regional,* or DDCR) of the *Commission de la santé et de la sécurité du travail du Québec* (CSST) does not have data on whether or not the victims of these injuries are young people studying and working concurrently. That said, when hours spent working are considered, young Quebecers aged 15 to 24 years have one and a half times more accidents than their older counterparts (Gervais et al., 2006). While from 2000 to 2008 injuries declined overall, the fact remains that in 2008 alone the CSST (2009) identified nearly 15,000 occupational injuries among participants less than 24 years of age. When considered over a 10-year period (1997-2007) the extent of occupational injuries among young workers becomes apparent: 55 accidents per day, two amputations per week, one death per month and 1,000 permanent after-effects (sequelae) annually. Overall, between 2000 and 2007, an average of 158 workers per year, aged 18 years or less, suffered injuries leading to permanent after-effects (Vézina, 2009). This represents about 6% of the 22,000 injuries identified during this period among workers in this age group. Proportionately, twice as many men than women injured at work will suffer throughout their lives from the effects of these injuries. In total, this means that following an occupational injury one young worker out of 20 will suffer permanently from this injury. This is worrying, since it is rare that these young people, often still in school, have begun their professional careers. Furthermore, it is highly likely that this data underestimates the magnitude of the problem. Indeed, numerous studies show that young people do not report work accidents consistently (Koehoorn and Breslin, 2003; Ledoux et al., 2008). Moreover, under-reporting of occupational accidents and diseases by individuals who do not work on a steady basis is a well-documented phenomenon (Quinlan and Mayhew, 1999; Lippel, 2001).

The present study aims to determine the effects of concurrent school activities and work constraints on the OHS of working students 19 to 21 years of age. More generally, it falls within the scope of research trying to understand why young workers are at increased risk of work accidents. This research has begun to shed light on diverse factors that contribute to their increased vulnerability, such as lack of training, job mobility (Godin et al., 2009), work constraints (Gervais et al., 2006, Ledoux et al., 2008), conditions favouring employability (Chatigny, 2001, Cloutier et al., 2002, Bourassa and Fournier, 2000), conditions of employment (Quinlan et al., 2001) and societal transformations (Vultur, 2004). However, none of this research has raised the question of the impact of concurrent activities and accumulated constraints on the OHS of young people, while taking into account that they are also a group at risk for problem sleepiness.

2. STATE OF KNOWLEDGE

Holding paid work during the school year is now a reality for many young people. Studies on the reconciliation of work and study have dwelled essentially on describing and analyzing the impact of part-time work (PTW) on the academic performance and well-being of students (Dumont, 2007). These studies also form part of a broader set of issues concerned with the transition from school to labour market. Nowadays, this transition lasts an average of nearly eight years, and either involves shuttling between training and paid work or takes the form of various work-study combinations (Franke, 2003).

Some studies have described the impact of work-study reconciliation on the health of young people, especially when taking into account their alcohol or tobacco consumption, or in terms of their level of physical activity (Bachman and Schulenberg, 1993; Kouvonen and Lintonen, 2002; Carrière, 2005). Some authors also examined the impact of fatigue, especially since adolescents and young adults have been identified as populations at risk for problem sleepiness (NIH, 1997). In the field of occupational health, the studies tend to focus on the work injuries of people under the age of 25, without really differentiating cases of students who hold jobs while studying from workers who study part-time or workers who are not studying.

2.1 Work-study reconciliation: a delicate balance

As demonstrated in the study by Csikszentmihalyi and Schneider (2000), employment tends to be perceived positively by students, for whom it affords a measure of personal and financial independence, while providing them with new contacts and outlets for socialization and promoting a positive image of themselves. According to Hamel (2007), paid work figures prominently in the value system of young people. Surveys of junior college students report that a majority of students view paid work as a positive experience in their personal development (Gingras and Terrill, 2006; Roy, 2008). Although the main reason given for working during one's studies is the possibility of increasing one's financial independence, some observers also note that it fosters a sense of responsibility (Gingras and Terrill, 2006). In addition, employment provides some students with the opportunity of freeing themselves from the more intellectual side of education while placing greater emphasis on manual or physical skills or forming new relationships (Roy, 2008). Some authors also report that work can contribute to the psychological health of students (Finch et al., 1991, Mortimer et al., 2002). Finally, student employment may, once the students have completed their studies, facilitate their integration into the labour market (Mihalic and Elliott, 1997). In this perspective, paid work helps maintain or improve students' health and well-being.

By contrast, stress appears to be an integral part of daily life for young students. In an interview forming part of an article by Mathieu (2008), Dumont estimated that, of 517 students in Secondary IV and Secondary V, 22.1% experienced high levels of performance-related stress while 24.8% experienced average stress. Among junior college students, a majority had the feeling they were in a race against time (Dumont, 2007; Roy, 2008). Analyses drawn from labour and household surveys conducted by Statistics Canada also show that four in ten teenagers say they are constantly pressured to do more than they are able and that six in ten teenagers shorten their sleep period when they need to allocate additional time to other matters (Marshall, 2007).

The latter study identified two other factors associated with stress among adolescents, namely, spending 2.5 hours per day doing homework and having a paid job of 20 hours or more per week.

The impact of concurrent work and study seems to take a more negative turn when too many hours per week are devoted to paid work or when this work is alienating or performed late at night. In this context, concurrent work and study may be associated with a decrease in a student's academic performance and commitment, an increase in their consumption of alcohol and drugs, a higher level of anxiety, symptoms of depression and fatigue, later bedtime hours, shorter duration of sleep as well as an increased frequency of falling asleep in class or while driving (Carskadon and Davis, 1989; Carskadon, 1990; Steinberg and Dornbusch, 1991; Steinberg et al., 1993, Bachman and Schulenberg, 1993; Carr et al., 1996, Stern et al., 1997; Vinha et al., 2002, Paternoster et al., 2003, Teixeira et al., 2004; Marshall , 2007). Dumont (2007) however has suggested that PTW concurrent with studies was a risk factor in the school adjustment for students in Secondary III and IV as soon as they devoted 11 hours or more per week to this PTW. The findings of the *Youth in Transition Survey* (18-20 years of age) specified however that among young people holding paid work the dropout rate was lower among those working a moderate number of hours per week and higher among those who held the equivalent of a full-time job (Bowlby and McMullen, 2002). In addition, it was shown that Secondary V students who did not hold paid employment were more likely to drop out than those who worked less than 20 hours per week (Bushnik, 2001). On the other hand, certain authors have demonstrated, using longitudinal data on students aged 14 and 15 years, that the number of weekly hours of paid work had no effect on their academic achievement, behaviour or health (Mortimer et al., 1996).

With regard to OHS, one study reported that there was a linear relationship between the number of weekly hours of paid work and the number of injuries among high school students (Weller et al., 2003). In the opinion of the authors, the increased risk of injury was due to a reduction in the hours of sleep and the onset of fatigue as a result of adding PTW to their school commitments and social activities. Of course, combining education and employment does not simply involve replacing hours of study with hours of paid work, but also requires a reorganization of daily activities in order to develop a new schedule, which often leaves less time for leisure and sleep (Carskadon, 1990; Franke, 2003). Ledoux et al. (2008) also show that students who are employed during the school year do not lighten their academic workload. Indeed, the number of hours spent on courses and studying is almost invariable, regardless of whether the students devote five, 15 or 25 hours to paid work – or do not work at all for that matter. In other words, the hours devoted to paid work are simply added to class hours and study (Ledoux et al., 2008; Roy, 2008; Gaudreault et al., 2009).

Finally, few of the studies identified compared the health of working students to that of the general population. In this regard, a study involving 756 university students holding paid work (Carney et al., 2005) obtained results that were cause for concern. The authors noted that the quality of life indicator linked to the health of working students, as measured by the SF-36 questionnaire (Ware and Sherbourne, 1992), was lower than that of a comparable population, based on age and sex. Specifically, the findings revealed that in seven of eight domains of health measured by the SF-36 (limitations related to physical state, bodily pain, perceived health, vitality, life and relationships with others, mental health and limitations due to mental state) the

working students had scores significantly lower than those of the reference population. Moreover, Gervais et al. (2006) have demonstrated that, among the 15-19 year-olds holding employment while pursuing their studies, the women experienced greater psychological distress than men, and a poorer perception of their mental health.

Given these findings as a whole, the question of the advantages and disadvantages of concurrent work and study remains unresolved.

2.2 Characteristics of student employment

Mortimer and Shanahan (1994) and Steinberg and Cauffman (1995) are but a few of the researchers for whom work environment is intimately linked to other contexts playing a role in the development of youth. The quality of the work experience, in their view, is linked in particular with a student's career path and how students feel about the world of work in general. For example, students who obtained more diverse roles tended to seek more information on the tasks related to their work, while those who obtained more feedback and opportunities for interaction with co-workers had a higher level of self-esteem and a greater sense of effectiveness at work (Brooks et al., 1995; Stone and Mortimer, 1998). If job characteristics are deemed to have a wide range of effects amongst adult workers, we can assume that the same holds true for younger workers (Stone & Mortimer, 1998). Instead of limiting their approach to a general measurement, such as the number of hours worked per week, or to the frequently cited 20-hour threshold, several researchers have pointed out the need to also consider work characteristics and work constraints (Carr et al., 1996; Stone and Mortimer, 1998).

According to Mortimer and Staff (2004), work constraints such as pressures, exposure to risk factors, workload or ambiguity in responsibilities were associated, in high school students, with a lower level of self-esteem, a reduction in work efficiency and an increase in depressive symptoms.

So, what are the characteristics of jobs held by young working students in Quebec? In most cases, they may be described as "odd jobs" or "McJobs" (Roy, 2008), found essentially in the service sector. Specifically, in 2005 Quebec's retail trade, accommodation and food services sectors employed nearly six out of ten students (Institut de la statistique du Québec, 2007). Student employment is concentrated in sectors known for their high turnover, low pay and the lack of social protection programs. For most students, these jobs are not related to their training program. According to data from the ELESJ-14 produced by ÉCOBES Recherche et transfert in collaboration with the Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST) (Ledoux et al., 2008), nearly two out of three students are employed in firms with fewer than 50 employees. Thus, the majority of these young people acquire their first work experiences in small enterprises (SEs) or small branches of large chains that are often less well equipped for the prevention and management of OHS than are large companies (Champoux and Brun, 2000). While in general the students say they are relatively satisfied with their working conditions (Roy, 2008), early entry into the labour market exposes them to a range of work constraints, both organizational and physical. Using data from the *Enquête sociale et de santé 1998* ("Health and Social Survey 1998", Government of Quebec, 2001), Gervais et al. (2006) have shown that, compared to older workers, young workers aged 15 to 24 years are more frequently exposed to

organizational constraints (irregular schedules, night shifts, low pay) and physical constraints (repetitive work, exertion, heavy lifting, exposure to noise, solvents or dust, etc.). Although students who are gainfully employed while studying are exposed to psychological stress comparable to that of young workers no longer in school, the latter are more often exposed to heavy physical stresses (Breslin, 2008).

Yet in a survey of 229 student workers (Ledoux et al., 2008), over 70% of the participants reported that their jobs required them to go fast and 35% considered their workload excessive. As most young people were in jobs where the pace of work originated from clients' direct requests, it is not surprising that a substantial proportion of young people (20%), especially cashiers and facilitators / trainers, reported experiencing tension with the public. In addition, the vast majority of these young people claimed to have very little autonomy in their work, though they were in a psychosocial development phase marked by the quest for autonomy. However, the same survey revealed that almost all participants (96.4%) had good relations with their colleagues. These findings tally with those obtained after analysis of 29 interviews with young people working in small shops and the catering sector; relationships between colleagues seemed to be decisive when it came to choosing between remaining in the job or not (Ledoux et al., 2009). Despite these good relationships, one in five reported that their superior did not facilitate the completion of the work and did not care about the well-being of those they supervised.

In general, the young people were also exposed to a range of physical constraints relating to the work. On all 19 questions on physical constraints, they accumulated an average of 6.3 constraints. Thus, almost all of the young people were commonly exposed to at least one of the four physical constraints related to posture. For 90% of the participants, this involved maintaining a standing position or having to walk frequently, as was also the case for 85% of the participants aged 15 to 19 surveyed in the *Enquête sociale et de santé 1998* (Gervais et al., 2006). Note that only one in six in the survey reported having the opportunity to sit down at will.

Finally, in the five jobs most often held by the 229 student workers in the above study, 54% had to use physical exertion, 45% had to engage in repetitive work and 32% had to handle heavy loads (Ledoux et al., 2008). These were the waiters and cooks who, on average, accrued the largest number of physical constraints. Lastly, only 4.5% of the participants reported being at risk for falls, though they were involved in several accidents reported in the survey (Ledoux et al., 2008).

This survey also showed that, upon entry into the labour market, students face a large number of constraints in their jobs, even in the "odd jobs" (Ledoux et al., 2008). Also, Gervais et al. (2006) showed that by combining data on exposure to work constraints with the rate of occupational injuries reported by workers the accumulated constraints are associated with an increased rate of accidents at work; this is more marked among young workers aged 15-24 than those aged 25 and over.

According to Ledoux et al. (2008), the majority of working students had their jobs on school days and only 7% of them reported not working weekends. In addition, most young people had an irregular work schedule (67%), and a significant proportion of them alternated between day work and evening work. In addition, 59% of the students who participated in this survey said

they had a day or less off per week. In this regard, several researchers believe that too many consecutive periods of work, or excessively short rest intervals between two periods of work, are all factors that can hinder recovery from work-related fatigue (Jansen et al., 2003a; van Dijk and Swaen, 2003).

2.3 A population at risk for problem sleepiness

The NIH (1997) has identified adolescents and young adults (12-25 years) as a population, like night workers, at risk for problem sleepiness. Changes in the sleep-regulating systems and habitual sleep schedules of young people (Laberge et al., 2001; Carskadon, 2004) are the cause of this particular risk. There is a consensus that sleep-related problems stem primarily from a conflict between, on the one hand, the physiologically determined need for sleep and, on the other hand, the timing of sleep episodes, which is simultaneously influenced by psychosocial factors and factors specific to the biological clock, as we shall see below (Millman, 2005). Daytime sleepiness has been associated with a higher risk of learning difficulties, mood disorders and risk behaviours in adolescents (Carskadon, 1990; Dahl and Lewin, 2002; Fallone et al., 2005).

A longitudinal study monitoring a sample of young pre-teens until the start of young adulthood revealed, firstly, that the need for sleep remained unchanged (9.25 hours) throughout this period and, secondly, that sleepiness during the day increased concomitantly with puberty, even when the need for sleep was met (Carskadon, 1982). Moreover, both transverse and longitudinal data highlighted the tendency of teenagers to gradually delay their bedtimes and to get up later and later; this delay in the sleep phase can last until the early twenties (Lack, 1986; Carskadon, 1990; Wolfson and Carskadon, 1998; Laberge et al., 2001; Strauch and Meier, 1988; Giannotti and Cortesi, 2002, Gau and Soong, 2003; Andrade and Menna-Barreto, 2002; Reid et al., 2002). For the transition between high school and junior college, the delay in bedtime is approximately two hours (Carskadon and Davis, 1989). During the school year, starting times for courses start require most young people to get up early, whereas there is a gradual delay of bedtimes with age. Despite an unchanged need for sleep, there is in fact a gradual decrease in the duration of nocturnal sleep among adolescents and young adults. The delay of the sleep phase may be attributed, firstly, to psychosocial factors that gain importance during adolescence, including more marked manifestations of young people's autonomy, an increase in school obligations, the beginning of paid work and greater access to late evening activities via telephone or Internet (Anders et al., 1978; Kirmil-Gray et al., 1984; Carskadon, 1990; Allen, 1992; Manber et al., 1995; Wolfson et al., 1995) and, secondly, to a biological component that intensifies at puberty.

Puberty is accompanied by changes in the circadian phase preference, that is to say, the time of day at which an individual realizes their optimal functioning. Thus, the most pubescent youth tend to go to bed in the small hours of the morning and sleep in. One observes an increase in evening types ("eveningness") among them, which seems to correspond to a phase delay in several biological rhythms (Ishihara et al., 1990, Andrade et al. 1992; Carskadon et al., 1993). Another laboratory study attempted to verify if the phase delay in the biological clock continued beyond adolescence by comparing the sleep and circadian rhythms of adolescents (14-17 years) and young adults (19-30) during the summer vacation period, when school hours have no impact (Laberge et al., 2000). The findings showed that the two groups were similar with respect to their

circadian phase preference and their melatonin secretion rhythm, suggesting that there is a phase delay in the biological clock of young adults, too. They are therefore also at risk for misalignment of their circadian phase when the properties of their endogenous circadian clock are in conflict with external demands or their lifestyle (Carskadon et al., 1998). Indeed, the phase delay of the biological clock does not only mean that young people have difficulty falling asleep early in the evening, but also that their propensity to sleep is still elevated in the morning. Thus, there is a potential conflict between young people's internal biological clocks and the school schedules and demands.

A final noteworthy feature of sleep during the second decade of life is that sleep duration on the weekend is 30 to 60 minutes longer than on weekdays; at age 20, this difference in sleep duration may increase to 2 hours (Carskadon et al., 1991, Hicks and Pellegrini, 1991; Wolfson and Carskadon, 1998; Laberge et al., 2001). Indeed, adolescents and young adults go to bed later on weekends than during the week, but get up much later too. Usually this discrepancy between the schedule of sleep episodes during the week and that obtaining on weekends is interpreted as the accumulation of a weekday sleep deficit followed by the attempt to offset it during the weekend. Despite this catch-up sleep, nocturnal sleep duration on weekdays and weekends gradually decreases between the ages of 10 and 20 years. It is especially the irregularity of the weekday / weekend schedule of sleep episodes that causes insomnia symptoms (Hicks et al., 1989). Indeed, the young person who goes to bed three hours later on Friday and Saturday will generally have difficulty falling asleep when he or she goes to bed at the "usual" time on Sunday evening, that is, the night before returning to class or work, which requires most young people to get up early. In sum, adolescents and young adults seem to be a population at risk for partial sleep deprivation. To the extent that many young people accumulate a sleep deficit due to biological and psychosocial factors, excessive daytime sleepiness and the exhaustion with which it is associated can affect their studies, i.e. their primary task, as well as their paid work. Recent data indicate, for example, that the proportion of young people complaining of daytime sleepiness increased significantly, from 46.2% to 60.7%, between the ages of 14 and 16 years (Gaudreault et al., 2005). In addition, a questionnaire survey conducted over a 10-year-period reported that 54% to 75% of young people (aged 20 to 24 years at the end of the study) expressed a desire for more sleep and that this desire was associated, both in adolescence and young adulthood, with a complaint of morning fatigue (Strauch and Meier, 1988). In the view of the NIH, young adults who attend college or in the workplace face even more intense psychosocial and behavioural influences all through their sleep (NIH, 1997).

2.4 Link between work characteristics and fatigue

The Canadian Centre for Occupational Health and Safety (CCHST, 2010) defines fatigue as a feeling of exhaustion, weariness or sleepiness resulting from a lack of sleep, a prolonged mental or physical activity, or long periods of stress or anxiety. Studies conducted with adult workers indicate that fatigue is associated with a number of work characteristics and constraints as well as with numerous OHS symptoms.

Based on data from the Maastricht Cohort Study on Fatigue at Work (Kant et al., 2003), a prospective study that observed a cohort of over 7,000 adult workers working in various companies and organizations, Bültmann and colleagues (2002a) used regression analyses to

study the relationship between the psychosocial characteristics of work and the subsequent presence of fatigue. Their findings revealed that the physical and mental demands associated with the task increased the risk of fatigue in men, whereas decision-making autonomy in men, and social support from work colleagues in women, were factors that prevented fatigue.

The relationship between job characteristics and chronic fatigue, defined as severe fatigue present for more than six months combined with a decrease in functional capacity that cannot be relieved by rest, was investigated in 735 Brazilian workers working in a bank. Regression analysis revealed that work pace, job dissatisfaction, minor psychiatric disorders and the performing of household tasks were risk factors for chronic fatigue (Fatima Marinho de Souza et al., 2002). Another survey, one involving 3,727 nurses, focussed on the possible links between eight types of physical demands and the duration of nocturnal sleep, the use of painkillers and absenteeism. Regression analysis revealed a link between an increase in physical requirements, on the one hand, and insufficient duration of sleep, use of painkillers and absenteeism, on the other hand (Trinkoff et al., 2001).

Furthermore, it has been clearly established that night work negatively affects worker alertness and performance (Akerstedt, 1988; Mitler et al. 1988) because they must work when their biological clock predisposes their body to rest (Folkard, 1975, Czeisler et al. 1980; Dijk et al. 1992) and try to sleep during the day when their body is predisposed to activity (Mills et al. 1974; Strogatz et al., 1986), resulting in sleep which is usually shorter and of lower quality than night-time sleep (Akerstedt and Gillberg 1981; Akerstedt 1995). Following several successive night shifts, one observes fatigued workers with a significant sleep deficit (Rutenfranz et al. 1977; Akerstedt, 1988; Folkard and Tucker, 2003; Folkard and Akerstedt, 2004).

Moreover, the population of young people pursuing studies was compared with workers on rotating morning shifts, with the period of nocturnal sleep in both cases being truncated so as to attend to the principal occupation (Rosa, 2002). In fact, the shift workers found it difficult to advance their bedtimes the night before the morning shift in order to get enough sleep (Folkard and Barton, 1993), and this caused fatigue and a subjective feeling of sleepiness during the morning shift (Knauth et al., 1980; Kecklund and Akerstedt, 1995). After a week of morning shifts, the workers could have accumulated a sleep deficit of several hours (Rosa et al., 1996). Since the circadian phase preference of individuals tends to become more ‘evening’ with age, there was a significant difference between young and older workers: the youngest slept less before the morning shift, and more after the evening or night shift. Again, in comparison with older workers, the young workers said they were more tired during the morning shift and less tired during the evening or night shift (Rosa et al., 1996). Thus, the young workers were more affected than were the older workers when they had to get up early for work.

Finally, a study of Brazilian adolescents who worked during the day and attended school at night revealed links between reduced sleep duration and several work characteristics. These characteristics were typical of jobs with significant physical or mental demands; jobs requiring little creativity; jobs providing little support from colleagues and, lastly, those that had to be performed in an unsafe, noisy or contaminated environment (Fischer et al., 2005). These findings altogether suggest the existence of a significant interaction between recovery through sleep, functional capacity and working conditions.

2.5 Link between fatigue, alertness and performance

Experimental studies on total or partial sleep deprivation conducted on healthy subjects have clearly shown that sleepiness is associated with deficits in various cognitive-behavioural tasks, including a decline in sustained attention, decreased reaction time, short-term memory disorders and greater difficulty in maintaining a stable level of performance (Dinges and Kribbs, 1991; Bonnet, 1994). Specifically, young adults (mean age 23 years) whose sleep was restricted to about five hours a night for seven consecutive nights showed significant increases in sleepiness and subjective fatigue immediately following their first night of partial sleep deprivation, while measures of performance (sustained attention, working memory, etc.) significantly decreased after the second night (Dinges et al., 1997). Furthermore, it is interesting to note that this partial sleep deprivation had a cumulative effect on daytime functions, and affected fatigue, mood and stress (Dinges et al., 1997). In addition to being associated with decreased learning ability and performance, problem sleepiness can ultimately lead to the occurrence of unintended sleep episodes (NIH, 1997). In this regard, a questionnaire survey conducted among 5,600 individuals found that those aged under 30 reported more unintended sleep episodes at work than those aged 30-45 years and those over 45 years (Akerstedt et al., 2002). Specifically, poor sleep quality was identified as an important predictor of unintended sleep episodes, both at work and during leisure time (Akerstedt et al., 2002a). In the same vein, the 2005 Sleep in America Poll (National Sleep Foundation, 2010) indicated the following: the group of young participants (18-29 years) reported with significantly greater frequency than did groups of older participants (aged 30-49, 50-64 and 65 and over) that they did not get up in the morning feeling rested, were evening types, did not show up for work or made errors at work at least once during the last three months

Furthermore, some studies also suggest the existence of a relationship between fatigue and work accidents. Using data from the prospective Maastricht study on fatigue at work, which followed a cohort of over 7,000 adults, Swaen et al. (2003) showed that not only chronic fatigue (resulting from insufficient recovery on a repeated basis), but also acute fatigue (occurring on a daily basis, but usually relieved by sleep) represented risk factors independent of the occurrence of workplace injuries.

Furthermore, studies generally show that young people are at greater risk for road accidents involving falling asleep at the wheel (Horne and Reyner, 1995; Pack et al., 1995; Kecklund and Akerstedt, 2001). For example, a retrospective study of 4,000 sleepiness-related accidents reported that 55% of them were caused by drivers aged 16 to 25 (Pack et al., 1995).

2.6 Student employment and occupational injuries

A study of Brazilian adolescents aged 11 to 19 who worked by day and attended school at night revealed that young people who claimed their jobs were psychologically stressful reported the following: more bodily pain, reduced sleep duration on weekdays and a higher number of work accidents (Fischer et al., 2005).

In the field of occupational health, studies tend to deal more with work accidents in which the victims are young people under 25 years of age; however, they do not really differentiate between, on the one hand, full-time or part-time students holding a job during the school year

and, on the other hand, young workers studying concurrently. It should also be pointed out that it is impossible to determine, using the DDCR data of the CSST, whether or not the victims are student workers.

The frequency rate of occupational injuries, measured in full-time equivalents (FTE) and compiled by the CSST among 15-24 year olds for the period 2000-2002, was 5.8%, that is, 2.2% higher than that recorded among workers 45 years and older. This rate increased to 11.4% when the young people held manual jobs (Duguay et al., 2008). The same trend was observed in both Canada and the United States, where the accident rates are usually higher among young male workers and those working in manual jobs or the manufacture of goods (Committee on the Health and Safety Implications of Child Labor, 1998, Breslin et al., 2003, Duguay et al., 2008).

Using data from the *Enquête sociale et de santé 1998* (Health and Social Survey 1998), Gervais et al. (2006) showed that the FTE frequency rate of occupational injuries for student workers (3%) was half that observed in young workers who were not also students (6%). Although young workers who were not students worked longer hours and held blue-collar jobs more often than did those who were students - due to fact that there are a greater proportion of jobs in the secondary and primary sectors than in the service sector - the accident frequency rate for male students aged 20-24 (5.3%) was nonetheless close to that of non-students (5.8%). Data from the *Canadian Community Health Survey* (Breslin, 2008) also revealed that the accident rate for young school leavers holding a high school diploma was twice as high (5.1 per 100 FTE) as that of young high school graduates still attending school (2.7 per 100 FTE). Also, the accident rate for students not holding a high school diploma rose to 3.1 per 100 FTE. However, these surveys used a rather restrictive definition of work accident: the accidental occurrence had to have been important enough to limit normal activities, and to necessitate a medical consultation within 48 hours following the occurrence. Furthermore, it is not uncommon for MSDs to not be considered. Thus, these rates could be underestimated.

Vezina (2009) has demonstrated an interest in CSST-certified occupational injuries for participants 18 years and under during the period 2000-2007. Over these eight years, 21,963 occupational injuries were reported among these young workers. This represents an annual average of about 2,700 injuries. A significant drop of nearly 900 injuries was observed between 2000 and 2007; this was somewhat greater, proportionately, than for Quebec as a whole. Also, accidents are always proportionately higher among the older segment of young workers (20 to 24 years) than among very young workers (15-19 years). Over the 2000-2007 period, the occupational injury ratio between young male workers and young female workers was 3:1. Moreover, this ratio was the same for all injuries listed among Quebec workers. In total, the industries and occupations where there was the greatest number of injuries among youth were clearly those in which young workers were concentrated: catering, retail and certain manufacturing sectors in which they usually held jobs such as labourers, material handlers, waiters, cooks, salespeople and cashiers.

Almost one third of injured workers aged 18 and under sustained their injuries in the hand. In second place were back injuries, which was also the location of one injury out of five among girls. In total, hands, backs, legs and arms together accounted for almost two thirds of the body locations of work accidents among young workers aged 18 and under. By comparing for the

same period the injuries of young workers to those of the rest of Quebec's active population, we observe that among workers aged 18 or less the proportion of hand injuries was twice as high as that for their older counterparts. However, there have been more back injuries among older workers.

With regard to the nature of the injuries, it was revealed that sprains, strains, open wounds and superficial injuries were the most common of all. While women were more often victims of strains and sprains, men were more often victims of traumatic injuries, such as open wounds, bruises, contusions and fractures. The nature of the injuries also differed between age groups. Open wounds and superficial injuries were more common among individuals 18 years and under. On the other hand, sprains and strains accounted for over one third of injuries to workers over 18 years of age.

The type of occupational injury involved indicates that half the men were injured as a result of contact with objects or equipment, whereas more women than men were injured as a result of exertion and reactions of the body to movements that were repetitive or during which they bore no load. Grouped together, these types of injuries, together with falls and exposure to harmful substances or environments, accounted for approximately 90% of the injuries reported by young workers. Note also that workers 18 years and under were injured, more often than not, as a result of contact with objects or equipment. Back pain, strains and sprains tend to result from overexertion and repetitive motion, and these types of injuries were indeed found more often among workers over 18 years of age.

These work accidents can have longer-term consequences for adolescents. Each year from 2000 to 2007, about 160 Quebeckers under 18 years of age were victims of workplace injuries serious enough to cause permanent sequelae (Vézina, 2009). Proportionately, twice as many men as women injured at work will suffer the consequences of these injuries throughout their lives. According to Parker et al. (1994a, 1994b), 15 to 26% of adolescents who had reported a work accident said they suffered from chronic pain, recurring medical conditions and sensory or motor limitations. Koehoorn et al. (2008) have shown that following a work accident the average annual number of visits to a general medical practitioner increased significantly among young workers of both sexes and that this number stayed at the higher level in the nine years following the injury. This phenomenon was particularly pronounced in the case of musculoskeletal injuries. These authors also reported a steady increase in medical visits in the three years preceding the work accidents sustained by the young women, with the consultations relating mainly to pain symptoms. The different trajectories for men and women in terms of their medical consultations suggest that young women experience more chronic and recurrent symptoms related to the type of jobs they hold, that these symptoms prompt them to consult more, even before a work accident has been declared and, lastly, that some of these symptoms persist in the years following the accident (Koehoorn et al., 2008). Although young men seem to be victims of accidents more frequently, these findings nonetheless suggest that young women suffer more from the long-term consequences of their injuries. This difference is less marked in the case of musculoskeletal injuries.

There is now sufficient evidence to confirm that, compared to personal characteristics, it is job type, job characteristics and the presence of work constraints that more satisfactorily explain the

occurrence of work accidents among young workers aged 15 to 24 years (Breslin et al., 2006, Gervais et al., 2006). Recent findings also identify job mobility as a predictor of the early occurrence of a work accident in a person's career path (Godin et al., 2009).

3. CONCEPTUAL FRAMEWORK AND OBJECTIVES

This analysis of the effects of concurrent school activities and work constraints on the OHS of students holding paid jobs during their studies is based on a particular conceptual framework (Figure 1). The framework was formed from an analytical model of the work situation centring on the person performing the activities (Guerin et al., 2006; Vézina, 2001) and the Butler model (2007) on the reconciliation of work and study. In the latter model, certain work features may or may not facilitate the reconciliation of study and work, and thus affect the young person's academic achievement, work performance, health and satisfaction.

In the first model, work activity is considered "the central element organizing and structuring the components of the work situation" (Guerin, 2006). The individual and his or her activities are at the heart of the work situation. This activity will depend on the characteristics of the individuals (age, gender, experience, perceptions, aspirations, etc.)[1]; the tasks and their requirements; the means and resources provided by the workplace; and the expectations and contributions of the person's various contacts in the workplace. This model also emphasizes the active role of the individual in his work situation. A regulation process is reflected in an activity through the development of operating procedures and strategies adapted to different work situations and to changes in the person's state (e.g., an increased level of work-related fatigue). The regulation process attempts to preserve a balance between maintaining health and achieving the task's objectives. When the strategies are no longer adequate to maintain equilibrium, it is because the regulation process has reached its limits. An imbalance follows, as manifested by certain effects on health or work performance.

In the case of working students, PTW forms part of a young person's school career (Charbonneau, 2006). The role played by paid work in the lives of students is influenced by the curriculum, the conditions and the facilities provided by the school, as well as by the expectations and contributions of the school's partners (or stakeholders). As in the case of the characteristics of the job held, these various elements will have an impact on a young person's activities and the development of their strategies for reconciling work and study. The result will be either balance or imbalance in their academic achievement, level of satisfaction and well-being, health and work performance.

The reality of PTW as part of the academic career itself is supported by transformations that have occurred in the labour market. Charbonneau (2006) discusses structural and institutional changes such as longer opening hours of businesses, job growth in the service sector and growth in atypical jobs in response to the need for flexibility on the part of businesses. These transformations in the labour market have increased the supply of part-time jobs available to students. In the same period, the school system broadened and diversified its training program. More generally, student employment forms part of a labour market exposed to increased competition and tight control of production costs.

[1] Note that adolescents and young adults are a population at risk for problem sleepiness.

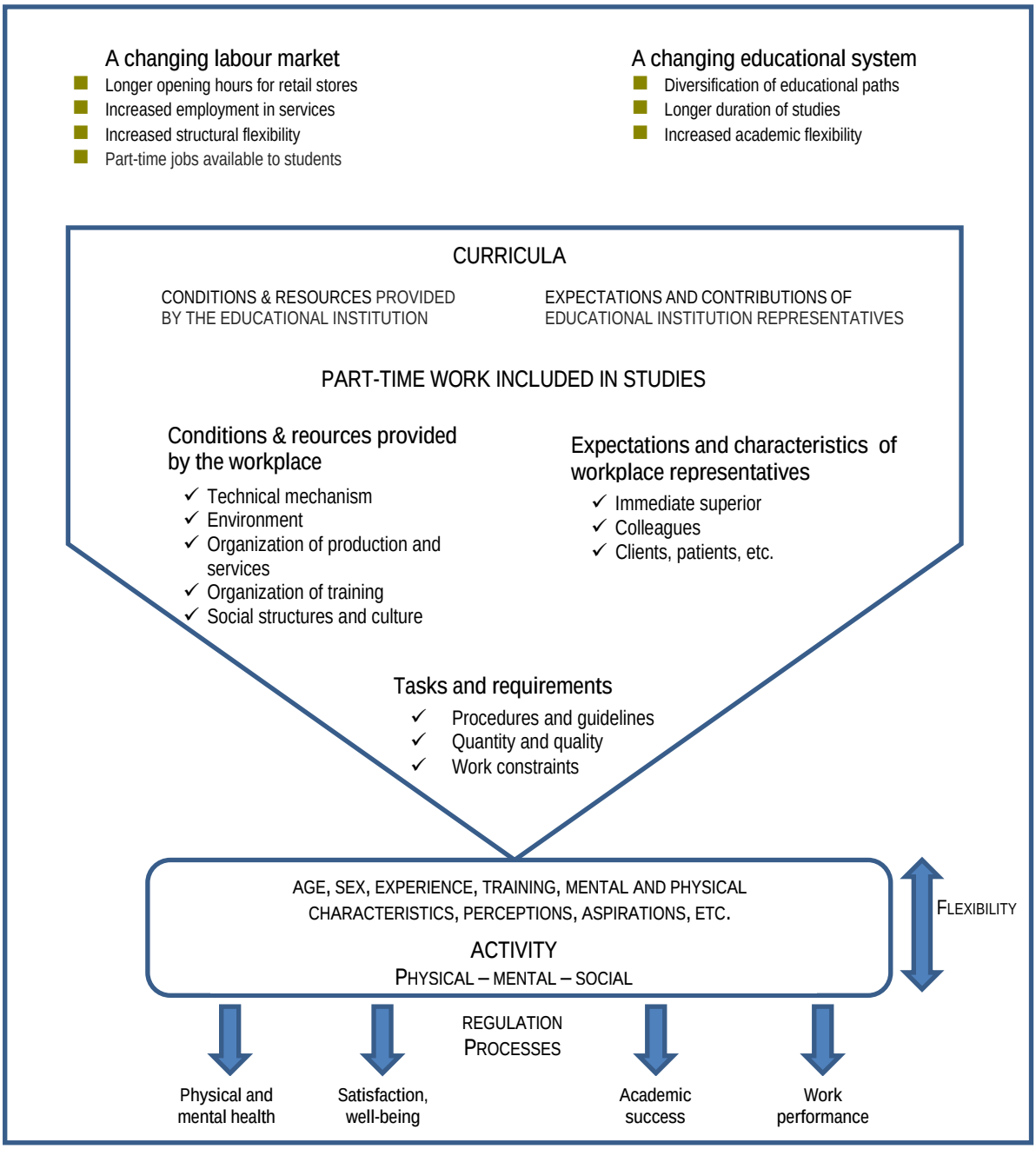

Figure 1: Conceptual framework for analyzing the effects of concurrent activities and accumulated work constraints

The primary objective of the present research project is to explore the concurrently accumulated effects of school activities and work constraints on the health and safety of students gainfully employed during their studies.

More specifically, the project aims to:

- provide a profile of the accumulated educational activities of students who are gainfully employed during their studies;
- provide a profile of the accumulated work constraints to which these young people are exposed;
- determine the effects of the accumulated activities and concurrent constraints on OHS and fatigue;
- describe accidental occurrences in the workplace;
- explore the relationship between reported occupational injuries and the subsequent presence of OHS indicators, such as MSD symptoms, psychological distress, work-related fatigue and sleep problems.

4. RESEARCH METHODOLOGY

4.1 The target population and collection methods

4.1.1 Background of the study and designing the research with the players in the field

To conduct the *Enquête longitudinale auprès des élèves saguenéens et jeannois âgés de 14 ans en 2002* (ELESJ-14, "Longitudinal Survey of Saguenéens and Jeannois Students aged 14 in 2002"), the Ministry of Education, Recreation and Sport (MELS) drew a stratified random sample by grade and sex from the population of students attending secondary schools in the Saguenay-Lac-Saint-Jean (SLSJ) region. The sample included students from both public and private institutions. A total of 1,901 students aged 12-18 years agreed to answer the self-administered questionnaire in May 2002 (1st cycle of the longitudinal monitoring). Of the 1,176 participants who were then 14 years of age (there had been an oversampling of this age group), 605 agreed, with the consent of their parents, to participate in the ELESJ-14 and, more exactly, to be asked again in 2004, 2006 and 2012. The most recent collection of data, which took place in spring 2006 (third cycle), obtained responses from 413 of the 535[2] young people still participating in the ELESJ-14. The persistence-retention rate between the first and third data collection cycles was thus 68.3%. Of the participants in the third cycle, 93% were young people in school and 55% were young people with at least one paid job in spring 2006 (Ledoux et al., 2008).

From the outset, the present research project involved the close collaboration of local officials, policy makers and practitioners in education and public health. A multiparty follow-up committee ensured that researchers had the best possible knowledge of the world of youth and that the recommendations stemming from the project's findings truly reflected the realities on the ground. The follow-up committee was composed of representatives from the *ÉCOBES Recherche et transfert* group at the *Cégep de Jonquière*, the *Agence de développement de réseaux locaux de services de santé et de services sociaux du Saguenay–Lac-Saint-Jean* ("Agency for the development of local networks of health services and social services in the Saguenay-Lac-Saint-Jean region"), the CSST, the *Fondation Lucie et André Chagnon*, the *Conseil régional de prévention de l'abandon scolaire* (CRÉPAS, "Regional Council for dropout prevention"), the Regional Office of the *ministère de l'Éducation, du Loisir et du Sport* (MELS), the *Université du Québec à Chicoutimi*, the *École secondaire Odyssée/Dominique-Racine-Lafontaine* (High School) and the Jonquiere School Commission.

4.1.2 Selection of participants

In October 2007, there was a mailing to all young people still participating in the ELESJ-14 (n = 535). This mailing contained, first, a sheet explaining the research project and, second, an answer sheet requesting, among other things, their consent to continue participating in the project. Specifically, the first document contained information on the criteria for inclusion in the research

[2] Between 2002 and 2006, dropping out, death or the impossibility of joining the group of participants resulted in a decrease of 70 participants relative to the original sample (n = 605).

protocol (attending school and holding at least one paid job), the periods during which the various stages of the project would occur (the fall and winter sessions of 2008), the constraints and requirements of the project (interviews, actigraphy, questionnaires, etc.) and the amount of financial compensation. In addition, they were asked to indicate on the answer sheet whether they would allow the research team to 1) contact them by phone to give them additional information on the research project and 2) keep their contact information until December 2012 with a view to the expected last wave of data collection for ELESJ-14. The young people then had to return the second document in a pre-paid, pre-addressed reply envelope provided for that purpose.

A total of 312 youths (147 men, 165 women) returned all of this information (58.3% response rate). All of the 235 youths (93 men, 142 women) who were in school at that time or planned to enrol, and who also wanted to get more information on the research project were contacted by telephone in one or the other of the two collection periods (December 2007 / January 2008 or August 2008). First, we rechecked the eligibility of the youths as concerned the two main inclusion criteria, namely, attendance at an educational institution and performance of paid work. Where appropriate, the youths completed a screening interview designed to exclude those who: 1) had sleep disorders (sleep apnea, periodic leg movements during sleep, narcolepsy); 2) had a history of dependence on drugs or alcohol in the past 12 months; 3) had taken a medication capable of affecting the sleep-wake or circadian rhythms; 4) had, during the last three months, taken a transmeridian trip involving a time difference of over 3 hours; 5) had certain medical or psychiatric conditions (seizures, dizziness, neuropsychiatric disease, heart problems, etc.) and 6) were pregnant or likely to get pregnant during the research project. At the end of the selection interview, the research assistant gave detailed information on the nature and objectives of the project to the youths meeting the criteria and indicating an interest in the project. All participants signed a consent statement previously approved by the Research Ethics Committee at the Université du Québec à Chicoutimi. Ultimately, 94 youths aged 19 to 21 years completed the research project during the winter and autumn sessions of 2008. Note that 78 of these 94 young people had also participated in the third cycle of the ELESJ-14.

4.1.3 The progress of the project and methods of data collection

The use of semi-structured interviews, actigraphs, logbooks and various validated questionnaires provided sources of information that kept the problems of generalization and bias to a minimum, while providing suitable support for complex social phenomena.

An initial semi-structured interview was conducted during the first half of the school term. The objective of the interview, lasting an average of an hour and a half, was to describe the configuration of activities (number of lesson periods, homework and study, paid work, etc.), describe the characteristics of the job(s) held and the work constraints to which participants were exposed as part of their main job[3]. During this initial interview, participants were also asked about accidental events that had occurred in the workplace over the past two years. Also, those

[3] When a participant held two jobs or more, we evaluated the job to which he devoted the most hours per week. When a participant had changed jobs, we evaluated the job held at the time the actigraph was worn.

who had suffered an employment injury were asked to describe the circumstances surrounding the occurrence of the last accidental event.

Once the first interview had been completed, each participant had to wear an activity monitor, called an actigraph[4], for a period of 14 consecutive days during the session[5]. Specifically, the actigraph was to be worn 24 hours out of 24, except during activities involving contact with water (bath, shower, swimming pool). Actigraphy is an ambulatory recording measure obtained by a motion sensor (accelerometer) the size of a wristwatch, and worn on the nondominant wrist (Appendix A). This little electronic device provides objective information on the pattern of activities, from which periods of nocturnal sleep can be deduced (Ancoli-Israel et al., 2003; Littner et al., 2003). In addition, each participant made entries in a logbook concomitantly with the use of the actigraph. Specifically, the logbook was a modified version of the Social Rhythm Metric by Monk et al. (1990, 1997). This instrument allows, firstly, quantifying social rhythms (meals, social and interpersonal interactions, work, leisure) and, secondly, determining the number and volume of activities performed (Activity of Life Index). The logbook was also used to gather information on bedtimes, rising times, nap times and periods when the actigraph was not worn – all with the objective of identifying artefacts that could lead to erroneous results when using algorithms (Sadeh and Acebo, 2002; Littner et al., 2003). After two weeks, a research assistant retrieved the actigraph and logbook, downloaded the data from the actigraph onto a computer and got the participants to complete an initial battery of validated questionnaires. This involved the Epworth Sleepiness Scale (Epworth Sleepiness Scale, Johns, 1991, 1992), the psychological distress scale of the *Enquête Santé Québec* ["Quebec Health Survey"] (Ilfeld, 1976; Deschenes, 1998), the Chalder Fatigue Scale (Chalder et al., 1993), an adaptation of the Nordic Questionnaire on MSDs (Standardized Nordic Questionnaire, Kuorinka et al., 1987; Forcier et al., 2001), the *Index de qualité du sommeil de Pittsburgh* (Pittsburgh Sleep Quality Index, PSQI, Buysse et al., 1989; Blais et al., 1997) and the chronotype questionnaire (Morningness-Eveningness Questionnaire, Horne and Östberg, 1976).

The latter questionnaire measures the circadian phase preference. Some individuals are morning people, going to bed early, getting up early and inclined to work in the morning, while others are evening people, going to bed late late, getting up late and thus favouring a later time period for performing their activities (Mongrain, 2006). These different circadian types are called chronotypes and can easily be identified by questionnaire. The Morningness-Eveningness questionnaire formulated by Horne and Östberg (1976) is unquestionably the one used the most to classify individuals into morning types (M-Types), intermediate types (I-Types) or evening types (E-Types). These chronotypes are distinguished primarily by the position of their sleep schedule; M-Types generally retire two hours earlier than E-Types (Kerkhof, 1991; Natale and Cicogna, 2002). In addition, chronotypes can be differentiated by the phase of many physiological and psychological variables controlled by the biological clock. Maximum alertness and performance occurs earlier during the day in M-Types than it does in E-Types (Horne et al., 1980; Kerkhof, 1991; Natale and Cicogna, 1996). Also, the peaks and troughs of the core body temperature rhythm, and the secretion rhythms of several hormones, including melatonin, appear on average two hours earlier in M-Types than they do in E-Types (Turek and Zee, 1999).

[4] Actiwatch-L, Mini-Mitter, Philips Respironics, OR.

[5] The actigraphs were not worn during school breaks or end-of-session exam periods.

At the end of the school term, a second semi-structured interview was conducted to document changes that had occurred during the session associated with the young people's studies, paid employment and work constraints. If a participant held a new position within the same workplace, or had a new main workplace, the work characteristics and constraints were then documented using a shortened version of the framework used in the first semi-structured interview. The latter interview, lasting an average of one hour, also aimed to record the strategies used by the participants to adapt to the work constraints and manage their work-study balance. Work accidents occurring during the term were also documented. Finally, every participant finished the project by completing a second battery of validated questionnaires. This involved a work-related fatigue scale (Occupational Fatigue Exhaustion Recovery Scale (OFER); Winwood et al., 2005, 2006) and the Job Content Questionnaire (Karasek, 1985; Karasek et al., 1998).

The Job Content Questionnaire, often viewed as a questionnaire for evaluating well-being at work, has three subscales: psychological demands, decision latitude and social support. "Psychological demands" refers to the amount of work to be performed, as well as to the mental demands and time constraints related to a particular work situation, while decision latitude refers, firstly, to the ability to choose how to do one's work and to participate in related decisions and, secondly, to the capacity to use skills and develop new ones. Social support includes all social interactions available at work, that is, involving supervisors as well as colleagues (Karasek and Theorell, 1990). Scores are interpreted as follows: the greater the scores, the greater the levels of psychological demand, decision latitude and social support at work.

4.1.4 Overview of variables collected

Data from the semi-structured interviews (I), actigraphy (A), logbook (L) and standardized questionnaires (Q) collected from the 94 participants form the corpus of data used in this project.

Table 1: Overview of Variables Collected

CATEGORY	VARIABLES	SOURCE
Academic characteristics		
Academic conditions and requirements (5)	Educational level Course timetable (schedule)[6] Number of class hours per week Number of study hours per week Undertaking an internship or placement	I
Regulation strategies (1)	Strategies for work-study reconciliation	I
Characteristics of the main job		
General characteristics (11)	Number of jobs Work timetable (schedule grid) Number of working hours per week Positions held, length of service (job and company); connection to studies Type of company, number of employees, union membership, remuneration Training received at time of hiring	I
Tasks (2)	Description of tasks Chronological description of the tasks during a typical day	I
Physical constraints[7] (17)	Prolonged standing and frequent walking (seat available); long periods of sitting; postures of the arms, shoulders, wrists or hands are difficult to maintain; back posture difficult to maintain; significant exertion of the hands or arms on tools; handling of heavy loads, repetitive hand or arm movements; precision movements; extreme temperatures (hot or cold); dust; solvents or chemical products; loud noise (hard to have a conversation); dangerous machinery; dangerous tools; working on a computer; small work space / clutter; risk of falls from heights, or falls at ground level	I
Organizational constraints[8] (15)	High work pace or workload; insufficient time allowed; concentration requirement; frequent interruptions; not having the freedom to organize one's work; not being able to take decisions independently; having no influence on how things are done; no requirement to learn new things; constantly redoing the same task; tense situations with the public; poor working environment; poor relationships with colleagues; poor relationships with his (her) superior(s); situations involving harassment; stress	I

[6] See Appendix B

[7] See Appendix C

[8] See Appendix D

Table 1 (suite): Overview of Variables Collected

CATEGORY	VARIABLES	SOURCE
Characteristics of the individual		
Personal characteristics (15)	Sex Educational level Dependent children Sources of Income Age at first job Work (career) path Most valued role (school, work, leisure)	I
	Age Chronotype (Horne et Östberg, 1976)	Q
	Bedtime; rising (getting up) time; sleep duration, sleep efficiency	A
	Social-rhythm regularity (SRM-5, SRM-17) (Monk et al., 1990, 1997) Concurrent activities (Activity of Life Index, ALI) (Monk et al., 1990, 1997)	L
Health indicators		
MSD symptoms (9)	MSD symptoms: over the last 7 days; in the last 12 months; caused by the work; forcing individual to cut back activities; Location of pain (back, neck / nape, lower extremities, shoulders, arms / elbow / wrist / hand) (Kuorinka et al., 1987; Forcier et al., 2001)	Q
	Pain experienced during the session	I
Psychological health and well-being at work (4)	Psychological distress (Ilfeld, 1976; Deschenes, 1998) Psychological demands at workplace; social support; decision latitude (Karasek, 1985; Karasek et al., 1998)	Q
Fatigue and sleep problems (7)	Acute and chronic work-related fatigue (Winwood et al., 2005, 2006) General fatigue (Chalder et al., 1993) Daytime sleepiness (Johns, 1991, 1992) Pittsburgh Index of Sleep Quality (PISQ) (Buysse et al., 1989; Blais et al., 1997)	Q
	Nature and causes of fatigue experienced during the session	I
Accidental events (23)	Number of accidental events; number of incidents; number of accidents. Information about the latest accidental event: position held; length of service; date; time; overtime; task and movements; training for the task; environmental characteristics (location, equipment, machines, tools used); handling circumstances; work pace; co-activity; other elements; type of accident; location of injury; nature of injury; length of absence; pain; care / hospitalization; accident report	I
Regulation strategies (1)	Strategies to manage work-related fatigue and discomfort	I

4.2 Processing of various data sources

The semi-structured interviews were recorded and transcribed according to predetermined themes, with each field in the database corresponding to a theme of the interview questionnaire[9]. This qualitative data was analyzed for content and some of it was recoded into discrete variables (including the constraints of physical and organizational work), facilitating the production of descriptive and inferential statistics.

First, the responses to the standardized questionnaires were captured; then, consistency analysis was used to correct aberrant responses. Subsequently, validation of 10% of the recordings, selected at random, confirmed the accuracy of the data[10]. After verifying their internal consistency, scales were derived and the variables for which recognized thresholds were available were categorized.

The logbook, completed daily for about two weeks by each of the 94 participants, yielded information on the regularity of social rhythms (Appendix E[11]). More precisely, this was a measure of the regularity with which an individual performed the same activities at the same times every day. Specifically, two measurements gauged the regularity of the activities of student workers. The first was the SRM-5, based on the implementation of five commonly performed activities, namely, getting up, the first contact with an individual, the first activity of the day (work or school), supper and bedtime. The second was the SRM-17, which is more exhaustive, compiling up to 17 activities. It thus adds 12 activities to the SRM-5: lunch, shower or bath, the initial departure from the house, dinner, nap, returning home, school work, sports or exercise, television, snack and two idiosyncratic activities. The analysis involved counting a "hit" each time an activity was performed within 1.5 standard deviation of the mean time in which this activity is usually performed by the individual. Thus, the SRM measurement corresponded to the average number of "hits" for all activities considered (5 or 17)[12].

The volume of weekly activities (Activity Level Index, ALI), the second type of measure that can be compiled from the Social Rhythm Metric (Monk et al., 1990, 1997) is, in turn, calculated by counting the total activities undertaken weekly by participants, as based on the 17 above-mentioned activities.

The data stored in the actigraph memory was downloaded into a brand of actigraphic sleep software called "Actiware" (version 5.0, Mini Mitter, Philips Respironics, OR). Sleep periods were established manually for each day of actigraphy by considering: 1) for the falling-asleep

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[9] The interviews were not transcribed verbatim but in memo fields of an Access database. A total of 188 interviews, each lasting an average of about 1.25 hours were transcribed. Data entry by topic, as opposed to the verbatim method, allows one to eliminate the step between the transcription stage and the selection of topics in each interview. Access software was selected because it offers the possibility of classifying information according to predetermined topics while facilitating the design of user-friendly data entry forms.

[10] The observed error rate was less than 0.1%.

[11] The SRM was slightly modified to better reflect the realities of everyday activities of young workers pursuing their studies.

[12] We took an average, weighted according to the number of days, of the SRM scores calculated for Week No. 1 and Week No. 2.

time: when the participant reduced activity to become motionless; for the waking-up time: when the participant increased her or his activity; 2) the brightness level recorded concomitantly by the actigraph, and 3) the bedtimes and rising times recorded in the logbook. Algorithms were then used to define the average number of hours of sleep and of being awake, as well as the exact duration of nocturnal sleep. Indeed, Actiware software automatically subtracts awakenings and stirrings occurring in the period between falling sleep and waking up.

4.3 Methods of analysis

Descriptive statistical analyses were performed for all of the study's objectives. To identify issues associated with important subpopulations (male or female; whether or not there was an accident, etc.), Chi-square tests for independence were used. Subsequently, tests for difference in proportions were performed. For problems that could be understood using continuous scales, the Mann-Whitney test[13] facilitated an assessment of the differences between subgroups in terms of their respective distribution. Also, simple correlations were presented using the Pearson coefficient.

In addition, other analytical methods were used to meet specific goals. These involved multiple and logistic linear regression analyses as well as correspondence factor analysis. Details of these analyses are presented in the section designated for this purpose.

When a statistically significant difference was detected in information contained in a table, a letter of the alphabet (or an asterisk) in superscript alerts the reader. A difference is considered significant starting with a 5% threshold. On the other hand, if the test was performed on data that have not been presented, the statistics are then accompanied, in the text, by the observed threshold of significance (p-value). The production of the various statistical analyses was performed with version 17.0 of SPSS software. The correspondence factor analyses were carried out using SPAD software.

4.3.1 Concurrent activities

During the first interview, the course timetable and working hours of each participant were used to complete a schedule facilitating a description of his or her allocation of time (or time structuring) (Appendix B). This schedule was annotated as necessary during the second interview when, for example, a change in the working hours of the main job, or in the course timetable, had occurred during the session. Note that it was the schedule of the participant at the time he or she was wearing the actigraph that was chosen for analysis.

Analyses of ascending hierarchical classifications, based on correspondence analysis (Benzécri and Benzécri, 1984), were then used to classify the participants according to the accumulation of activities recorded during the session. These methods allowed us to understand several dimensions of the accumulated activities at the same time, while considering the network of relationships among them. The variables used to develop the typology of young people according

[13] To the extent that the numbers were relatively small, the exact significance level was calculated using the SPSS Exact Tests module.

to their time structuring and accumulated activities were: the type of work schedule, the moment of work in the week, the work shift, the average number of work days per week, the average number of working hours per week, the average number of hours of study per week, the type of course timetable, the number of days of courses, the number of hours of courses per week, the number of days per week with no scheduled activities, whether they participated in a seminar or workshop and, lastly, the number of jobs held[14]. The illustrative variables were educational level and sex.

4.3.2 Health profile and sleep-wake habits

The health profile of the participants was drawn from validated scales and questionnaires. The frequency of certain health indicators was calculated when there was a recognized cut-off point. Thus, prevalence rates were estimated for excessive fatigue (score greater than or equal to 4 on the Chalder Fatigue Scale) deemed to require medical attention; high psychological distress (score greater than 28.57 on the Ilfeld scale, using the Quebec health threshold based on the 80th percentile among 15-24 year olds); daytime sleepiness (score greater than or equal to 11 on the Epworth Sleepiness Scale) and sleep problems (score greater than or equal to 5 on the PSQI).

In addition, the number of pain sites was determined from a validated questionnaire (Kuorinka et al., 1987; Forcier et al., 2001). Specifically, the participants were interviewed for the presence of pain and symptoms, the location of symptoms (over the past year and during the 7 days preceding the handing over of the questionnaire), the occupational source of the pain and the impact on work and other activities.

In addition, the description of the participants' sleep-wake habits, as measured by actigraphy, was presented according to the sex of the participants. This portrait was compared with the self-reported data in the logbook, i.e., bedtime and rising time. Also presented were the relationship between data from the actigraphy and complaints related to sleep quality and wakefulness (or alertness). The chronotype was determined for each participant by using the procedure described by Horne and Östberg (1976). Finally, we drew a comparative portrait of participants' sleep-wake habits based on the various chronotypes.

4.3.3 Accumulation of physical and organizational constraints

Only the physical and organizational constraints of the main job held when the actigraph was being worn were selected for analysis. Thus, the description of the accumulated constraints did not reflect all the work constraints to which participants could be exposed, since 14 participants (14.9%) had more than one job during the observation period.

At the time of the interviews, to validate participants' responses regarding the importance of certain work constraints in their jobs, the interviewers asked them to provide an example. Content analysis of the example allowed us to adjust some of the answers: in a few cases, a "no" turned into a "yes" (or vice versa) because the example provided by the participant revealed the opposite to be true. Also excluded from the analyses were constraints reported by the

[14] These variables were categorized.

participants, but to which they were not exposed during the observation period (e.g., excessive summer heat, whereas the interview took place in the autumn). Moreover, the codification of the data was more complex in cases of participants who were employed to fill several positions; this was especially true in the case of the two participants whose main job was comprised of two positions with significantly different characteristics and located in two different places. The constraint was accepted if it was present in either of the positions.

When we took a closer look at the data, we organized the responses into relatively detailed categories to assess the variability of situations. We then performed two types of coding. The first determined if the constraint was present or absent, while the second described the constraint according to different categories taking into account the number of participants (Appendices C and D). Eighteen physical constraints and 15 organizational characteristics were selected for analysis.

Frequency distributions were performed for each of the constraints, and tables were created based on the type of job. The accumulation of constraints was also calculated. These findings were enriched by content analysis of the interviews, and reflected how these constraints were perceived by the participants.

Ascending hierarchical classifications were produced using SPAD software to distinguish between types of overlapping (or concurrent) physical and organizational constraints. Sex, job type, number of jobs and number of hours were included as illustrative variables.

4.3.4 The effects of accumulated activities and accumulated constraints

Logistic or multiple linear regression models were used (depending on the level of measurement of the dependent variable) used to examine the relationship between on the one hand the accumulation of activities, the accumulation of constraints and personal characteristics, and on the other hand each of the OHS symptoms considered individually. In fact, the use of regression analysis allowed us to estimate the effect of an independent variable on the phenomenon being studied, and to do this when other potential explanatory factors were present. Therefore, it became easier to determine the specific contribution of each factor. The independent variables available for these analyses were either continuous or dichotomous, with the variables applying to one or more categories being transformed into the latter type. When there was collinearity between two independent variables, only one of them was chosen. In addition, independent variables for which missing values amounted to more than 10% were not considered.

Although the factors selected in the multiple regression analyses must be viewed as factors associated with the problems being studies, some reservations persist as to the factors that were *not* selected in the final model. Indeed, the small numbers making up the body of available data suggests relatively low statistical power. When interpreting the findings, we must therefore pay more attention to the factors selected by the aforementioned analyses than to the non-selected factors. Thus, we cannot say whether these factors were rejected because they did not improve the explanation of the phenomenon studied once the other factors had been selected, or because the statistical power was insufficient to detect their influence.

As concerns the continuous dependent variables, namely, the acute and chronic work-related fatigue, multiple linear regression models enabled us to identify the factors associated with the phenomenon being studied. To do this, and as based on a suggestion by Hosmer and Lemeshow (2000), only the independent variables most strongly correlated with the dependent variable ($p < 0.25$) were included in the model. This preliminary step reduced to about ten the number of variables to be included in the models (Draper and Smith, 1981)[15]. Only variables whose contribution to the model is considered significant ($p < 0.05$) will be discussed.

With respect to the dichotomous dependent variables, that is to say, daytime sleepiness, the presence of pain caused by the work, psychological distress and sleep problems, logistic regression analysis was used to identify the factors associated with the phenomenon under study. Since the limited number of participants allowed us to include only a limited number of independent variables in each model (Katz, 2003), only the factors most strongly correlated with the dependent variable were, in this case too, included in the models. Readers will be able to assess the quality of the models by referring to the Nagelkerke R^2 and the proportion of participants correctly classified by the model. Here too, only the variables whose contribution to the model is considered significant ($p < 0.05$) will be discussed.

4.3.5 Work incidents and accidents

To characterize accidental events occurring in the workplace, only the events that forced individuals to stop/interrupt their work (without necessarily being away from the workplace) and limited their activity were selected for analysis. Accidental events were divided into two categories. The first included work accidents involving at least one of the following situations: 1) an absence of at least one day; 2) discomfort or pain for more than one day; 3) treatment such as stitches, wearing a splint, or care provided by a health professional or 4) a medical consultation in a doctor's office or hospital. The second category involved events that did not meet these criteria; they were defined as incidents. We also took into account whether or not participants reported having been the victim of an occupational accident as defined above, or if they mentioned the occurrence of incidents they could enumerate or multiple incidents (too numerous to be counted) between 2006 and 2008.

Descriptive statistics of the accidental events were produced. Later, the occupational accidents received more detailed qualitative analysis. Types of accident scenarios were created along with a portrait of the reporting of these accidents.

First, it was necessary to establish whether the young people who had been victims of accidents or incidents at work during the two years preceding the survey had experienced health problems earlier, when they were aged 17-18 years, that is, during the third cycle of the longitudinal study (Ledoux et al., 2008). Second, we verified whether the current OHS profile of students who reported having had accidents or incidents during the two years preceding the survey differed from those who did not report them. Finally, we examined whether the participants who did or

[15] What is commonly called "the rule of thumb" has to be limited to one independent variable for every ten cases or participants.

did not report an accident at 17-18 years of age (third cycle) had a different health status in the present survey (fourth cycle). To do this, bivariate tests (Mann-Whitney) were performed to determine whether there were differences in the distribution of the following variables for each group: psychological distress, MSD symptoms, general fatigue, work-related acute and chronic fatigue and daytime sleepiness.

5. RESULTS

5.1 Description of the cohort

The sample consisted of 94 participants, 54 women and 40 men, aged 19 to 21 years. Nearly seven in ten (68.1%) completed the project during the 2008 autumn session, while the rest (31.9%) completed it during the 2009 winter session. Also, over one third of the participants were enrolled in university (36.2%), more than half in junior college (55.3%) and less than one in ten in a Diploma of Vocational Studies program (diplôme d'études professionnelles, DEP) an adult general education (formation générale des adultes, FGA) or other training that resulted in receiving a diploma (8.5%). Note, too, that these 94 participants constituted a subsample of participants in the ELESJ-14.

5.1.1 Areas of study and main[16] jobs held

If we turn to the participants' fields of study, there are certain differences between the choices made by women and those made by men (Table 2).

Table 2: Fields of study of student workers, by sex

Fields of study	Male	Female	Total
Education, psychology, social work, kinesiology	5	18	23
Paramedical care: nursing, respiratory therapy, dietetics, dental hygiene, massage therapy, animal health	1	18	19
Accounting, secretarial studies, administration, commerce	4	7	11
Engineering technology, instrumentation, aircraft maintenance, electromagnetics, welding	10	0	10
Arts and literature; advertising; multimedia	4	1	5
Humanities	4	1	5
Architecture, design, urban planning	2	2	4
Computing	4	0	4
Other[a]	6	7	13
Total	**40**	**54**	**94**

[a] Medical laboratory technology, biology, environment, natural sciences, political science, history, tourism, spiritual guidance, etc.

In fact, the majority of the women were studying in fields related to education, social sciences and paramedical care or nursing (n = 36), while the men's profile was much more varied, with more of them in technical and computer programs and the like. If we consider all jobs held

[16] This was the main job held when the actigraph was worn.

during the sessions (terms) in which participants were interviewed, only 16.0% of them held jobs connected to their studies[17]. Specifically, 12 women were working as technicians or had jobs related to health care or education, that is, consistent with their field of study, while only three men had jobs related to their field of study.

Almost two thirds (64.9%) of the participants lived with their parents. Of the 33 participants who were not living with their parents, 13 received no financial support from them, though most received loans and grants. In addition, 35 participants were paying for their studies themselves. Only two students had a dependent child. Finally, we note that 38 participants had a car to pay for (data not shown).

The majority of participants (60.6%) worked[18] in the following sectors: retail trade; accommodation and catering; and bars and nightclubs. Just as many men as women worked in the latter two sectors (Table 3). Note that only women (n = 6) were working in the field of health care and social assistance.

A large number of participants worked in small businesses. Indeed, nearly two thirds (64.1%) were employed in settings with 50 or fewer employees. Also, half the participants (50.0%) worked in firms with 20 or fewer employees[19]. More than four out of five participants had regular (or in rare instances permanent) status (80.9%), while the others were on contract or had temporary status (14.9%) or were on call or did not declare their income (4.3%). Lastly, nearly one in four (23.6%) said they were unionized (data not shown).

[17] Dietary technician, architectural and construction technician, mechanical engineering technician, dental hygiene technician, nurse / client care attendant, therapist, caregiver for autistic children, monitor, swimming instructor, multimedia intern, research trainee, fire-fighter, secretary-bookkeeper.

[18] This was the main job held when the actigraph was worn.

[19] Note that 39 of the 94 workplaces were part of broader set of companies or chains (branches).

Table 3: Economic sectors selected by student workers, by sex

Economic sector	Men	Women	Total
Retail trade	14	22	36
Accommodation, catering, bars and nightclubs	11	10	21
Arts, entertainment, recreation and sports	4	5	9
Health care and social assistance	0	6	6
Educational services	2	3	5
Other[a]	9	8	17
Total	**40**	**54**	**94**

[a] Construction; manufacturing; government; information and cultural industries; wholesale trade; professional, scientific and technical services; administrative, support, waste management and sanitation services.

Table 4 presents the student workers' length of service of in the position held and in the company. One observes that 57.4% of participants held the same position for less than a year, while half (50.0%) worked in the same company for that period. On average, participants as a whole had 15 months of service in the same position, and just under 17 months of service with the same company (data not shown). This short length of service was due, firstly, to the young age of the participants and, secondly, to their greater mobility, which stemmed from the fact that they were still in school. Note that most participants (53.2%) entered the workforce between the ages of 15 and 17 years.

Table 4: Length of service of student workers in the position held and in the company

Length of service	In the position %	In the company %
Less than 6 months	38.3	30.9
6 to 11.9 months	19.1	19.1
12 to 35.9 months	26.6	30.9
36 months or longer	16.0	19.1
Total	**100.0**	**100.0**
(n)	**(94)**	**(94)**

Participants held a wide variety of jobs (Table 5). A majority (56.5%) were menial jobs, commonly called "McJobs", i.e., jobs typically taken by students. The type of employment held varied by sex. Men (32.5%) were less likely than women (46.3%) to hold jobs that required contact with clients, such as cashier, salesperson or waiter. In addition, only women worked as caregivers or lab technicians. As for the men, they held jobs infrequently held by the women participating in the study: cook, labourer, mechanic, repairer, delivery person and inventory technician.

Table 5: Type of job held by student workers, by sex

Job held	Men	Women	Total
Cashier / Clerk-Cashier / Chief Cashier / Pump Attendant	4	11	15
Salesperson / Clerk-Salesperson	5	7	12
Waiter / Bartender / Busperson / Head Waiter	4	7	11
Coach / Facilitator / Instructor / Trainer	2	5	7
Cook, Assistant Cook	4	1	5
Secretary / Receptionist / Switchboard Operator, Project Manager	1	5	6
Reception Clerk / Information Agent / Bellhop (hotel) / Security Guard	2	2	4
Maintenance Person: Recycling System, Sanitizer, Building Maintenance Management, Hotel Attendant	3	1	4
Labourer / Mechanic / Repairer	4	0	4
Caregivers: Health-care Aide, Nurse, Therapist	0	4	4
Baker / Fishmonger	2	1	3
Multiple-StationWorker: Cashier-Cook, Cashier-Dishwasher	0	4	4
Person in charge of more than one department: Assistant Manager, Team Head, Head Clerk	1	2	3
Laboratory Technician	0	3	3
Delivery Person	2	0	2
Inventory Technician	2	0	2
Other: Sound Technician, Ski-centre Operator, Sports- match Scorekeeper, Projectionist, Other Multiple-Station Workers	4	1	5
Total	**40**	**54**	**94**

5.1.2 Health profiles and sleep patterns of participants

Table 6 presents the mean scores of participants, by sex, in the various questionnaires used to understand their psychological and physical health.

Table 6: Mean scores for certain characteristics related to the psychological and physical health, by sex of the student workers

Health-related characteristics	Mean Score (Standard Deviation)		
	Men	Women	Total
General fatigue **	1.72 (2.75)	2.98 (2.60)	2.45 (2.72)
Acute fatigue *	33.40 (17.16)	43.58 (20.25)	39.31 (19.58)
Chronic fatigue	29.91 (18.40)	32.04 (20.72)	31.16 (19.72)
Daytime sleepiness	8.33 (3.36)	9.31 (3.76)	8.90 (3.61)
Sleep problems	4.87 (2.25)	4.50 (1.82)	4.66 (2.01)
Psychological distress	22.34 (11.35)	25.85 (15.34)	24.38 (13.85)
Psychological demands	19.87 (4.78)	19.96 (4.64)	19.92 (4.67)
Decision latitude	65.54 (13.96)	65.19 (13.82)	65.33 (13.80)
Social support	25.85 (3.34)	25.09 (4.60)	25.41 (4.11)
Number of pain sites			
Over the past 12 months ***	1.46 (1.27)	2.40 (1.34)	2.00 (1.38)
Over the past 7 days **	1.15 (1.09)	1.87 (1.35)	1.57 (1.29)
Leading too reduced activity	0.21 (0.47)	0.25 (0.85)	0.23 (0.71)
Caused by work	0.38 (0.67)	0.74 (1.09)	0.59 (0.95)
(n)	**(38 ≤ n ≤ 39)**	**(53 ≤ n ≤ 54)**	**(92 ≤ n ≤ 93)**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

First, the levels of general fatigue and work-related acute fatigue were higher for women than for men. Similarly, the mean number of pain sites for women was higher than that for men -- both during the past year and during the seven days preceding their participation in the study (Table 6). Note also that 40.7% of women and 17.9% of men had a level of general fatigue deemed to require medical attention (Chalder et al., 1993) (data not shown). Furthermore, 31.2% of the

students reported experiencing drowsiness during the day. Sleep problems were also present in almost half of the participants (46.2%). In addition, 37.6% of the student workers said they felt a high level of psychological distress (data not shown).

The vast majority of participants reported having experienced pain in at least one part of the body, both in the past 12 months (n = 80) and during the week preceding completion of the questionnaire (n = 73) (Table 7). As expected, back pain and neck/nape pain were the body parts most frequently identified by participants as pain sites. On the other hand, over a third of participants (n = 34) stated that these pains were related to the performance of their jobs and almost one in seven (n = 13) was forced to cut back their activities due to reported pain. Note that the back was the body part in which pain led to reduced activity among the largest number of participants.

Table 7: Number of student workers who said they had experienced pain in various parts of the body

Pain site[a]	Pain felt			
	Over the last 12 months	Over the last 7 days	Caused by the work	Having forced a reduction in activity
1. Back	63	52	20	10
2. Neck/nape	45	32	9	1
3. Lower limbs	36	30	15	4
4. Shoulders	23	17	5	2
5. Arm / elbow / wrist / hand	17	13	5	4
At least one pain site	**80**	**73**	**34**	**13**
(n)	**(92)**	**(92)**	**(92)**	**(92)**

a The student could have reported experiencing pain in more than one body part.

Table 8 shows the sleep patterns of participants, by sex, recorded by the actigraph. First, the men fell asleep and woke up later than the women, both on school days and on weekends. As a corollary, the men slept less than did the women. However, the men and the women did not differ as to the efficiency of their sleep[20].

As might be expected, on average the participants fell asleep earlier on school days than on weekends (24:07 am versus 1:28 am, $p < 0.001$) and on average woke up earlier on school days than on weekends (7:49 am versus 9:06, $p < 0.001$). Consequently, we can estimate the sleep phase delay between the weekday sleep time and that of the weekend to be 81 minutes. Stated differently, in comparison with weekdays, falling-asleep time was delayed an average of just over an hour and a quarter on Fridays and Saturdays.

[20] Sleep efficiency is the ratio between total sleep time and the time spent in bed multiplied by 100

Furthermore, falling-sleep time as recorded by the actigraph was highly correlated with the bedtime as reported by participants in their logbook ($r = 0.94$, $p < 0.001$). In addition, waking up time as indicated by the actigraph was highly correlated with getting-up time as indicated in the logbook ($r = 0.96$, $p < 0.001$). Finally, as deduced from the getting up time and bedtime recorded in the logbook ($r = 0.73$, $p < 0.001$), sleep duration estimated by the actigraph was strongly correlated to the total time spent in bed.

Table 8: Sleep habits of student workers, by sex

Sleep habits	Mean Score (Standard Deviation)[a]		
	Men	**Women**	**Total**
Falling asleep time ***	01:15 (82)	24 :01 (77)	24:32 (87)
School days ***	24:49 (83)	23:36 (75)	24 :07 (86)
Weekends **	02:09 (118)	24:59 (104)	01:28 (115)
Waking-up time **	08:32 (74)	07:58 (67)	08:12 (72)
School days *	08:06 (84)	07:36 (67)	07:49 (76)
Weekends *	09:30 (108)	08:47 (98)	09:06 (104)
Sleep duration ***	06:07 (41)	06:46 (38)	06:30 (44)
Sleep efficiency (%)	79. 8 (4.8)	81. 5 (4.3)	80. 8 (4.6)
(n)	**(40)**	**(54)**	**(94)**

[a] Times are given in the hours:minutes form; the standard deviation, in parentheses, is given in minutes. * p < 0. 05; ** p < 0. 01; *** p < 0. 001

The objective measures obtained by the actigraph were also significantly related to the quality of sleep and to the quality of wakefulness (or alertness). Specifically, the participants who, according the PSQI, had sleep problems also had later falling-asleep times on weekends (01:56 versus 01:05, $p < 0.05$), and later waking times on weekends (09:29 versus 08:46, $p < 0.01$), than did participants without sleep problems. In other words, the weekend sleep-episode schedule of student workers with sleep problems was in significant phase delay compared to that of students without sleep problems. Finally, a negative relationship was observed between waking time and severity of daytime sleepiness ($r = - 0.23$, $p < 0.05$): the young people who got up early were more likely to experience sleepiness during the day (data not shown).

Analysis of responses to the chronotype questionnaire revealed that 15 participants were M-Type, 59 were I-Type and 19 were E-Type. As expected, the E-Type participants went to bed later than did the M-Type participants; this was true both during school days (01:34 versus

22:48, p <0.001) and during weekends (03:15 versus 24:02, p <0.001). Similarly, the E-Types got up later than did the M-Type participants, both during school days (08:43 versus 06:34, p <0.001) and during weekends (10:36 versus 08:16, p <0.001). However, the E-Types did not differ from M-Types when it came to sleep duration (06:05 versus 06:35, ns) (data not shown).

We can therefore say that these students, aged 19 to 21 years, performed different kinds of jobs during the school year, jobs rarely linked to their fields of study, in the small business sectors of retail trade, accommodation and catering. They slept on average six hours and thirty minutes per night and almost half of them reported sleep problems. In addition, more women than men experienced general fatigue and work-related acute fatigue. Finally, a majority of participants said that over the last seven days they had experienced pain at least somewhere in the body.

5.2 Busy activity profiles fluctuating over time

5.2.1 Hectic schedules

For most participants, the organization of the weekly school schedule was relatively stable over the course of the session, except for the 26 young people (27.7%) who had begun an internship during the session. Seven participants dropped out of at least one course, and one participant terminated his (her) studies[21]. In addition, nearly 30.0% of the young people experienced changes in their employment status (Table 9), which could indicate a simple change of job in the same company, a job change but with a different company, a new second job, an end to one of the two jobs held or simply ending their work[22]. Finally, the work schedule of some participants changed considerably during the session, sometimes to help reconcile their work with their studies, sometimes at the request of the employer.

In regard to working hours, they were rarely the same from week to week. A majority of participants (69.1%) worked on both weekdays and on weekends. Only 12.8% of participants worked only on weekdays (this is more often the case with participants attending university, or enrolled in the DEP or the FGA). On the other hand, nearly one in five (18.1%) worked only on weekends (data not shown).

[21] This participant ended his studies after having worn the actigraph and completed the first set of questionnaires.

[22] The reasons given by these youths for ending their work were: an overloaded schedule (end of session, training, etc.) and going on holiday before starting a summer job. On the other hand, some had quite simply completed their contract or had decided to change jobs to improve their working conditions (schedule, salary, work related to their field of study, etc.) or following a promotion. Also noted were: dismissal following a return from sick leave; resignations due to conflictual relationships with the supervisor or employer; and travel and telephone expenses that had not been reimbursed.

Table 9: Employment status of participants during the session observed

Employment status	%
No change	71. 3
Change of company	10. 6
Ending work	8. 5
Change of job in same company	5. 3
An end to one of the two jobs held initially	4. 3
Total	**100. 0**
(n)	**(94)**

Half the participants had both day work and evening work, while just over a quarter (27.7%), had day work only. Only 16.0% of the participants worked nights (occasionally or exclusively). Participants worked primarily in the evening on weekdays (49.3%) and worked mostly in the day on weekends (62.5%). Significantly, 10.5% of participants worked at night on weekdays. On average, participants spent 3.12 days per week in paid employment, 4.06 days attending school while on 1.22 days per week they did both paid work and school activities. This distribution did not differ by sex. However, it appears that the average number of days during which participants did both courses and paid work was lower among those who attended university compared to those attending high school or junior college ($p < 0.05$). The average number of days off was higher among university students than among those attending junior college ($p < 0.001$) (data not shown).

5.2.2 Accumulation of activities exceeding 35 hours per week

The 94 participants devoted an average of 19.96 hours to their courses, 18.64 hours to paid work and 6.99 hours to academic projects and study, for a total of 45.59 hours per week devoted to these activities. For about one in six participants (17.0%), the combination of these activities was 55 hours or more per week (data not shown).

Figure 2 shows that even when the number of hours devoted to paid work was higher, the number of hours devoted to courses and course work did not vary significantly ($p = 0.476$ and $p = 0.435$). Thus, those who worked more accumulated a greater number of hours in these three activities combined. Specifically, students who worked between 20 and 29.9 hours per week, and those who worked 30 hours or more per week, accumulated more hours in the three activities combined than did students who were gainfully employed between 15 and 19.9 hours per week, between 10 and 14.9 hours, or less than 10 hours ($p < 0.05$). For example, those who held one or more jobs for 30 hours or more per week accumulated on average nearly 20 hours more than did those working less than 10 hours ($p < 0.001$).

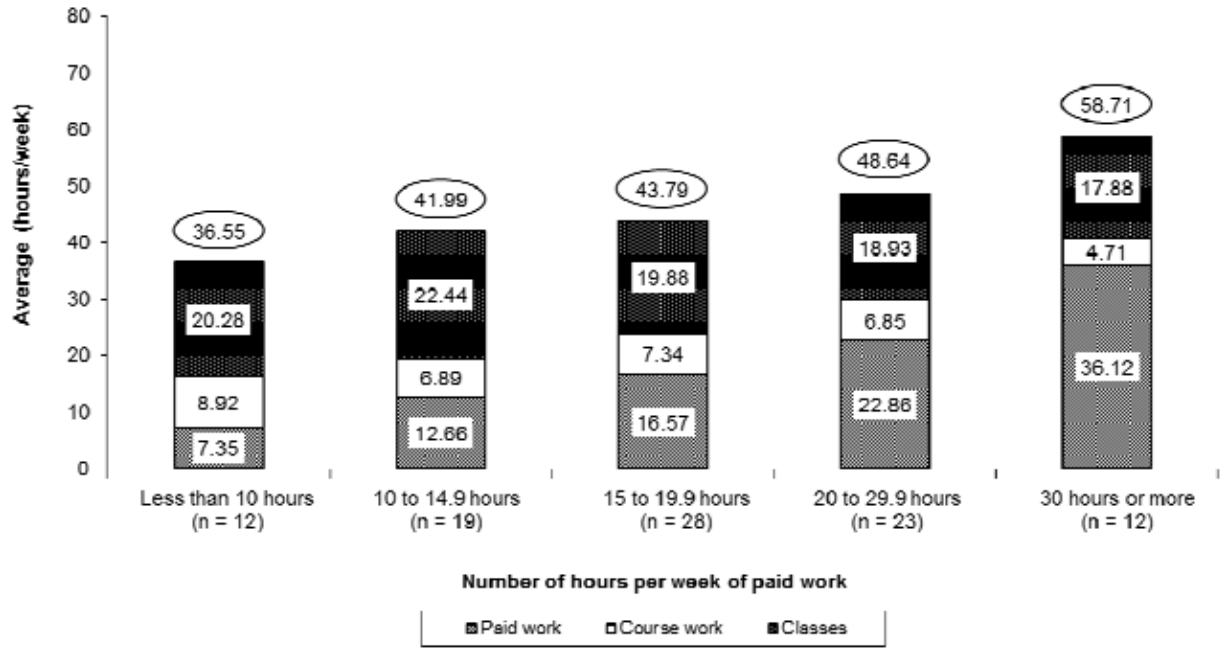


Figure 2: Average number of hours per week spent on paid work, classes and course work, by number of hours of paid work per week

The number of hours devoted to paid work, classes (course hours) and course-related work varied with the educational level (Table 10). Students enrolled in the DEP, the FGA or other programs reported devoting, on average, a greater number of hours per week to paid work (30.31 hours) and fewer hours to course work (1.44 hours) than those reported by participants at the junior college and university levels. Participants at the junior college level had a greater number of course hours per week and accumulated a greater number of hours in total than did university students. Lastly, it was university-level participants who devoted the greatest number of hours to course work (9.10 hours).

Table 10: Mean number of hours per week of paid work, classes and course work, by educational level

Educational level	(n)	Mean number of hours[a] (Standard Deviation)			
		Paid work	Classes	Course work	Total
DEP, FGA or other	(8)	30. 31 $^{\alpha. \beta}$ (11. 29)	19. 25 (10. 52)	1. 44 $^{\delta. \theta}$ (1. 88)	51. 00 (13. 07)
Junior college	(52)	18. 21 $^{\alpha}$ (8. 13)	23. 01 $^{\gamma}$ (7. 61)	6. 47 $^{\delta. \mu}$ (6. 66)	47. 69 $^{\Psi}$ (11. 53)
University	(34)	16. 54 $^{\beta}$ (6. 80)	15. 46 $^{\gamma}$ (5. 96)	9. 10 $^{\theta. \mu}$ (5. 59)	41. 10 $^{\Psi}$ (8. 41)
Total	**(94)**	**18. 64 (8. 70)**	**19. 96 (8. 08)**	**6. 99 (6. 33)**	**45. 59 (11. 10)**

[a] Mann-Whitney rank tests were used. The same superscript Greek letter affixed to two mean numbers indicates a significant difference at the 1% level.

5.2.3 Different types of concurrent activities and varied social rhythms

Based on the respondents' accumulated activities and the description of their social rhythms it is possible to classify each respondent into one of the following five categories[23]:

Category 1: "Occupied" student workers (n = 35)
- 25 to 30 hours of courses per week
- 15 to 20 hours of paid work per week
- Worked on weekdays and weekends
- Day and evening shifts condensed into 2 to 3 days
- 1 day off, or less, per week

Category 2: Workers who were also studying (n = 11)
- Over 30 hours of paid work per week
- 4 to 7 days per week of paid work
- Vast majority attended adult education centres or were completing a DEP

Category 3: Weekday student workers (n = 23)
- Mostly university level
- Less than 15 hours of classes per week
- Worked mainly on weekdays
- 1 to 4 days a week without paid work or school

[23] The grouping of participants into categories was based on their similarity; the categories were constructed so that each described profiles that were the most alike, and as distinct as possible from the other categories (Appendix F).

Category 4: Weekday students working weekends (n = 15)
- 30 hours or more of courses per week (usually spread out over five days)
- 10 to 15 hours of paid work per week (usually on the weekend days)

Category 5: Students with an unpredictable work schedule (n = 10)
- Students whose work schedule varied from week to week

These findings suggest that the accumulation of activities could take many forms depending on the status of the young person involved (a student worker or a worker who was studying) and their education level. In addition, some students tended to segment their weeks into days devoted to either work or classes, while others worked and attended courses on the same day. Note also that the mean weekly number of days devoted to studies and coursework did not emerge as a feature that varied by type of student. Lastly, none of these types had a higher proportion of either women or men.

We were also interested in the social rhythms of the participants. Note first that a higher score in the logbook suggested that the participant had greater regularity in their schedule of sleep-wake episodes and in the time taken for meals or to perform various activities. While the SRM-5 took into account only five activities (rising time, their first contact with someone, the start of their classes or paid work, suppertime, bedtime), the SRM-17 considered the time taken to perform up to 17 activities. As expected, the SRM-5 and SRM-17 scores were highly correlated ($r = 0.879$, $p < 0.001$).

Both the SRM-17 scores ($p < 0.05$) and the SRM-5 scores ($p < 0.05$) varied according to the typology of accumulated activities presented above. Specifically, *post hoc* tests revealed that the **Weekday student workers** (Category 3, n = 23) had an SRM-17 score lower than that of the **"Occupied" student workers** (Category 1, n = 35) and the **Workers who were also studying** (Category 2, n = 11) (1.80 versus 2.34 and 2.32, $p < 0.01$). In other words, the schedules of the **Weekday student workers** were less regular than those of the students in the other two categories. In fact, the **Weekday student workers** had between 1 and 4 days without work or school activity, while the **Workers who were also studying** and the **"Occupied" student workers** had heavier schedules, which presumably required greater regularity. Finally, the volume of activities performed by the participants over a 7-day period, as measured by the ALI, did not differ by typology.

5.2.4 A few strategies for planning class schedules and paid work

These youths used various strategies to manage their paid-work schedule. Usually, it was the course schedule that determined the time slots available for paid work, and few of these young people were in a position to affect their choice of course schedule; those who *were* in a position to affect this choice tended to be university students. In most cases, the participants did not report any difficulties with regard to planning their paid-work schedule. Many of them submitted their course schedule to their employer or informed them of their availability. In addition, several of them voluntarily reduced the time devoted to paid work in order to reserve one or more days off for the purpose of study or recreation. Others indicated to their employers the minimum and maximum number of hours they wished to work per week. Some also mentioned that their length

of service with an employer allowed them to choose the schedules they preferred. Several said it was easy to find replacements, as needed, for their jobs. A few participants were able to establish their work schedule or modify it, as appropriate, together with their colleagues. Ten participants also reported having schedules that were unpredictable from one week to the next.

Some came to an agreement with their employer that they would work only on weekends. The 15 participants who reported working at night did so mainly on weekends and tried to get the following day off (one participant reported experiencing great difficulty in adapting to that shift). On the other hand, to better reconcile work and study some participants left their jobs (n = 5) or reduced the weekly number of hours (n = 6) during the session.

Finally, young people were absent from their jobs more often because of school requirements than the reverse. Also, employers usually proved very accommodating. On the other hand, 11 participants said they missed one or more courses due to work. The main reasons given to explain their absences were: difficulties linked to a last minute replacement (n = 4), a work transfer (n = 3), participation in a particular event (n = 2) and an excessive level of fatigue (n = 2).

We may conclude from these findings that most participants reported no particular difficulty in planning their work schedule; they could easily be replaced if necessary and the employers usually proved to be conciliatory in this regard. On the other hand, nearly 30% of them went through a change in terms of their employment status during the 4-month observation period. Other factors that had an impact: work schedules often changed from one week to another and most of the participants worked both weekdays and weekends.

The students aged 19 to 21 years spent on average about 46 hours per week in classes, course work and paid work. This accumuation of activities was higher among junior college students (47.7 hrs / wk.) than among university students (41.1 hrs / wk.). In addition, secondary level students in DEP or FGA programs devoted more hours per week to paid work than did college or university students (30.3 hours versus 18.2 hours and 16.5 hours, respectively). Thus, it appears that the profile of these students was more that of a of a young worker who was studying, while those attending college and university seemed to be working students, with many more hours devoted to lectures and coursework.

5.3 Work constraints and their accumulation

5.3.1 Organizational constraints not specific to job type

Participants reported being exposed to multiple organizational constraints. However, some of these constraints resurfaced more frequently, such as tense situations with the public; being interrupted frequently; the need to stay focused and the repetitive nature of the task (Table 11). Note that the vast majority of participants considered the work atmosphere to be very good, both as concerned colleagues and their superior(s).

Table 11: Organizational constraints related to the work of the participants, by sex

Organizational constraints	Men	Women	Total
Tense situations with the public	14	40	54
Frequent interruptions	19	31	50
Requiring much concentration or focus	20	28	48
Repetitive nature of the task	18	29	47
Little autonomy in decision making	15	25	40
Little influence on how things are done	16	24	40
Few new things to learn	22	16	38
Little freedom to organize work or tasks	15	16	31
High work pace or workload	14	16	30
Stress	7	21	28
Experienced difficulty with work pace or workload	5	11	16
Poor relationships with colleagues	4	5	9
Poor relationships with superior(s)	2	4	6
Poor work environment	2	4	6
Lack of time	1	1	2
Average[a]	**4.50**	**5.04**	**4.81**
(n)	**(40)**	**(54)**	**(94)**

[a] For the sole purposes of determining the cumulative average, four respondents could not be considered because of missing values for certain constraints (2 or more).

Overall, the constraints most frequently reported by men corresponded to those most frequently reported by women. That said, if we examine the distribution of constraints by sex, more women than men were faced with situations of tension with the public (74.1% versus 35.0%, $p < 0.001$) and stress (38.9% versus 17.5% $p < 0.05$); men also said they had to learn new things as part of their work less often than women (55.0% versus 29.6%, $p < 0.05$).

In the interviews, the young people reported right from the start that there had been very little tension with the public. As the interview progressed, however, we learned that several of them had to deal with dissatisfied customers or difficult situations such as verbal abuse, aggressive behaviour or children in crisis. Most students learned to live with these situations, but 21 of them reported that they felt shaken, fatigued and stressed following such situations.

In interview, these young people had difficulty distinguishing between workload and work pace. The answers they gave spontaneously focused on the pace of their work. As for the concept of workload, they sometimes referred to the physical workload, while at other times to the responsibilities associated with the task. Although a majority of participants (68.1%) did not consider their workload or their work rate too high, one in five still saw their paid work as hard, tiring, demanding and stressful. While almost all of the participants (97.6%) reported having enough time to do their job, 26 participants reported occasionally having to accelerate the pace at the expense of quality, having to ask a colleague to complete their work or having to carry over their work to the following day (data not shown). Finally, the participants who reported experiencing stress in the workplace cited as causes the following: the high pace of work;

working under pressure; managing relationships with colleagues or clients; being responsible for the safety of others and, lastly, the fear of making errors, not knowing something or breaking something.

The interviews also revealed participants' perceptions regarding the repetitive nature of their work. About a third of them (33.7%) did not view their work as repetitive. For, while they always performed the same collection of tasks, these were many and varied; furthermore, the types of demands, customers and unexpected circumstances changed over time. When the work was seen as repetitive, participants reported doing the same thing or referred to routine. Finally, it should be noted that, in the context of service jobs, the students did not necessarily feel that the repetitive nature of the work constituted a constraint.

Although student jobs are generally considered less demanding, participants reported that they had to stay focused (n = 48), learn new things[24] (n = 54) and take decisions independently[25] (n = 43). Specifically, tasks requiring concentration were those involving committing information to memory (an order, a product number), performing calculations (making out an invoice, performing an inventory, counting money, measuring ingredients), communicating and monitoring people. Also, five participants reported having to concentrate in the performance of hazardous tasks such as using a table saw, handling hazardous materials, using knives, etc.

In general, new learning acquired through work operations related to the product, new procedures or techniques and the development of certain interpersonal skills. Latitude in decision making took a variety of forms; it referred either to the possibility of making decisions independently in the execution of one's work, to freedom in organizing one's work and tasks, or to deciding how to do one's tasks. Most participants reported having some flexibility in organizing their work and tasks, but significantly less in the way they executed their tasks. Finally, most students reported having influence over how things were done, including identifying a problem, influencing the choice of working methods, or broaching new ideas. Note, however, that over a quarter of the participants (26.6%) admitted to having no influence over their work environment.

In conclusion, a majority of participants felt that their work environment was good. Note that six participants believed that their work environment was difficult and told of conflicts with their colleagues (Appendix G). Finally, seven participants worked alone.

The accumulation of organizational constraints

For the most part, the type of job held was not necessarily an indicator of the type of organizational constraints to which the working students were exposed (Table 12). On the contrary, we found that the same organizational constraint could be present in various similar job types. Thus, these findings suggest the existence of diverse contexts in which the job was exercised. Therefore, the conditions for performing the job varied for the same type of job.

[24] For two participants, it was not possible to establish whether they faced this constraint within the context of their work.

[25] For 11 participants, it was not possible to establish whether they faced this constraint within the context of their work.

Furthermore, certain jobs resulted in a greater accumulation of organizational constraints than did others. This was particularly true in jobs such as cashiers, gas station attendants, waiters, bartenders and those associated with food preparation.

Table 12: Organizational constraints related to the work of the participants, by type of work held[26]

Organizational constraints	Food preparation	Cashier, Gas station attendant	Waiter, Bartender	Technician	Other	Sales	Secretary, Switch-board operator	Manual labour	Group leader, Trainer, Caregiver	Total
Tense situations with the public	9	11	8	1	2	6	8	2	7	**54**
Frequent interruptions	9	12	7	3	3	4	4	2	6	**50**
Requiring concentration or focus	8	5	5	5	4	3	4	6	8	**48**
Repetitive nature of the task	7	13	7	2	2	7	3	4	2	**47**
Little autonomy in decision making	4	9	4	2	4	6	5	6	0	**40**
Little influence over how things are done	7	5	6	2	2	7	3	4	4	**40**
Few new things to learn	6	10	6	1	1	3	2	8	1	**38**
Little freedom to organize work or tasks	3	7	2	2	3	3	4	5	2	**31**
High work pace or workload	10	7	1	3	0	2	1	3	3	**30**
Stress	5	6	2	2	1	2	4	2	4	**28**
Experienced difficulty with work pace or workload	2	2	2	1	1	3	0	2	3	**16**
Poor relationships with colleagues	2	0	3	1	0	0	0	1	2	**9**
Poor relationships with superior(s)	0	3	2	0	0	1	0	0	0	**6**
Poor work environment	1	0	3	0	0	0	0	0	2	**6**
Lack of time	1	0	1	0	0	0	0	0	0	**2**
Cumulative average[a]	**5,69**	**5,50**	**5,36**	**5,00**	**4,60**	**4,18**	**4,13**	**4,09**	**4,00**	**4,81**
(n)	**(13)**	**(17)**	**(11)**	**(5)**	**(5)**	**(12)**	**(9)**	**(11)**	**(11)**	**(94)**

[a] For the purpose only of determining the cumulative average, four respondents could not be considered because of missing values for certain constraints (2 or more).

[26] See Appendix H for the job groupings used in the cross analysis.

5.3.2 Accumulation of job-specific physical constraints

Working students are not only exposed to organizational constraints; they also report being exposed to a range of physical constraints (Table 13). But some stand out more, like prolonged standing (n = 73) and the handling of heavy loads (n = 43). In contrast, others are experienced infrequently, such as long periods of sitting (n = 8) or having to maintain a difficult posture of the upper limbs (n = 8). Note that when using tools more men than women must make a major effort with their hands or arms (17.5% versus 3.7%, $p < 0.05$).

Table 13: Physical constraints of jobs held by participants, by sex

Physical constraints	Men	Women	Total
Prolonged standing	31	42	73
Handling of heavy loads	22	21	43
Risk of falling	17	20	37
Repetitive hand or arm movements	17	16	33
Reduced workspace / clutter	14	16	30
Dangerous tools	14	14	28
Dangerous machinery	13	10	23
Extreme temperature (cold)	11	11	22
Solvents or chemicals	9	12	21
Loud noise	7	10	17
Back posture difficult to maintain	5	12	17
Dust	8	5	13
Precision movements	6	6	12
Working on a computer	5	7	12
Extreme temperature (hot)	5	4	9
Significant exertion of hands or arms on tools	7	2	9
Long periods of sitting	3	5	8
Upper limb posture difficult to maintain	3	5	8
Cumulative average	**4.93**	**4.04**	**4.41**
(n)	**(40)**	**(54)**	**(94)**

Physical constraints associated with work activity

Over three quarters of the participants (n = 73) reported that their jobs required remaining standing for long periods, and over half of these (n = 37) had no place to sit down (Appendix C). Most of those who worked standing up (36 of 73) said that by the end of their shifts they were experiencing fatigue or pain in their legs or feet, sensations that generally faded by the evening or after a good night's sleep. The symptoms were more common when the working students had no place to sit down in the workplace. Some of these students introduced strategies to overcome this constraint, such as reducing movement, moving more (when the activity involved little movement) leaning against something and sitting down, either as soon as possible, or as soon as there were fewer customers present or when the supervisor was not present. Also, 19 participants indicated it was important to have good shoes, or had purchased them especially for their jobs.

In rarer cases, participants reported having to frequently adopt difficult-to-maintain postures of the back and upper limbs. In almost all these cases, postural constraints of the back were related to inadequate workspace.

Of the participants who reported handling heavy loads as part of their work (n = 43), whether this involved manipulating, storing or shipping these loads, 29 did so on a regular basis. These heavy loads could be trays; racks or display cases containing dishes; pots; full jugs or pails; orders; inventory that needed to be moved; pallets of 20-litre paint containers; propane tanks or beer barrels. For some participants, this might involve a 400-pound heavy machine that had to be tilted, while for others it was patients who had to be moved. Also, 15 of the 43 participants who worked in handling reported that the work involved discomfort or pain. Less than one in ten of the participants reported major exertion with their hands or arms when using tools.

Thirty-three participants reported having to perform repetitive movements of their hands and arms during their shift or in connection with a specific task. These repetitive actions arose in a variety of tasks such as handling products[27], cutting or preparing food, putting away or washing dishes, opening gallon containers or beers, serving dishes or shooters, pressing the keys on a cash-register keyboard or computer and counting money. In addition, various tasks such as screwing, operating a ski lift, massaging a client, scraping the surface of an ice-skating rink or pipetting may require repetitive movements. Lastly, 11 participants reported feelings of discomfort or pain related to this physical constraint.

The physical constraints of the work environment

There were 30 participants who reported having to work in small or cluttered workspaces, especially kitchens, service counters or product storage areas. Also, nearly two out of five participants (n = 37) reported a risk of falling in their workplace. This usually involved the risk of slipping because of a wet or greasy floor, or because of activities that had to be performed outdoors in winter or on steep steps leading to storage space. In this connection, five participants also reported having bumped into something, having been burned or nearly falling over due to a lack of space. In addition, 12 participants reported risks of falling related specifically to the use of unsuitable ladders and stepladders. For example, following an accident at work that resulted in his absence for six weeks, a young inventory technician said he would in future refuse to climb unsafe ladders. Finally, the jobs held sometimes exposed participants to working at heights, even though the work situations lacked any special adjustments or preparation. We note the case of a lab technician who in wintertime had to climb up a very slippery tank to take samples, and that of a maintenance technician who had to walk on top of machines located at a height of nearly three metres.

When we asked students if they used dangerous tools, some did not mention knives right away, even though several of these participants had already been cut by them. A similar attitude prevailed in the case of dangerous machinery. Participants did not spontaneously refer to ovens, grills, oven/stove rings, fryers, dishwashers, steamers, waffle irons, mixers or slicers as hazardous equipment, despite the fact that several of them said they had been burned by heating elements or hot oil.

[27] Placing products on shelves, unloading pallets, assembling orders or boxes, packing, putting things in bags, etc.

As concerns the physical work environment, 22 participants reported working in a cold environment. Examples cited included tasks performed in a constant draft or working outside in the winter. As part of their work, 21 participants used chemicals -- highly typical of cleaning tasks performed in the kitchen. Two participants who were gas-station attendants reported being exposed to gasoline vapour. In addition, eight of these 21 participants reported some discomfort related to the use of these chemicals (headaches, skin reactions, coughing, coated tongue, etc.). Finally, 17 participants reported working in a noisy environment, making conversation difficult. This was the situation in kitchens and bars, and in situations that required equipment such as table saws, pneumatic tools and jackhammers.

The accumulation of physical constraints

As was the case with organizational constraints, a given physical constraint may be present in similar types of employment (Table 14). We note, once again, that jobs requiring food preparation resulted in a greater accumulation of physical constraints. On the other hand, the two other job groups accumulating the most physical constraints (technician and manual worker) did not not correspond to those accumulating the greatest number of organizational constraints (cashier / gas station attendant and waiter / bartender). Furthermore, it is interesting that a job type that seemed to require relatively more skills, such as technician, exposed participants to a combination of physical constraints greater than that inherent to other types of jobs requiring fewer qualifications, such as cashiers or waiters.

Table 14: Physical constraints associated with jobs held by participants, by type of job held[28]

Physical constraints	Food preparation	Cashier, Gas-station attendant	Waiter, Bartender	Technician	Other	Sales	Secretary, Switch-board operator	Manual Worker	Group organizer, Trainer, Caregiver	Total
Prolonged standing	13	4	8	2	11	9	14	10	2	**73**
Handling of heavy loads	12	1	6	3	5	4	6	6	0	**43**
Risk of falling	7	3	8	2	4	5	5	3	0	**37**
Repetitive hand or arm movements	10	4	3	1	3	2	7	3	0	**33**
Reduced workspace / clutter	6	3	4	2	3	4	6	2	0	**30**
Dangerous tools	9	1	6	1	5	2	2	2	0	**28**
Dangerous machinery	9	2	6	1	1	0	3	1	0	**23**
Extreme temperature (cold)	4	1	3	2	3	2	6	0	1	**22**
Solvents or chemicals	8	1	5	0	2	3	2	0	0	**21**
Loud noise	3	1	5	2	0	2	0	3	1	**17**
Back posture difficult to maintain	4	3	2	1	2	1	3	1	0	**17**
Dust	0	2	3	2	2	1	2	0	1	**13**
Precision movements	4	1	3	0	2	2	0	0	0	**12**
Working on a computer	0	0	0	1	3	1	1	0	6	**12**
Extreme temperature (hot)	3	1	1	2	1	1	0	0	0	**9**
Significant exertion of hands or arms on tools	2	1	4	1	0	1	0	0	0	**9**
Long periods of sitting	1	1	0	1	1	1	1	0	2	**8**
Upper limb posture difficult to maintain	1	4	1	0	1	0	1	0	0	**8**
Average	**7.38**	**6.80**	**6.18**	**4.80**	**4.08**	**3.73**	**3.47**	**2.82**	**1.44**	**4.41**
(n)	**(13)**	**(5)**	**(11)**	**(5)**	**(12)**	**(11)**	**(17)**	**(11)**	**(9)**	**(94)**

[28] See Appendix H for the job clustering used in the cross analysis.

We may conclude from these findings that the organizational constraints did not seem particularly job-specific and did not vary by sex. The organizational constraints most frequently reported involved tense situations with the public, multiple interruptions during work, the need to stay focused and the repetitive nature of the work. These young people found the concept of workload difficult to grasp: they associated it with either speed of execution or degree of responsibility. A similar attitude could be seen with regard to latitude in decision-making, which for them sometimes meant freedom to organize their work as they wished and at other times the power to decide how to accomplish the tasks. Furthermore, over a quarter of the participants felt they had no influence in the workplace, though the majority reported a very good work climate.

Lastly, unlike the organizational constraints, the accumulation of physical constraints was more specific to certain jobs such as food preparation, technical jobs and manual labour. On the other hand, three-quarters of the participants reported having to stand for long periods, many did not have a place to sit down, and a majority said they felt pain in their legs and feet. Moreover, nearly half of the participants had to handle heavy loads. Limited space and a lack of equipment suitable for work at height were also frequently reported as constraints.

5.4 The effects of accumulated activities and accumulated constraints on the health of students who work during the school year

The objective of the present section is to verify the extent to which the accumulated activities and work constraints, when combined with the individual characteristics of students, were associated with certain health indicators. Although the characteristics used in the regression analyses that follow must be considered as factors connected to the issues under study, given their small number and relatively low statistical power we cannot state beyond a doubt that the characteristics not used in a particular model did not play a role in the issue addressed[29].

To begin, there was the matter of verifying the relative and combined role of various characteristics -- reflecting the accumulation of activities, and the accumulation of physical and organizational constraints -- in explaining the severity of the work-related fatigue. To accomplish this, we used multiple linear regression analyses[30]. Two separate models were created, one for acute fatigue, the other for chronic fatigue.

First, Table 15 shows the characteristics associated with acute work-related fatigue among working students. This first model accounts for 33.6% of the variance in the score obtained by participants in the subscale for acute fatigue. Specifically, this model identified four characteristics related to a higher level of acute fatigue. These characteristics were, in order of importance, the higher number of organizational constraints ($b = 2.777$, $p < 0.01$), the fact that they sometimes or always worked at night ($b = 14.013$, $p < 0.01$), the greater number of jobs held since the age of 15 ($b = 9.767$, $p < 0.05$) and greater psychological demands at work ($b = 0.874$, $p < 0.05$).

[29] This besides the factors that were not measured as part of the study

[30] Note that an observed positive value with non-standard coefficients (b) estimated by these models indicates a positive linear relationship between the potential explanatory variable (independent variable) and the dependent variable; conversely, a negative coefficient indicates a negative linear relationship.

Table 16 shows the characteristics associated with chronic work-related fatigue. This model can explain 43.7% of the variance of the score obtained by working students in the chronic-fatigue subscale. Five characteristics, in particular, are associated with higher levels of chronic fatigue. These are, in order of importance, weaker social support at work ($b = - 1.571$, $p < 0.001$), a higher number of organizational constraints ($b = 2.902$, $p < 0.001$), a more 'evening' form of chronotype (or circadian phase preference) ($b = - 0.632$, $p < 0.001$), greater psychological demands at work ($b = 1.032$, $p < 0.01$) and a greater number of jobs held since age 15 ($b = 10.500$, $p < 0.01$).

Table 15: Characteristics associated[a] with acute fatigue in working students

Characteristics selected[b]	b	Standard error
Constant	52.772	36.389
1. Number of organizational constraints	2.777 **	0.952
2. Works sometimes or always at night (0, 1)	14.013 **	4.975
3. Average number of jobs per year since the age of 15	9.767 *	4.347
4. Psychological demands of work[c]	0.874 *	0.402
5. Number of hours of study per week	0.484	0.278
6. Women (0, 1)	6.902	3.963
7. Decision latitude[c]	- 0.247	0.146
8. Number of physical constraints of the work	- 0.641	0.612
9. Social support at work[c]	- 0.480	0.478
10. Average falling-asleep time	- 1.346	1.390
n = 89[d]; F = 5.445*** (dl = 10); $R^2_{adjusted}$= 0.336		

[a] The associated characteristics were identified using multiple linear regression analysis. They are presented in order of importance of their contribution to the multiple model, as evidenced by the observed significance level (p).

[b] The analysis centres on the 10 characteristics that were selected because of their simple correlation with the dependent variable in the study (p <0.25, Hosmer and Lemeshow, 2000).

[c] Note that the higher the scores, the greater the demand, flexibility and support.

[d] Five participants could not be considered because of missing values.

* p < 0.05; ** p < 0.01; *** p < 0.001

Table 16: Characteristics associated with chronic fatigue in working students

Characteristics selected[b]	b	Standard error
Constant	53.384*	25.102
1. Social support at work[c]	- 1.571***	0.396
2. Number of organizational constraints	2.902***	0.845
3. Chronotype[d]	- 0.632***	0.178
4. Psychological demands of work	1.032**	0.376
5. Average number of jobs per year since the age of 15	10.500**	4.005
6. Number of hours of work-school-studies	0.218	0.149
7. Duration of sleep	-0.789	2.275
n = 89[e]; F = 10.629*** (dl = 7); $R^2_{adjusted}$ = 0.437		

[a] The associated characteristics were identified using multiple linear regression analysis. They are presented in order of importance of their contribution to the multiple models, as evidenced by the observed significance level (p)

[b] The analysis centres on the seven characteristics that were selected based on their simple correlation with the dependent variable in the study (p <0.25, Hosmer and Lemeshow, 2000).

[c] Remember that the higher the scores, the greater the demand and support..

[d] Note that a higher score means that a person is more of a "morning type", preferring to go to bed and to get up earlier, while a lower score means that an individual is more of a "night type", preferring to go to bed and to get up later.

[e] Five participants could not be considered because of missing values.

* p < 0.05; ** p < 0.01; *** p < 0.001

Secondly, there is the question of establishing the relative and combined role of the various characteristics reflecting the accumulation of activities, and the accumulation of physical and organizational constraints, in explaining the presence of pain caused by work, daytime sleepiness, sleep problems and a high level of psychological distress. Each of these health indicators underwent logistic regression analysis. The coefficient used in this type of model to quantify the link between the selected characteristic and the dependent variable is the odds ratio ($e\beta$)[31].

The first logistic regression model, based on characteristics reflecting the accumulation of activities and work constraints on personal characteristics, had two variables associated with the presence of pain caused by work performed by the working students (Table 17). This model can explain a significant proportion of the variance in the dependent variable ($R^2_{Nagelkerke} = 0.389$). First, participants exposed to a greater number of physical constraints as part of their job(s) increased the likelihood that they would suffer from pain associated with the performance of the aforementioned job(s) ($e\beta = 1.475$, $p < 0.001$). Only 15.6% of those exposed to two or fewer physical constraints said they were struggling with pain caused by the work, versus 65.5% of those who reported six constraints or more. In addition, being subjected to greater psychological demands as part of his (her) job(s) increased the risk that the working student had pain connected to the performance of the paid work ($e\beta = 1.127$, $p < 0.05$).

[31] A value of one for this coefficient means that the factor has no effect on the probability of having or not having a given health problem. The more the odds ratio value increases beyond one, the greater the probability that having a health problem will increase with the factor. Conversely, a value below one indicates a decreased risk.

Table 17: Characteristics associated[a] with the presence of work-related pain in working students

Characteristics selected[b]	Presence of work-related pain		Odds ratio e^{β} (95% CI)
	Yes (37.0 %)	No (63.0 %)	
1. Number of physical constraints			
Mean (Standard error)	6.24 (3.32)	3.34 (2.30)	1.475 *** (1.202 - 1.809)
0 to 2 Constraints (%)	15.6	84.4	
3 to 5 Constraints (%)	32.3	67.7	
6 Constraints or more (%)	65.5	34.5	
2. Work-related psychological demands[c]			
Mean (Standard error)	21.59 (4.37)	18.98 (4.64)	1.127 * (1.001 - 1.270)
3. Regular work schedule (0. 1)			
No (%)	60.0	40.0	1.000
Yes (%)	34.1	65.9	0.215 (0.042 – 1.116)
4. Mean waking time			
Mean (Standard error)	07:52 (74)	08:24 (69)	0.852 (0.535 -1.357)

n = 92[d]; $\chi^2 = 30.847$ (df = 4; $p < 0.001$); Hosmer and Lemeshow test, $p = 0.316$; $R^2_{Nagelkerke} = 0.389$; Proportion of participants correctly classified by the model = 73.9 %= 73.9 %

[a] The associated characteristics were identified using a logistic regression analysis. They are presented in order of importance of their contribution to the model, as evidenced by the observed significance level (p).

[b] The four characteristics with the highest bivariate association with the variable under study were included in the model.

[c] Note that a higher score corresponds to greater psychological demands at work.

[d] Two of the participants could not be considered because of missing values.

* p < 0,05; ** p < 0,01; *** p < 0,001

A second logistic regression model was created to assess the relative and combined roles of the various characteristics reflecting the combination of activities and work constraints and personal characteristics in accounting for daytime sleepiness (table not presented). Although significant ($\chi^2 = 12.724$, $p < 0.05$), the model performed poorly ($R^2_{Nagelkerke} = 0.188$) and none of the variables under study appeared to be related to the presence or absence of daytime sleepiness.

The third logistic regression model (Table 18) selected two characteristics as being associated with the presence of sleep problems. The model can explain a significant portion of variations in the score related to sleep problems ($R^2_{Nagelkerke} = 0.404$). First, according to the chronotype questionnaire, being more of an evening type is associated with having an increased risk of sleep problems ($e^{\beta} = 0.870$, $p < 0.001$). Importantly, no morning type revealed any sleep problem; this, contrasted with intermediate types (49.2%) and evening types (73.7%). In addition, working fewer days per week was associated with an increased risk of sleep problems ($e\beta = 0.559$, $p < 0.05$).

Table 18: Characteristics associated[a] with sleep problems in working students

Characteristics selected[b]	Sleep problems		Odds ratio e^{β} (95% CI)
	Yes (46,2 %)	No (53,8 %)	
1. Chronotype[c]			
Mean (Standard error)	44.81 (7.95)	53.54 (9.39)	0.870*** (0.799 - 0.946)
Morning type (%)	0.0	100.0	
Intermediate type (%)	49.2	50.8	
Evening type (%)	73.7	26.3	
2. Number of days of paid work per week			
Mean (Standard error)	2.80 (1.07)	3.43 (1.46)	0.559* (0.349 - 0.894)
3. Regularity of social rhythms[d]			
Mean (Standard error)	1.96 (0.60)	2.27 (0.63)	0.570 (0.196 - 1.656)
4. Falling asleep time on weekends			
Mean (Standard error)	01:56 (102)	01:05 (122)	0.919 (0.632 - 1.335)

n = 83[e]; χ^2 = 29.974 (df = 4 ; p < 0.001); Hosmer and Lemeshow test, p = 0.342; $R^2_{Nagelkerke}$ = 0.404;
Proportion of participants correctly classified by the model = 72.3 %

[a] The associated characteristics were identified using a logistic regression analysis. They are presented in order of importance of their contribution to the model, as evidenced by the observed significance level (p).

[b] The four characteristics with the highest bivariate association with the variable under study were included in the model.

[c] Note that a higher score means that a person is more "morning type", preferring to go to bed and get up earlier, while a lower score means that an individual is more "evening type", preferring to go to bed and get up later.

[d] Note that a high score indicates that the participant was more regular, that is, performed the same activities every day at approximately the same times.

[e] Eleven participants could not be considered because of missing values.

* p < 0.05; ** p < 0.01; *** p < 0.001

The fourth and final logistic regression model (Table 19) identified three characteristics as being associated with the presence of psychological distress. Model fit was assessed using the Nagelkerke R^2 ($R^2_{Nagelkerke}$ = 0.255). First, having accumulated a greater number of jobs was associated with an increased risk of high levels of psychological distress ($e\beta$ = 6.411. p <0.05). In addition, going to bed earlier on school days was associated with an increased risk of high levels of psychological distress ($e\beta$ = 0.607. p <0.05). Finally, accumulating fewer weekly activities was associated with an increased risk of high levels of psychological distress ($e\beta$ = 0.927. p <0.05).

Table 19: Characteristics associated[a] with psychological distress in working students

Characteristics selected[b]	Psychological distress		Odds ratio e^{β} (95% CI)
	Yes (37.6 %)	No (62.4 %)	
1. Number of jobs currently held			
Mean (Standard error)	1.23 (0.43)	1.10 (0.31)	6.411* (1.468 - 27.996)
2. Falling asleep on weekdays			
Mean (Standard error)	23 h 45 (79)	24 h 20 (88)	0.607* (0.400 – 0.921)
3. Volume of weekday activities			
Mean (Standard error)	79.46 (8.13)	82.68 (8.10)	0.927* (0.864 – 0.994)
4. Social support at work[c]			
Mean (Standard error)	24.11 (4.73)	26.19 (3.51)	0.895 (0.795 - 1.007)
5. Number of hours of work-school-studies			
Mean (Standard error)	47.35 (11.87)	44.33 (10.54)	0.997 (0.953 - 1.043)

n = 93[d]; χ^2 = 19.245 (df = 5; p < 0.01); Hosmer and Lemeshow test, p = 0.903; $R^2_{Nagelkerke}$ = 0.255;
Proportion of participants correctly classified by the model = 71.0 %

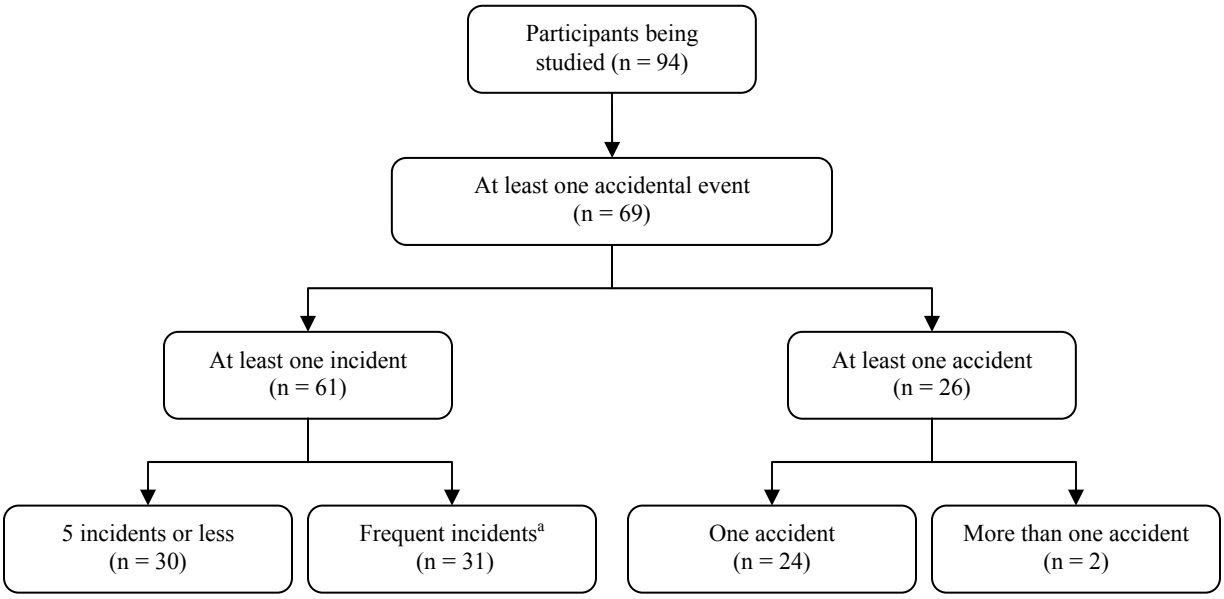
[a] The associated characteristics were identified using a logistic regression analysis. They are presented in order of importance of their contribution to the model, as evidenced by the observed significance level (p).
[b] The five characteristics with the highest bivariate association with the variable under study were included in the model.
[c] Note that a higher score corresponds to greater social support at work.
[d] One participant could not be considered because of missing values.
* p < 0.05; ** p < 0.01; *** p < 0.001

We conclude from these findings that it is not the accumulation of work and studies themselves that seem to have an impact on the health of students engaged in paid work during the school year but, rather, the working conditions and particularly the psychosocial risk factors, such as psychological demands and social support, as well as the accumulation of organizational and physical constraints. Note, nevertheless, that the number of jobs held since age 15 was also identified as a factor associated with work-related fatigue.

5.5 Accidental events

5.5.1 Accidents and frequent incidents, one of the realities of paid work for students

Almost three quarters (73.4%) of the participants reported experiencing at least one accidental event over the two years preceding the study. These were either incidents (n = 61) or accidents (n = 26) (Figure 3). Although the majority of these accidental events had had consequences that one could describe as minor, several of these working students suffered cuts (n = 39), burns (n = 20), contusions (n = 20) and sprains or fractures (n = 9). Of the participants reporting incidents, 31 said they were so frequent that they were unable to count them. They usually happened to individuals working in food preparation or as manual labourers. Note too that 18 of the 26 working students who had had at least one accident also reported having had one or more incidents.



[a] Incidents too frequent for the participant to be able to count them.

Figure 3: Breakdown of reported accidents and incidents

Men reported having had a work accident more often than did women (40.0% versus 18.5%, $p < 0.05$). By examining the jobs providing the context for these accidents, we note that the injuries often occurred in jobs referred to as manual or kitchen jobs traditionally performed primarily by men. Of the 23 accidents that were subject to further analysis[32], almost half (n = 12) resulted in discomfort or pain lasting more than a week, thus affecting the performance of activities associated with daily living (Table 20). In addition, eight accidents resulted in work absences lasting 10 days or more. Following their accident, 13 of the 23 participants consulted a doctor or went to the hospital. Specifically, four participants were given stitches, three had to wear a splint and one had surgery. The majority of accidents (n = 17) were reported to the employer. Only three cases led to changes in work equipment or spatial planning. Also, only eight of the 23 above-mentioned occupational accidents were reported to the CSST, five of which were compensated (data not shown).

[32] In the case of one of the participants, two accidents were reported, one at each interview. For another participant, the details of the accident were not explained during the interview and therefore do not appear in this analysis. The third accident not selected concerned a young woman who was hit by a car on her way to work by bike.

Table 20: Breakdown of accidents by duration of absence, presence of discomfort/pain and consultation or not of a health professional

Duration of discomfort or pain	Frequency
No discomfort or pain	5
Less than one week	6
One to four weeks	9
More than one month	3
Total	**23**

Duration of absence	**Frequency**
Less than one hour, or was not absent	11
One day	4
10 days or more	8
Total	**23**

Consultation of a health professional	**Frequency**
No	9
Yes	13
Total	**22**[a]

[a] One of the participants who reported having an accident did not have this information.

The circumstances surrounding the 23 work accidents are described in Appendix I. One observes that in many cases a combination of factors contributed to the occurrence of the accident. On the other hand, only rarely did it result from a lack of experience. The factors that played a role in the occurrence of the accidents were both the technical environment and the organizational environment of the work.

The poor spatial planning and the characteristics of the equipment used contributed significantly to the occurrence of the accidents. For example, an overhead storage compartment in an inaccessible location forced a worker to climb up onto a counter and handle a display support with his arms above his head, ultimately dropping it onto his knee (Case No. 1). Another case was a bruised ankle, which occurred following the handling of a heavy truck with no brakes on a dimly lit slope (Case No. 10). Similarly, the weight and dimensions of equipment (e.g., a heavy table), or its instability, often made it difficult to handle (Cases No. 18 and No. 11). Other events involved faulty or unsuitable equipment. For example, a young worker was burned on the arm while trying to pick up residue located at the bottom of a deep fryer, using the only tongs that were available to him and that were too short (Case 6).

The organizational environment can also play a role in the occurrence of accidents. Take the example of working under pressure. In a store, a young saleswoman who had only two hours to place clothes on a shelf located high up was injured when, to save time, she decided to carry several garments simultaneously (Case 3). Working alone was also a factor in two accidents. A gymnastics coach working alone had to monitor several children exercising on a beam at the same time. When a child fell on her she was not able to catch him/her in time (Case 13). In the other case, a female worker had to single-handedly lift up an elderly dependent patient who had fallen down (Case No. 19).

We may conclude from the analysis that multiple factors contributed to the accidents. Figure 4 summarizes them, their impact on work activity and potential consequences of work accidents. More often than not, the victims attributed the contribution of the physical environment (n = 20) rather than the organizational environment (n = 6) to the occurrence of accidents. Note, however, that the role of the organizational environment was more difficult to determine, especially in interviews, since this was rarely a factor causing the injury directly.

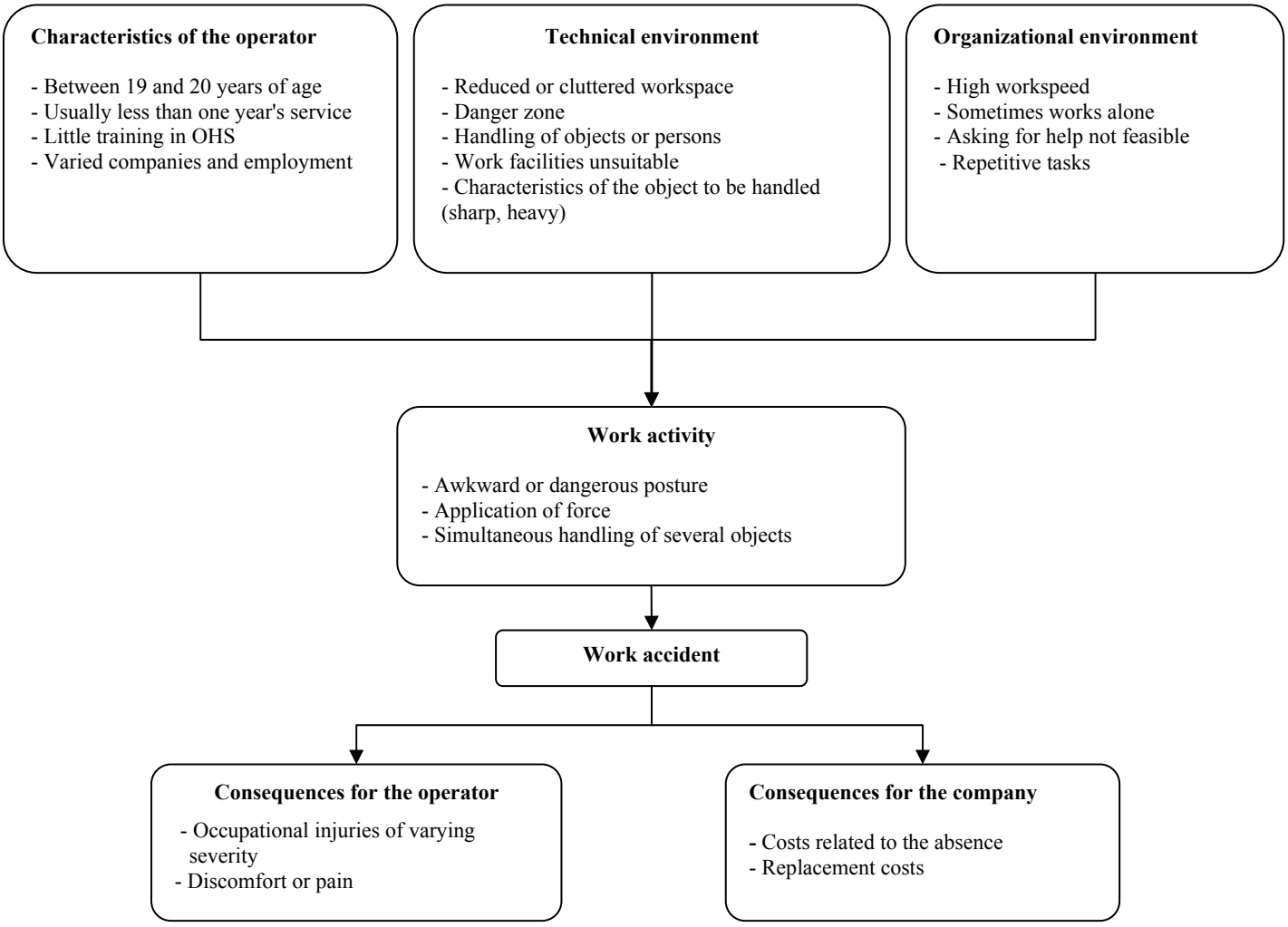


Figure 4: Main factors associated with the occurrence and consequences of accidents

These findings altogether indicate that accidental events are part of the reality of young people. The incidents were sometimes so frequent that almost a third of respondents were not able to count them. Of the 23 accidents analyzed, only five resulted in compensation. Several environmentally-related factors - some linked to the technical environment, others to the organizational environment - contributed to the occurrence of these accidents. Contrary to what one might think, lack of experience rarely seems to have been involved.

5.6 Work accidents, accumulated activities and health

First, the findings revealed that the occurrence of a work accident within the 24 months preceding the third wave of the longitudinal survey, in which 78 of the 94 working students participated, was significantly associated with the occurrence of work accidents within the

24 months preceding the present study ($p < 0.05$). Specifically, seven of the 14 youths reporting an occupational injury at that time also reported an accident in the last 24 months.

In an attempt to explain potential accident factors, we compared the accumulated-activity profiles of working students according to whether or not they had reported an accident within the last 24 months (Table 21). Participants who had reported an accident worked more days per week (3.95 versus 2.78) and had fewer days off (0.69 versus 1.17) than those who did not report one. In addition, students who reported having suffered an occupational injury worked comparatively more hours per week (24.68 versus 16.33). Finally, participants who had had an accident reported more hours of classes, course work and paid work than those who had not had an accident (51.32 versus 43.40).

Table 21: Accumulated-activity profiles of participants reporting an accident or no accident during the two years preceding the survey

Weekly number of …	**Mean (Standard error)**	
	At least one accident	**No accidents**
Work days ***	3.95 (1.28)	2.78 (1.17)
School days	3.92 (1.29)	4.12 (0.99)
Days off *	0.69 (0.87)	1.17 (1.04)
Hours of paid work ***	24.68 (10.18)	16.33 (6.84)
Hours of courses	18.81 (8.52)	20.40 (7.93)
Hours of school work	7.83 (8.64)	6.68 (5.24)
Accumulated hours of paid work, classes and school work **	51.32 (11.96)	43.40 (10.00)
(n)	**($24 \leq n \leq 26$)**	**($60 \leq n \leq 68$)**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Moreover, any accident may be accompanied by sequelae in the short, medium or long term. A comparison was therefore necessary to verify if, from the standpoint of mental and physical health, differences were observed between participants reporting either a work accident or work incident in the last 24 months and those who did not report one (Table 22).

First, participants who reported being victims of an accident during the 24 months preceding the study had a greater accumulation of work-related pain than did participants not reporting this. Note also that participants who reported having had an accident during the last two years tended to have a degree of chronic fatigue higher than that of participants not reporting such an accident

in the same period (p = 0.057). Given, on the one hand, the small numbers and, on the other hand, the small number of students reporting work accidents, we cannot eliminate the possibility that the other health indicators may have varied according to whether or not the participants had sustained a work accident.

Table 22: Participants reporting or not reporting an accident during the two years preceding the survey: comparisons of certain health indicators

Health indicators	Score or mean number (Standard deviation)	
	At least one accident	No accidents
General fatigue	2.20 (2.87)	2.54 (2.68)
Acute work-related fatigue	38.50 (18.87)	39.61 (19.96)
Chronic work-related fatigue	38.89 (23.75)	28.43 (17.48)
Daytime sleepiness	9.00 (4.08)	8.87 (3.45)
Sleep problems	4.24 (2.01)	4.81 (2.00)
Psychological distress	24.67 (13.09)	24.28 (14.21)
Pain (over the last 12 months)	2.24 (1.45)	1.91 (1.36)
Pain (over the last 7 days)	1.72 (1.34)	1.51 (1.27)
Pain caused by work*	0.92 (1.15)	0.46 (0.84)
Activity-restricting pain	0.36 (0.76)	0.18 (0.70)
(n)	**(24 ≤ n ≤ 25)**	**(67 ≤ n ≤ 68)**

* $p < 0.05$

We may conclude from these findings that the occurrence of an initial work accident early in the career of young people was associated with the occurrence of a work accident in early adulthood. In addition, participants who had had an accident accumulated comparatively more hours of so-called "productive" activities, reported more pain and had a higher level of chronic work-related fatigue.

6. DISCUSSION

Several social transformations have helped make gainful employment concurrent with studies a way of life for most students. Amongst others, certain changes in the labour market itself have fostered the growth of PTW among students (Charbonneau, 2006). For example, in the 1990s a new law allowed storekeepers to greatly extend the hours during which their facilities were kept open. In this sector, much of the workforce is composed of students or young people under the age of 25 frequently working part time. Between 1976 and 1996, the proportion of these jobs among young people 15 to 19 years increased from one fourth to more than two thirds (Grenier, 1998). Thus, recent developments in the labour market underlie the creation of a growing demand for student labour. To better understand the OHS issues related to this new reality, the present study attempted to determine the effects of accumulated activities and accumulated work constraints on the OHS of students aged 19 to 21 who were employed during their studies, taking into account the fact that they were also a group at risk for problem sleepiness.

Unsurprisingly, the majority of jobs the participants held while pursuing their studies were usually in industries highly favoured by young workers, such as the retail, accommodation and food services sectors (Institut de la statistique du Québec, 2007). On the other hand, the present study has demonstrated that, from the age of 19, some participants begin to take jobs requiring greater technical skills and related to their fields of study; this is especially true of women working in health care or education. From early on in their careers, both women and men -- even as students -- do not hold the same types of jobs, a phenomenon already revealed in other studies on the work performed by young people (Gervais et al., 2006, Institut de la statistique du Québec, 2007, Ledoux et al., 2008), and one that tends to persist throughout their professional lives (Messing, 2000).

The present study also revealed that the activity profiles exemplifying the accumulation of work and study are not stable over time, but fluctuate considerably, especially in regard to employment. Over a four-month observation period, about 30% of the participants saw their employment situation change. However, job mobility was identified as a predictor of the early onset of occupational injuries in the employment paths pursued by young workers 16 to 24 years of age (Godin et al., 2009). Moreover, as was the case in our 2008 study (Ledoux et al., 2008), young students who held paid work did not seem to decrease their weekly hours of classes and course work; they simply added the hours devoted to paid work to those devoted to academic requirements. The situation appeared particularly challenging for the students at the junior college level and those completing a DEP or enrolled in the FGA, with these two groups devoting, respectively, an average of 47 and 51 hours per week to paid work, classes and course-related work. Although nowadays we know a little more about the paid work performed by junior college students, to date there has been no study conducted on the health and safety of young people attending the FGA or completing a DEP while working almost full time.

The literature on PTW concurrent with a person's studies and also addressing the issue of student health has focused essentially on the effects of certain behaviours such as smoking and alcohol use and the frequency of physical activity (Carrière, 2005), or has addressed the issue in terms of daily worries, stress or self-esteem (Dumont, 2007; Marshall, 2007; Roy, 2008). However, the present study has shown that students who work during the school year face a range of other

risks to their health and that job characteristics, work schedules and career paths are associated with a variety of health indicators. In this sense, our team added its voice to a small group of researchers (Carr et al., 1996; Stone and Mortimer, 1998) who have indicated a need for research to include more details on the characteristics and constraints of work so as to obtain a more accurate picture of the effects of paid work on the health and well-being of students.

Work-related fatigue among students

Two in five women (40.7%) and nearly one in five men (17.9%) reported a level of general fatigue deemed to require medical attention (Chalder et al., 1993). This sex-based difference, unfavourable to women, started in adolescence (ter Wolbeek et al., 2006) and seemed to persist until early adulthood. Regarding work-related fatigue itself, female gender was also previously identified -- using logistic regression analysis in a sample of over 18,000 workers -- as a predictor of the presence of fatigue (Akerstedt et al., 2002b).

In particular, work-related fatigue can be classified as acute fatigue and chronic fatigue. In general, it can be argued that acute fatigue is reversible and that certain offsetting mechanisms, such as rest or changing tasks, can assist in the recovery. On the other hand, chronic fatigue is more persistent and therefore less likely to be eliminated by offsetting mechanisms (Wada et al., 2008). Furthermore, chronic fatigue, also called prolonged fatigue or persistent fatigue, behaves as a risk factor for development of subjective and objective factors related to job characteristics, as well as to health-related and personal factors (Jansen et al., 2007). In this regard, multivariate analyses have identified, for both acute fatigue and chronic fatigue in students, objective and subjective factors related to the performance of paid work.

Specifically, these analyses identified the accumulation of organizational constraints of work, psychological demands, social support in the workplace and having held a greater number of jobs since the age of 15, as explanatory factors for the severity of work-related fatigue among students who held a paid job during the school year. Although the majority of these students did not view their workload as excessive, remember that one in five perceived his or her paid work as hard, tiring, demanding and stressful. Organizational constraints of work were previously identified as a factor increasing the risk of fatigue among working adults (Bültmann et al., 2002a), but to our knowledge this was the first time this relationship had been documented among students whose work was primarily part time. Some authors are unsure if fatigue among workers is a precursor to an underlying disease or if it reveals a predisposition to develop disease in the future (van Amelsvoort et al., 2002). The study by Bültmann and colleagues (2002b), which surveyed thousands of workers participating in the Maastricht Cohort Study of Fatigue at Work, supports the latter hypothesis completely. Indeed, these researchers have shown that psychosocial risk factors such as low levels of social support, little latitude in decision-making and greater exposure to psychological demands were associated with higher levels of fatigue. In the same vein, this prospective study also showed that worker perception of positive change regarding social support, latitude in decision-making and psychological demands in the work environment was associated with a decrease in fatigue (Janssen and Nijhuis, 2004). With the knowledge that work-related fatigue is a risk factor for accidents among adult workers (Swaen et al., 2003), interventions to prevent or reduce fatigue among students who are employed during the school year (Martin et al., 2012) should target not only the physical constraints of work

(Laberge et al., 2011), but also its organizational constraints. Also, longitudinal data from the aforementioned Maastricht cohort study on fatigue at work, like many other publications, have revealed that transitions in work schedules, especially the night shift, are associated with the presence of acute and chronic fatigue (Jansen et al., 2003b; From Raeve et al., 2007). In these circumstances, it should come as no surprise that we took note of the higher level of work-related, acute fatigue among students employed at night. Despite the fact that the young people try to organize their schedules so as to take a day off after working a night shift, the findings indicate that this strategy does not appear sufficient to mitigate the effects of night work, even if such work is not a constant feature of their work schedule. Lastly, the association between a relatively large number of jobs held since age 15 and the presence of acute or chronic fatigue suggests that job mobility not only has an influence on the early onset of occupational injuries (Godin et al., 2009), but also on the level of work-related fatigue.

The impact of sleep of insufficient quality or quantity

The objective data obtained here through actigraphy strongly correlate with the schedule of sleep-wake episodes documented by students in their logbooks. The sleep-phase delay begun in adolescence seemed to continue into early adulthood since the participants aged 19 to 21 went to bed, on average, at about midnight on school-days and at 00:30 on weekends, significantly later than what is usually observed among those 17-19 years of age (Wolfson and Carskadon, 1998). Also, the present data on sleep patterns are consistent with those reported among college and university students (Tsai and Li, 2004). Sex-based differences, observed here in the sleep-episode schedules of students 19 to 21 years of age were also consistent with the literature. Indeed, the studies generally show that women sleep more than men (Park et al., 2001; Williams, 2001; Tsai and Li, 2004; Hurst, 2008). Furthermore, the sleep efficiency of around 80% suggests that about half the students had inadequate quantity or quality of sleep. Note that sleep efficiency greater than 80% is generally regarded as normal. Conversely, sleep efficiency of less than 80% typically results in insomnia. Moreover, the substantial proportion of students reporting sleep problems (46.2%) is of concern since recent analysis of data in the *Enquête sur la santé dans les collectivités canadiennes* revealed that sleep disorders, characterized by frequent difficulty initiating sleep or staying asleep, were associated with a higher risk of work accidents among workers aged 15-64 years (Kling et al., 2010), thus corroborating observations made previously among construction and railroad workers (Chau et al., 2004a; 2004b).

The present findings also revealed that an evening phase preference, that is to say, to have an inclination for later bedtimes and later rising times, was also associated with sleep problems. In this regard, previous studies conducted on junior college students had reported, firstly, that the sleep habits of evening types were bad compared to those of intermediate types and morning types (Peszka et al. 2009) and, secondly, that a longer delay in sleep phase (later bedtimes and rising times) was more likely to be associated with poor sleep quality (Carney et al., 2006). The data obtained here among students employed during the school year seem to support these findings. At the same time, a preference for a more evening type of circadian phase was also associated with higher levels of chronic fatigue. Although in terms of sleep duration the evening types did not differ from the morning types, the chronotype score[33] was positively associated with duration of nocturnal sleep ($r = 0.33$, $p < 0.01$). In other words, the preference of participants

[33] Note that a higher score corresponds to morningness (a more morning type).

of this age for a later sleep-wake episode schedule (Lack, 1986; Carskadon and Davis, 1989) could lead to sleep disorders and chronic fatigue. Indeed, chronic fatigue can result from a cumulative sleep deficit (Baldwin and Daugherty, 2004). Note, however, that the school-career or employment requirements could also favour the endorsement by participants of this age for a later sleep-episode schedule. As early as 1913, Terman and Hocking (cited in Millman, 2005) were attributing changes observed in the sleep of adolescents to an increased school load. Wolfson and Carskadon (1998) also showed that students who worked more than 20 hours per week went to bed later, slept less and fell asleep in class more often than those working less than 20 hours per week. In sum, we cannot assess the sleep-wake rhythm phase of adolescents and young adults without considering their main activities, namely, their studies and paid work.

The scientific literature indicates that individuals who do not sleep well tend to have lower productivity at work and seek more medical consultations (Nishikitani et al., 2005; Léger et al., 2006). Also, workers who suffer from insomnia have a higher absentee rate (Godet-Cayre et al., 2006). The relationship observed here between sleep complaints and fewer days per week spent at paid work could mean that the students with an insufficient quality or quantity of sleep significantly reduced their paid work activity. However, the direction of the relationship between sleep problems and the conditions in which the job is performed can be reversed. Indeed, the perception of employment-related stressors is linked to the development and continuation of insomnia symptoms (Jansson and Linton, 2006). The cross-disciplinary nature of the present research does not allow us to come to any definite conclusions on the causal links between sleep problems and the number of days per week[34] of paid work performed by the students.

Symptoms of psychological distress

Studies among adolescents have shown that sleep problems are a predictor of psychological distress and, conversely, that psychological distress could lead to sleep problems (Dahl et al., 1996; Dahl and Lewin, 2002; Patten et al., 2000). For Cousins et al. (2007), the reciprocal interaction between psychological distress and sleep problems may form a vicious circle, following which it may be observed that each symptom has grown. In a study of 34 teenagers aged 14-17 using actigraphy, these authors documented more concretely an association between high levels of psychological distress, lower sleep efficiency and increased time in bed (Cousins et al., 2007). The present study concurs with the latter findings since the students suffering from a high level of psychological distress went to bed earlier on weekdays, and this suggests that they spent more time in bed. Also, it may seem paradoxical that students in the high psychological-distress category had a lower volume of weekly activities than those without psychological distress, yet accumulated a greater number of jobs. The scientific literature on the impact of work on the family indicates that conflicts may arise when the time, energy and commitment necessary to meet the requirements associated with one role make it difficult to meet requirements of a second role (Greenhaus and Beutell, 1985). Thus, it is possible that workers will limit their work involvement so as to adapt to the demands of family life, or vice versa (Lambert, 1990). We also know that individuals who accorded great importance to these two roles did not experience more inter-role conflicts or health effects than did individuals who accorded less importance to them (Lachance et al., 2006). Yet, three quarters of the participants responded that they placed greater

[34] Note that there is a significant relationship between the average number of working days and the number of hours of paid work per week ($r = 0.73$, $p < 0.001$).

value on their studies. It can therefore be assumed that the students who accumulated a greater number of jobs were more likely to experience conflict, revealed here by the presence of a high level of psychological distress, and reduced their volume of activities per week in an attempt to better meet the requirements associated with their roles of student and worker.

Note, lastly, that the jobs held by the students were jobs with low wages and little social protection. However, over a third of the participants had to assume various financial responsibilities (housing, education, car payments, etc.). Therefore, one can easily imagine that some of them may have felt insecure about their jobs, and that this could result in health effects including the presence of psychological distress (Sverke et al., 2002; Tompa et al., 2007).

Symptoms of musculoskeletal disorders

In a survey of this same cohort of young people when they were aged 17-18 years (Ledoux et al., 2008), we noticed that over half of those who reported having experienced pain during the year preceding the survey had also felt it during the seven days preceding the survey. Once again, it appears that students who hold paid jobs during the school year have proved to be a population struggling with persistence or chronicity in their perceived musculoskeletal pain, as almost all (91.3%) of those who experienced pain at least somewhere in the body during the 12 months preceding this study also felt it during the preceding week. Also, according to Ledoux et al (2008), women are different from men in terms of the number of sites of the pain they feel. Among students who reported at least one pain, over a third (37.0%) saw a link with the performance of their jobs, a relatively high proportion given the fact that the main activity of this cohort was, in principle, their school mission. Moreover, Van Nieuwenhuyse et al. (2004) have shown that the first episode of back pain is common in the first year of work. Earlier data from the *Enquête sociale et de santé 1998* had revealed that the physical work constraints such as handling heavy loads, exertion of arms and hands on tools, machinery or equipment, and exposure to vibration from hand tools were associated with musculoskeletal pain, and this, regardless of age (Arcand et al., 2001). Given that young workers are more often exposed to these constraints than are adults (Gervais et al., 2006), it is legitimate to note a link between the number of physical constraints to which students are exposed in their paid work activity and the presence of work-related pain. It is also interesting to note that participants who experienced job-related pain also suffered greater psychological demands. A systematic review of psychosocial factors contributing to neck and nape pain identified some empirical support for a positive relationship between this pain and high levels of psychological demand at work (Ariens et al., 2001). To our knowledge, the present study is nonetheless the first to link the accumulated work-related pain (note: this is essentially PTW) and high levels of psychological demand among students.

Concurrent activities and persistent effects on health

Most studies on the long-term effects of paid work performed concurrently with a person's studies have been conducted by economists, and have focused on the effects of the skills, knowledge and experience gained through paid work on the subsequent employability of young people (Wofford Mihalic and Elliott, 1997). From the standpoint of health, the main effect of long-term paid work identified in the literature is an increased use, once adulthood has been

reached, of alcohol and drugs. The association found here between the number of jobs held since age 15 and higher levels of acute and chronic fatigue between 19 and 21 suggests that holding multiple jobs during adolescence may also have medium-term effects on the health of young people. Arguably, the adaptive resources of the young people who had held a relatively large number jobs since the age of 15 years were greatly challenged, and these young people were consequently more likely to become fatigued. Indeed, it is quite possible that these young people were obliged, relatively more frequently, to come to terms with a variety of work environments and adapt to new ways of doing things. Fortunately, a growing number of parents have been concerned about the potential effects on their teenagers of work-related fatigue, in particular its effects on their curriculum (Phillips and Sandstrom, 1990, Runyan et al., 2009). In this regard, findings of the *Enquête interrégionale 2008* -- carried out on some 4,000 students 12 to 18 years of aged -- reveal the need for vigilance on this issue. In particular, it suggests that almost a third of young people say they do not do school work because of fatigue (36.0%), and feel they do not have enough energy left to do this homework or study after performing their jobs (32.9%). In addition, a quarter said they were often too tired at school due to the nature of the tasks they were obliged to perform in their paid work (25.0%) (Gaudreault et al., 2010).

Breslin et al (2007a) recently considered the relationship between the risk of accidents and the time allocated to paid work and recreational activities among adolescents and young adults; their study was based on a representative sample of nearly 10,000 Canadians aged 15 to 24. They showed that young people who were deeply involved in both work (> 20 hours / week) and recreation (> 3 hours / week) were more likely to have an accident. They interpreted these findings to be a consequence of the adding together of the risks inherent in these activities. These results took into account all accidents irrespective of type (sports, driving, working), and affecting young workers who were not students as well as young student workers; that said, there is an interesting parallel with the observation we have made here of a link between the occurrence of work accidents and a greater accumulation of activities (such as in increase in the hours of paid work, classes or coursework per week). Considering that 1) the students who, from the age of 15 started accumulating a comparatively greater number of jobs reported a higher level of fatigue in connection with the exercise of their present job and 2) the youth who reported a work accident over the last two years differed significantly from those who did not report an accident, as indicated by the activities accumulated (more days of paid work and hours of paid work per week, fewer days off, etc.) and by the pain caused by work (they also tended to differ in terms of chronic fatigue level), is there not good reason to argue that some young people accumulating concurrent activities may be at greater risk for their health? Given that work is playing an ever-greater role in the lives of students, it is imperative that employers take measures to reduce both the physical and organizational constraints to which young people are exposed as soon as they enter the labour market (Laberge et al., 2011). In this way, we can prevent certain health problems from recurring throughout their careers, and slow the phenomenon of occupational wearing out.

Early occupational accidents and their implications for the career path

Occupational injuries sustained by young people have not only a long-term impact on their health, but also economic consequences. First, studies have determined that between 15% and 26% of adolescents who sustain an occupational injury report permanent sequelae including, to

varying degrees, chronic pain, scarring, hearing loss and loss of mobility (Parker and al., 1994a, 1994b). Among young Quebecers aged 18 and under who were compensated for an injury between 2000 and 2007, about 5% suffered permanent bodily and psychological impairment (Vézina, 2009), effects which will last throughout their working lives. Also, Breslin and colleagues (2007b) showed that young people 16 to 24 who sustained a work accident earned significantly less in the year following the accident than young people who did not sustain such an accident.

Our study shows that in many cases, participants reported various difficulties, discomfort and injury because of an accidental event. Often, these short-term effects did not translate into work absences since the PTW meant that the period between workdays was often sufficient to recover from the impact of certain events. Thus, when it comes to PTW we must question the relevance of indicators claiming to judge the severity of occupational injuries according to the length of the absence that followed. Furthermore, our findings suggest that when the first accident occurs early in a career (often in adolescence), this increases the risk of sustaining another later.

Although Quebec does not have specific legislation defining the minimum age for entering into employment (Conseil de la famille, 1992), rights and obligations have been drawn up to ensure the safety of young workers as well as the development of their full potential. For example, the law on labour standards states: "No employer may have work performed by a child that is disproportionate to the child's capacity, or that is likely to be detrimental to the child's education, health or physical or moral development" (Commission des normes du travail, 2010). For the *Commission des normes du travail* (2010), prohibited work is work that involves too many consecutive hours of work considering the child's age, or excessive physical demands relative to the child's abilities. In 1992, the *Conseil de la famille*, the *Secrétariat à la famille* and the *Fédération des comités de parents du Québec* published a companion guide for parents containing certain recommendations (Ministère du Travail, 1998). It considered, among other things, the following possibilities: prohibiting night work for children; limiting their paid employment to 10 hours per week; limiting it to 2 or 3 days a week; limiting it to 2 or 3 hours per day; and avoiding evening work, especially after 9 pm (21:00). In light of our present findings among students aged 19 to 21, these recommendations are highly relevant and topical. On the other hand, they are no substitute for concrete action to improve the work conditions for students, a population too often seen as cheap labour, and one that is competent yet disposable (Conseil permanent de la jeunesse, 2001). Indeed, the present findings reveal that several elements in the technical and organizational environment have contributed to the occurrence of accidents. In this sense, the circumstances of the accidents sustained by students do not differ from those faced by workers of all ages (Laflamme, 1988). Lack of experience and training do not explain everything!

7. GENERAL CONCLUSION

The present undertaking sought to determine the effects of accumulated (i.e., concurrent) activities and accumulated work constraints on the OHS of students gainfully employed during the school year. On the one hand, our approach used data collected through semi-structured interviews, validated questionnaires and the wearing of an actigraph used in conjunction with a log book and, on the other hand, employed both qualitative and quantitative methods.

The study participants held a variety of jobs -- though these were rarely related to their field of study -- in small business in the service sector. Both the men and the women had jobs in which there was contact with the public, but only the women worked in establishments providing care to individuals. We observed sex-based differentiation from the very earliest years of their integration into the labour market. Although most students reported no particular difficulty in planning their schedule, nearly 30% experienced a change in their employment status during the 4 months of observation. In addition, the work schedules often changed from one week to the next, and a majority of the participants worked both on weekdays and on weekends. On average, they devoted about 46 hours per week to paid work, classes and course work. Even when the number of hours devoted to paid work was high, the number of hours devoted to classes and course work did not however vary significantly. Thus, among these 19 to 21 year-olds holding paid employment during the school year, the phenomenon was more an accumulation of activities than a conciliation of work and study. Five types of profiles representing the accumulation of work and study were introduced, varying primarily according to the student's level of education and status (either a student worker or a worker who was studying). Secondary-level students enrolled in either the DEP or FGA program devoted a greater number of hours per week to paid work than did their junior college or university counterparts (30.3 hours versus 18.2 hours and 16.5 hours, respectively).

Participants aged 19 to 21 slept an average of 6.3 hours per day, and almost half of them reported having sleep problems. On average, they went to bed at about midnight on weekdays and at about 01:30 on weekends, which is substantially later than the time usually observed for young people in late adolescence. The presence of a significant level of general fatigue is more prevalent in women than in men. It was not the accumulation of work and study in itself that seemed to have had an impact on fatigue but, rather, the working conditions and especially the psychosocial risk factors such as psychological demand and social support as well as the accumulation of organizational constraints. The most frequently reported organizational constraints were tense situations involving the public, frequent interruptions during work, the need to stay focused and repetitive work. Although both men and women reported being exposed to the same organizational constraints, more women than men faced stress and situations of tension with the public. As for physical constraints, also known to relate to work-related fatigue in student workers (Laberge et al., 2011), three-quarters of the participants reported having to remain standing for prolonged periods, many did not have a place to sit down, and a majority said they felt pain in the legs and feet. Moreover, nearly half the participants had to handle heavy loads that came in a wide variety of shapes, volumes and weights. Limited space and a lack of equipment suitable for work at heights were also often reported as constraints. It was the jobs involving tasks related to food preparation that exposed students to greater accumulation of organizational and physical constraints -- constraints associated with the presence of fatigue and

increased physical pain.

This research, like many others, revealed that accidental events are part of the reality of students holding paid employment. The incidents were so common that the students sometimes had difficulty counting them. Of a total of 23 accidents analyzed, only five resulted in compensation. This suggests that the accidents reported in the Central and Regional Data Warehouse of the *Commission de la santé et de la sécurité du travail du Québec* (CSST) represent only the tip of the iceberg in the accidental events of which young workers are victim. Several factors, some related to the technical environment, others to the organizational environment, contributed to the occurrence of these accidents and, contrary to popular belief, the lack of experience rarely seems to have been a factor. However, participants who sustained a work accident also accumulated a greater number of hours of "productive" activity (i.e., classes, school work, paid work) and reported more pain.

Lastly, this research reveals the presence of effects, connected to early entry into the labour market, which could be described as "persistent". Thus, it appears that when the first accident occurs early in the adolescent's career this might be linked to the occurrence of an accident in early adulthood. In addition, the number of jobs held as of the age of 15 was associated with the level of work-related fatigue.

Methodologically, this research combined several data sources and various types of analysis. The findings reveal a high correlation between the data collected through actigraphy on sleep-episode schedules and that collected in the logbooks. In addition, the interviews demonstrated that, from one student to another, concepts such as workload, work pace and the repetitive nature of a task often referred to different realities. Thus, depending on the individuals involved, latitude in decision-making could refer to their autonomy in organizing their work or the possibility of deciding how to perform their tasks. While many of the young people enjoyed a certain freedom in organizing their work, they had very little discretion in how they performed their tasks. The semi-structured interviews revealed that certain work constraints were not reported immediately, such as situations of tension with the public; as the interview progressed, we gradually learned that many students had to negotiate with unhappy customers or deal with aggressive behaviour. In sum, students who worked during the school year had to adapt to various work situations, learn to interact and communicate, and deal with various health effects. We believe we have documented these effects and situations in the most effective way, by combining data from various sources. Note that this research was conducted among young people from the Saguenay-Lac-Saint-Jean region participating in a longitudinal survey. Although the jobs they held were representative of the jobs held by young Quebec workers, this was nonetheless a regional sample. Additional studies will have to confirm our findings on the health of young people who work while studying, especially a larger population of secondary school students.

8. AVENUES FOR FURTHER ACTION AND RESEARCH

The findings of this research have prompted us to propose certain courses of action aimed at students holding paid employment and their employers. All indications are that recent labour market trends, which point to a growing demand for student labour, will be maintained in the longer term. Although students who work are considered less at risk for occupational injuries than are young people no longer in school, the findings of the present study underline the importance of implementing preventive measures in workplaces attracting large numbers of students.

To OHS and public health workers, we propose:

- developing measures that will target jobs involving tasks related to food preparation, such as a cook and assistant cook. These jobs typically expose young workers to a greater number of physical and organizational constraints and therefore increase their risk of becoming victims of an accidental event.

- promoting simple solutions to employers, for example, making available adapted tools and chairs in the workplace; these could have an immediate effect by reducing pain, discomfort and risk of accident. It would be interesting to find out why seemingly simple solutions sometimes prove difficult to implement in practice.

- pursue preventive actions affecting the physical constraints to which young people are exposed, while also reducing organizational constraints.

- educating and informing young workers who are also studying on the possible health effects of the accumulation of work and study (taking into account that they also constitute a population at risk of problem sleepiness), especially if their jobs expose them to several constraints or if they work at night.

Certain avenues of research also emerge from the main findings of this study:

- We must concern ourselves with the reality of young people enrolled in the FGA or completing a DEP who have a heavy profile of concurrent activities. However, few studies have addressed OHS issues specific to this subpopulation, which nevertheless seems to work almost full time while pursuing their studies.

- Our findings suggest that scales for evaluating levels of work-related fatigue could be used in workplaces for targeting prevention efforts, particularly with regard to organizational constraints. Further research could be done in this area.

- Given the fact that work accidents reported to the CSST likely represent just the tip of the iceberg, work should continue to document indicators such as work-related fatigue, pain and discomfort and better target prevention efforts among students holding jobs during the school year.

- Our results also highlighted the cumulative impact of organizational constraints on the severity of work-related fatigue, even when the students work only part time. Yet, most young people do not consider their workload to be too high. This seeming contradiction highlights the need for research to better understand the perceptions of young people vis-à-vis their working conditions.

- At a time when job insecurity appears to be the dominant trend, research on the effects of concurrent jobs starting in adolescence (and mobility) on health seem justified.

- In the current context of job mobility, knowledge must be developed on the conditions surrounding the induction and integration of students into the workplace with a view to preventing adverse effects on their occupational health and safety.

Lastly, we believe that an interdisciplinary approach is essential in addressing these issues.

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APPENDIX A: THE "ACTIWATCH" AW-64

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APPENDIX B: SCHEDULE GRID USED DURING THE INTERVIEW

Participant number: _____

Last name: _____ First name: _____

Number of hours devoted to studies and coursework: _____ this week
_____ on average

Number of hours spent in paid work or courses	**Job 1** _____	**Job 2** _____	**Program of studies** _____
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			
Saturday			
Sunday			
Total hrs. / wk.			
Overtime			
Additional information			

Job 3 (where applicable):

_____

_____

Leisure activities _____ Number of hours / week____

APPENDIX C: FINDINGS OF ANALYSES LINKED TO PHYSICAL CONSTRAINTS ON 94 PARTICIPANTS IN THEIR MAIN JOB

Physical constraints Responses of participants	**(n)**	**Presence of constraint (0 = no, 1 = yes)**	**Consolidation of classes for correspondence analysis (CA)**	**With impact[a]**
Prolonged standing and frequent walking				
Prolonged standing, with seat available	7	1	Prolonged standing	36
Prolonged standing, without a seat available	10	1		
Prolonged standing, seat availability depends on job held	1	1		
Prolonged standing and frequent walking, with seat	23	1	Prolonged standing and frequent walking	
Prolonged standing and frequent walking, without seat	27	1		
Prolonged standing and frequent walking, seat availability depends on job held	2	1		
Prolonged standing and frequent walking (availability of seat unknown)	3	1		
No	21	0	No	–
Sitting for long periods				
Yes	8	1	Yes	7
No	86	0	No	–
Arm, shoulder, wrist or hand postures difficult to maintain				
Yes	8	1	Yes	3
No	86	0	No	–
Back postures difficult to maintain or repeat (excluding long periods of standing)				
Leaning, bending	12	1	Yes	13
Neck position, kneeling, crouching	5	1		
No	77	0	No	–

[a] Number of participants for whom the physical constraint resulted in an impact on health: pain, discomfort, injury or incident.

APPENDIX C: FINDINGS OF ANALYSES LINKED TO PHYSICAL CONSTRAINTS ON 94 PARTICIPANTS IN THEIR MAIN JOB - CONTINUED

Physical constraints Responses of participants	**(n)**	**Presence of constraint (0 = no, 1 = yes)**	**Consolidation of classes for correspondence analysis (CA)**	**With impact[a]**
Significant exertion by hands or arms on tools				
Yes	9	1	Yes	7
No	85	0	No	–
Handling of heavy loads (e.g. lifting, carrying, transporting people or loads such as boxes, furniture, etc.)				
Heavy, each shift or almost	29	1	Heavy, each shift or almost	15
Heavy, but not in each shift	9	1	Heavy, but not in each shift	
Less heavy, but prolonged or repeated	5	1	Less heavy, but prolonged or repeated	
No	51	0	No	–
Repetitive hand or arm movements				
Yes, to some extent throughout the shift	22	1	Yes, to some extent throughout the shift	11
Yes, related to a specific task that comes up regularly	11	1	Yes, related to a specific task that comes up regularly	
No	61	0	No	–
Precision movements: pulling, pushing, lifting, lowering, rotating, grabbing, holding, maintaining etc.				
Yes	12	1	Yes	5
No	82	0	No	–
Warm environment				
Yes, all the time	5	1	Yes	4
Yes, not all the time	4	1		
No, only in summer	9	0	No	–
No	76	0		

[a] Number of participants for whom the physical constraint resulted in an impact on health: pain, discomfort, injury or incident.

APPENDIX C: FINDINGS OF ANALYSES LINKED TO PHYSICAL CONSTRAINTS ON 94 PARTICIPANTS IN THEIR MAIN JOB - CONTINUED

Physical constraints Responses of participants	**(n)**	**Presence of constraint (0 = no, 1 = yes)**	**Consolidation of classes for correspondence analysis (CA)**	**With impact[a]**
Cold environment				
Environment near or below zero, constant	5	1	Constant cold environment	9
Cool air or cold air flow, constant	7	1		
Environment near or below zero, not constant	6	1	Cold environment, not constant	
Cool air or cold air flow, not constant	4	1		
No	72	0	No	–
Dust				
Dusty environment	6	1	Dusty environment	6
Same activity or other service that generates dust	7	1	Same activity or other service that generates dust	
No	81	0	No	–
Solvents and chemicals				
Yes, every shift or almost	15	1	Yes, every shift or almost	8
Yes, but not every shift	6	1	Yes, but not every shift	
No	73	0	No	–
Loud noise: difficult to have a conversation a few feet away, even if shouting				
Continuously noisy environment	8	1	Continuous noise exposure	1
Noisy environment not continuous, task related	5	1	Noise exposure, not continuous	
Noise related specifically to the use of tools	4	1		
No	77	0	No	–
Vibrations from hand tools				
Yes	3	*Too few 'yes': This variable was not retained in the analysis.*		0
No	91			–

[a] Number of participants for whom the physical constraint resulted in an impact on health: pain, discomfort, injury or incident.

APPENDIX C: FINDINGS OF ANALYSES LINKED TO PHYSICAL CONSTRAINTS ON 94 PARTICIPANTS IN THEIR MAIN JOB – CONTINUED

Physical constraints Responses of participants	**(n)**	**Presence of constraint (0 = no, 1 = yes)**	**Consolidation of classes for correspondence analysis (CA)**	**With impact[a]**
Use of dangerous machinery				
Using machine(s) during all shifts or almost	19	1	Yes	10
Infrequent use of machines	4	1		
No	71	0	No	–
Handling dangerous tools				
Use of tool(s) during each shift	24	1	Yes	14
Less frequent use of tools	4	1		
No	66	0	No	–
Working with a computer				
Yes, for the most part	6	1	Yes	4
Yes, for a part of the shift	6	1		
No	82	0	No	–
Small work space, clutter				
Main work area, or generally cluttered	18	1	Main work area, or generally cluttered	5
Not all the time, very locally or in connection with a task	12	1	Not all the time, very locally or in connection with a task	
No	64	0	No	–
Risk of falling from height or at ground level: slippery or uneven terrain				
Risk of falling at ground level	25	1	Risk of falling at ground level	18
Risk of falling from a height	12	1	Risk of falling from a height	
No	57	0	No	–

[a] Number of participants for whom the physical constraint resulted in an impact on health: pain, discomfort, injury or incident.

APPENDIX D: FINDINGS OF ANALYSES LINKED TO ORGANIZATIONAL CONSTRAINTS ON 94 PARTICIPANTS IN THEIR MAIN JOB

Organizational constraints Responses of participants	**(n)**	**Presence of constraint (0 = no, 1 = yes)**	**Consolidation of classes for correspondence analysis (CA)**
Workpace or workload			
A lot, fast work required, rapid	30	1	A lot, fast work required, rapid
Reasonable, normal	20	0	Reasonable, normal
At times, a lot or fast	44	0	At times, a lot or fast
Workpace or workload felt to be difficult			
Difficult, tiring, demanding, stressful (sometimes or all the time)	16	1	Difficult, tiring, demanding, stressful (sometimes or all the time)
Accepts usual pace/load or likes a faster pace	10	0	Feels comfortable or adapted
Not too demanding, okay, “not as bad as…”, pleasant	47	0	
Quiet, relaxed and sometimes boring	8	0	Quiet, relaxed and sometimes boring
Non-response	13	0	Non-response
Enough time to do the work			
No	2	1	No, but often there is leeway (the work may be may postponed, the next person completes the job or, on occasion, there is a lack of time)[35].
Yes, but sometimes lacks time, or has lacked on a few occasions	8	0	
Yes, but sometimes works quickly (in some cases, this impacts on work quality)	4	0	
Yes, the next person finishes up	6	0	
Yes, may postpone the work (often until the following day)	8	0	
Yes	47	0	Yes, and sometimes things are quiet
Yes, downtime	3	0	
Yes, time available to do homework	4	0	
Yes, quiet, relaxed	3	0	
Non-response	9	0	Non-response

[35] The participants who responded *no* were included in this category for the purposes of the correspondence analysis because there were too few of them. They were not randomized because in any case they could not be grouped together with the participants who answered *yes*.

APPENDIX D: FINDINGS OF ANALYSES LINKED TO ORGANIZATIONAL CONSTRAINTS ON 94 PARTICIPANTS IN THEIR MAIN JOB – CONTINUED

Organizational constraints Responses of participants	**(n)**	**Presence of constraint (0 = no, 1 = yes)**	**Consolidation of classes for correspondence analysis (CA)**
Work requires concentration			
Yes	48	1	Yes
Usually, has to concentrate somewhat on work, not excessively, sometimes, from time to time, except for specific tasks	21	0	Usually, has to concentrate somewhat on work, not excessively, sometimes, from time to time, except for specific tasks
No	22	0	No
Non-response	3	0	*Randomly distributed* [36]
Often interrupted at work			
Yes	27	1	Yes
All the time, often, a lot, during each shift, constitutes part of the job	23	1	All the time, often, a lot, during each shift, forms part of the job
Not during all shifts, sometimes, it depends, a little	12	0	Not during all shifts, sometimes, it depends, a little
No	30	0	No
Non-response	2	0	*Randomly distributed*
Freedom to organize one's work, freedom to organize one's tasks			
Under orders from a colleague or a superior to get organized	8	1	Under orders, or simple tasks not requiring organization
Not appropriate, not really including any organization of tasks	5	1	
Not always under someone's orders	5	1	Gets organized within a framework (priorities, guidelines, sometimes under someone's orders)
Instructions to follow	6	1	
Prioritizes but organizes as sees fit	6	1	
Organize themselves into teams	3	0	Organizes his or her work (as a team, plans, as he or she sees fit)
Organizes as sees fit	38	0	
Decides courses, activities	5	0	
Organizes the work of others	4	0	
Non-response	14	0	Non-response

[36] When there were three or fewer non-respondents for a constraint, they were randomly assigned by the SPAD program among the other categories.

APPENDIX D: FINDINGS OF ANALYSES LINKED TO ORGANIZATIONAL CONSTRAINTS ON 94 PARTICIPANTS IN THEIR MAIN JOB – CONTINUED

Organizational constraints Responses of participants	**(n)**	**Presence of constraint (0 = no, 1 = yes)**	**Consolidation of classes for correspondence analysis (CA)**
Freedom to organize one's work: Freedom in the way of performing tasks			
Procedures, methods to follow	12	*Too many non-responses; This variable was not retained for the correspondence analysis*	
Procedures, methods and certain freedoms	12		
Colleague who approves method	3		
Only one way of doing things	7		
As he-she sees fit	25		
Non-response	35		
Making decisions independently			
No	25	1	No
Sometimes, it depends, from time to time, a little	15	1	Sometimes, it depends, from time to time, a little
Yes	40	0	Yes
Yes, a lot	3	0	
Non-response	11	0	Non-response
Having influence on the way things are done at work			
No	25	1	No
A little, on certain points, it depends, sometimes, occasionally, maybe, yes and no	15	1	A little, on certain points, it depends, sometimes, occasionally, maybe, yes and no
Yes	46	0	Yes
Don't know	2	0	Non-response; Don't know
Non-response	6	0	
His or her job requires learning new things			
No	38	1	No
A little (it depends, somewhat, sometimes, perhaps, it's limited to…)	9	0	A little (it depends, somewhat, sometimes, perhaps, it's limited to…)
Yes	45	0	Yes
Non-response	2	0	*Randomly distributed*

APPENDIX D: FINDINGS OF ANALYSES LINKED TO ORGANIZATIONAL CONSTRAINTS ON 94 PARTICIPANTS IN THEIR MAIN JOB – CONTINUED

Organizational constraints Responses of participants	**(n)**	**Presence of constraint (0 = no, 1 = yes)**	**Consolidation of classes for correspondence analysis (CA)**
His or her job consists in redoing the same thing			
Yes, it's repetitive, it's always the same thing, it's the same operation, it's routine	47	1	Yes
Same thing, but many or varied tasks	8	0	Yes, but with some variability in the work (contingencies, relations with customers, same thing but varied tasks)
Same day, basic shift with variations or unexpected concerns	5	0	
Relationships that change the work: customers, youngsters, residents, patients	16	0	
New, but if one is aware of the whole story (things are not quite what they seem)...	2	0	
No	8	0	No or because holds several posts
Holds various posts	4	0	
Mixed (answers included several of the cases above)	2	0	
Non-response	2	0	*Randomly distributed*
Tense situations with the public			
Only unhappy customers (regularly or rarely)	30	1	Only unhappy customers (regularly or rarely)
Nasty clients	3	1	Tense situation with customers to be managed, bad behaviour of certain customers, patients or young people, intoxicated customers
Crisis situations to manage	7	1	
Intoxicated clients	6	1	
Harassing clients	1	1	
Behaviour of children, adolescents	4	1	
Bad behaviour, some patients in crisis	3	1	
No situations of tension with the public	23	0	No situation of tension with the public
No relations with the public	17	0	No relations with the public

APPENDIX D: FINDINGS OF ANALYSES LINKED TO ORGANIZATIONAL CONSTRAINTS ON 94 PARTICIPANTS IN THEIR MAIN JOB – CONTINUED

Organizational constraints Responses of participants	**(n)**	**Presence of constraint (0 = no, 1 = yes)**	**Consolidation of classes for correspondence analysis (CA)**
Work environment			
Unusual atmosphere, constraining, that deteriorated or burdened by friction	6	1	Unusual atmosphere, constraining, that deteriorated or with friction
Better than before, it depends on the day, relatively good, appropriate, appropriate but, great except, lacking in atmosphere, generally fine but ...	14	0	Better than before, it depends on the day, relatively good, appropriate, appropriate but, great except, lacking in atmosphere, generally fine but ...
Good, very good, pleasant, convivial, great, love it, friendly	68	0	Good, very good, pleasant, convivial, great, love it, friendly
Work alone	6	0	Work alone
Relationships with work colleagues			
Situation of significant conflict with one or more colleagues	9	1	Situation of significant conflict with one or more colleagues
Good relations but minor tensions	10	0	Good relations, but minor tensions or tension with a single colleague
Tension with one colleague, but good relations with others	4	0	
Good relations, no tension	65	0	Good relations, no tension
Work alone	5	0	Work alone
Non-response	1	0	*Randomly distributed*
Relations with his (her) superiors			
Don't like him or her, or tense situation	4	1	Don't like him or her, tense situation or deteriorated.
Deteriorated	2	1	
Get along well, good, very good, no tension	69	0	Get along well, good, very good, no tension
Good or correct / reasonable, but with some tension or frustrations	9	0	Good or appropriate, but with some tension or frustrations; improved
Improved	3	0	
Aloof relationship, or do not know superior	4	0	Aloof relationship, or do not know superior
Non-response	3	0	*Randomly distributed*

APPENDIX D: FINDINGS OF ANALYSES LINKED TO ORGANIZATIONAL CONSTRAINTS ON 94 PARTICIPANTS IN THEIR MAIN JOB – CONTINUED

Organizational constraints Responses of participants	**(n)**	**Presence of constraint (0 = no, 1 = yes)**	**Consolidation of classes for correspondence analysis (CA)**
Harassment situation			
Yes	4	*Too few 'yes'. This variable was not retained in the analysis.*	
Indirectly	1		
Yes, previously (not this term / session)	7		
No	82		
Stress			
Naturally stressed person	4	1	Constant or recurring stressful situations, person naturally stressed (stress as deadline approaches)
Constant stress, relatively constant, all the time, forms part of the job	9	1	
Stressful situations that recur	14	1	
Somewhat stressful situations, minor stresses, very sporadic, or does not really apply	6	0	No job stress, stressful situations rare, occasional minor stresses.
Stressful situations are rare, not frequent, far from occurring all the time	3	0	
In the past yes, but did not arise this term / session	3	0	
No, only when the job started	8	0	
No	38	0	
Stressful situations with positive effects	7	0	Stressful situations with positive effects

APPENDIX E: INVENTORY OF THE DAY'S ACTIVITIES (SRM)

Name: _____ Date: $_{d}$_ _ / $_{m}$_ _ / $_{y}$_ _ _ _ Day of the week: _____

Activity	Check if not done	Time	Check if alone	Individual: 1. Only present 2. Actively involved			
				Family member	Boyfriend/ Girlfriend	Friends	Others (specify)
Rising time	—						
First contact with an individual (in person or by telephone)							
Breakfast: _____							
Shower, bath							
First departure from the home							
School begins							
Lunch: _____							
Nap							
School ends							
Return home							
Supper: _____							
Homework/study							
Work begins							
Work ends							
Sports/exercise: _____							
Television							
Snack							
Activity A _____							
Activity B: _____							
Bedtime	—						

Occurrence of a particular event: _____

APPENDIX F: ACTIVITY PROFILE OF RESPONDENTS[A]

Significant variables at time of analysis[b]	Category I "Occupied" student workers	Category II Workers who were also studying	Category III Weekday student workers	Category IV Weekday students working weekends	Category V Students with an unpredictable work schedule
Regularity of working hours					Variable schedule (100.0)
Work period	Weekdays and weekends (100.0)		Weekdays (34.8)	Weekends (80.0)	
Shift	Days and evenings (80.0)			Day only (73.3)	
Average number of workdays per week	2.1 to 3 days (51.4)	More than 4 days (100.0)		2 days or less (100.0)	Variable (100.0)
Average number of working hours per week	15 to 19.9 hours (51.4)	30 hours or more (81.8)		10 to 14.9 hours (53.3)	
Average number of days with courses per week				5 days (86.7)	
Average number of class hours per week	25 to 29.9 hours (31.4)		Less than 15 hours (56.5)	30 hours or more (53.3)	
Average number of days off per week (no classes or paid work)	0.1 to 1 day (51.4)		More than a day (100.0)		Variable (100.0)
Level of education[c]		DEP. FGA[d] (45.5)	University (74.0)		
(n)	**35 participants**	**11 participants**	**23 participants**	**15 participants**	**10 participants**
Percentage of inertia[e]	**17.1**	**5.9**	**26.0**	**6.8**	**3.5**

[a] The categories are derived from a cluster analysis based on the correspondence analysis.
[b] For each variable, the percentage of the predominant modality within one or several categories is shown in parentheses..
[c] The level of education was not employed as an active variable in the correspondence analysis.
[d] DEP: Diploma of Vocational Studies; FGA: Adult general education.
[e] The percentage of inertia is the percentage of explained variance.

APPENDIX G: HIERARCHICAL CLASSIFICATIONS OF WORK ENVIRONMENT[A]

Description of variables [b]	Category I Good relationships at work	Category II Works in a difficult environment	Category III Works alone
Work atmosphere	Atmosphere: good, very good, pleasant, fun, convivial, great, friendly (84.0)	Atmosphere: abnormal, constraining, including friction or that deteriorated (100.0)	Does not apply because works alone (85.7)
Relations with co-workers	Good relationships with colleagues, no tension (77.8)	Situation of significant conflict with one or more colleagues (100.0)	Does not apply because works alone (71.4)
(n)	**81 participants**	**6 participants**	**7 participants**
Percentage of inertia[c]	**66.3**	**4.0**	**1.9**

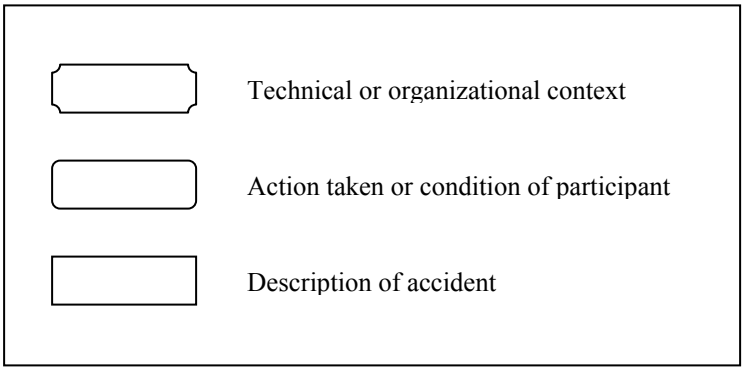
[a] The profiles were obtained through correspondence analysis.
[b] For each variable, the percentage of the predominant modality in the category is indicated in parentheses..
[c] The percentage of inertia is the percentage of explained variance.

APPENDIX H: CORRESPONDENCE BETWEEN TYPES OF JOBS AND BREAKDOWN OF JOBS HELD, BY SEX

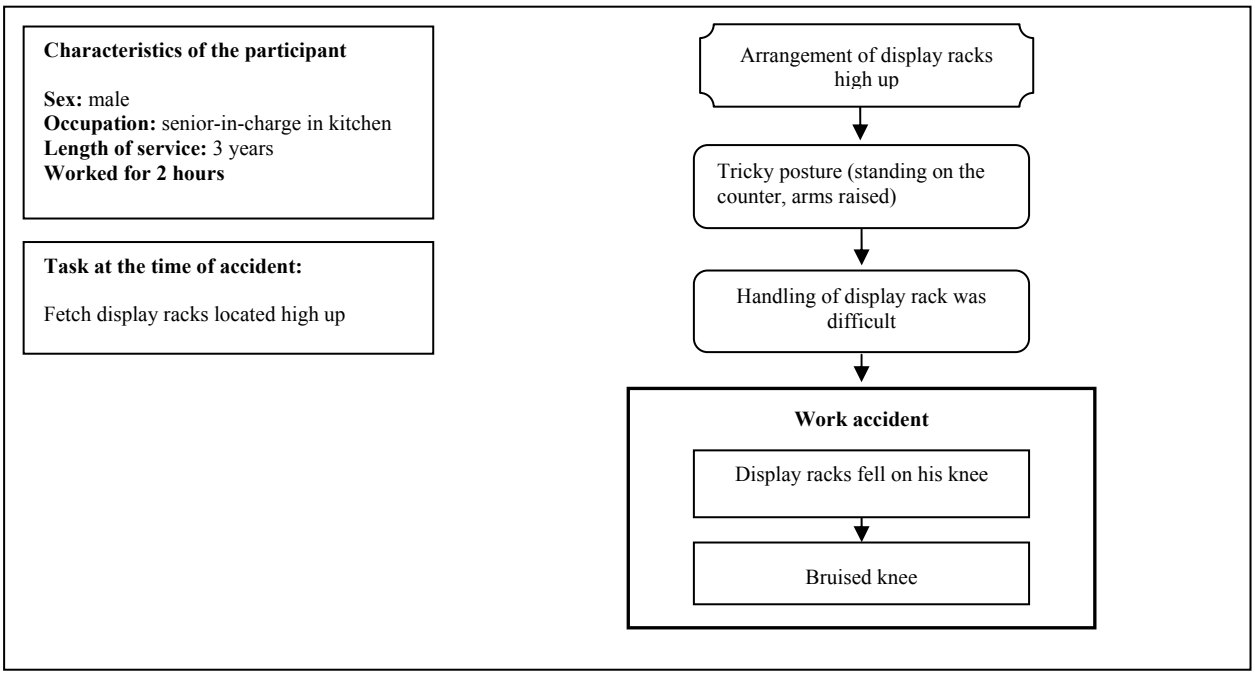
Types of job	Job held	Men	Women	Total
Cashier, gas station attendant	Cashier, clerk cashier, head cashier, gas station attendant, person in charge of employees in a business	4	13	17
Food preparation	Cook, fishmonger, baker, person in charge of employees in a restaurant, multi-station or multi-job employment in catering	7	6	13
Salesperson	Seller, sales clerk	5	7	12
Waiter, bartender	Waiter, bartender, bus boy, head waiter	4	7	11
Group leader, trainer, caregiver	Group leader, trainer, coach, instructor, healthcare personnel	2	9	11
Manual labourer	Labourer, mechanic, repair person, maintenance worker, page in a hotel, delivery person	10	1	11
Secretary, telephonist	Secretarial work, receptionist-telephone operator, project manager, reception clerk, information officer, security guard	2	7	9
Technician	Laboratory or inventory technician	2	3	5
Other	Ski-centre operator, multi-station or multi-job employee, scorekeeper, projectionist, sound technician	4	1	5
Total		**40**	**54**	**94**

APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS

Legend

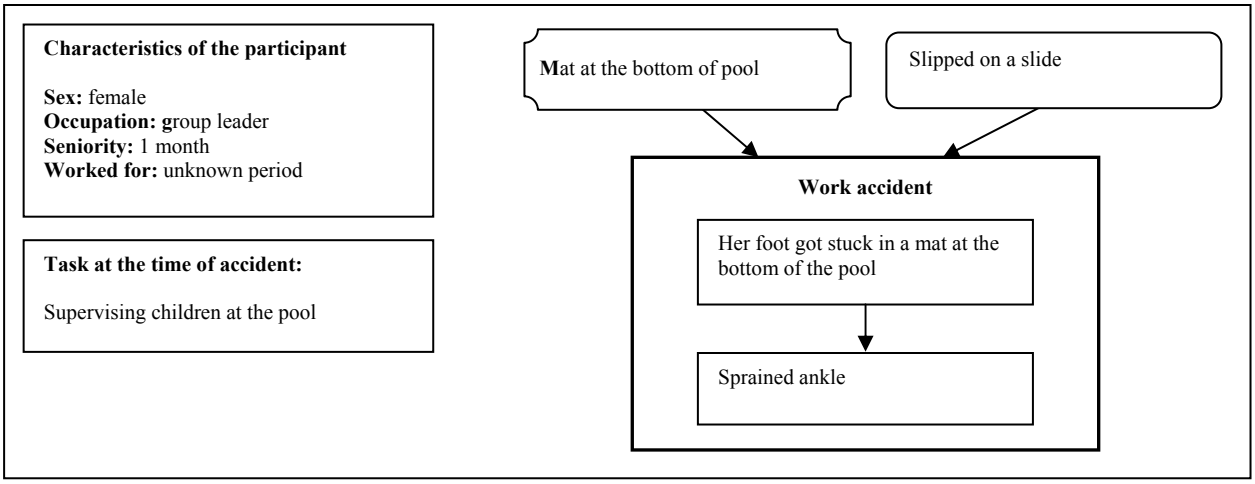


Case 1: The participant was working as a cook. He got on top of a counter to retrieve display racks placed high up. During this manoeuvre, his arm was above his shoulder; the display racks fell on him, bruising his knee, and resulting in pain that lasted a week.

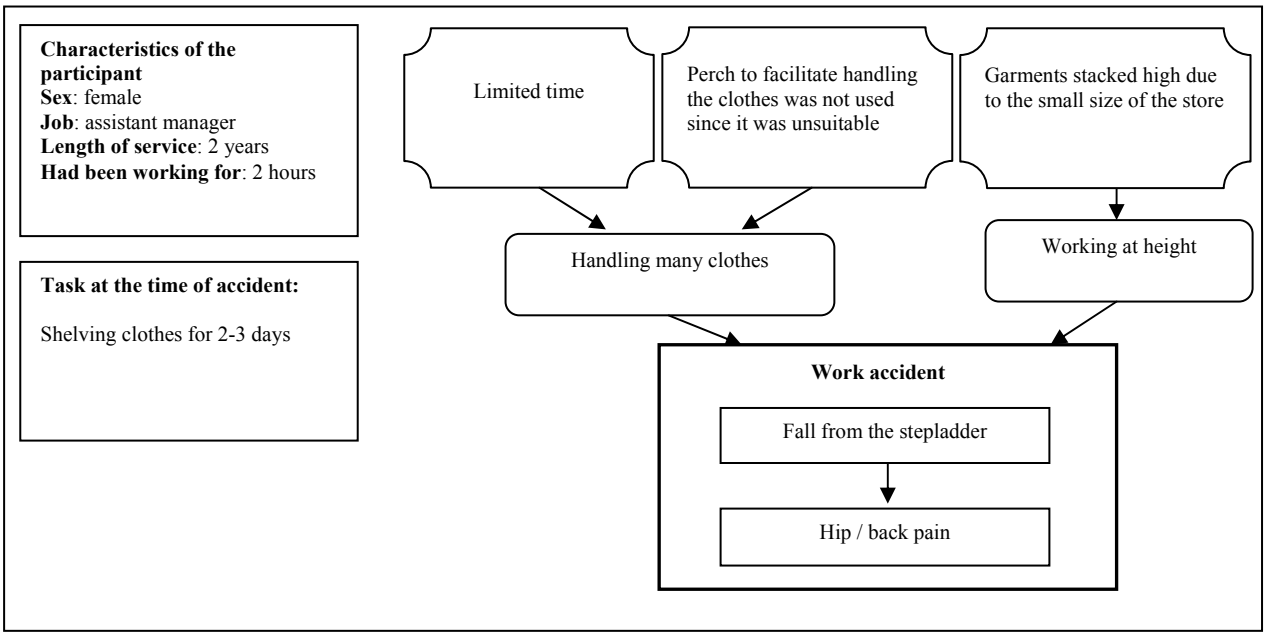


APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 2: The participant was working as a group leader with children. The accident occurred when she slipped on a slide in a pool. Her foot got stuck in a mat at the bottom of the pool, causing a sprain.

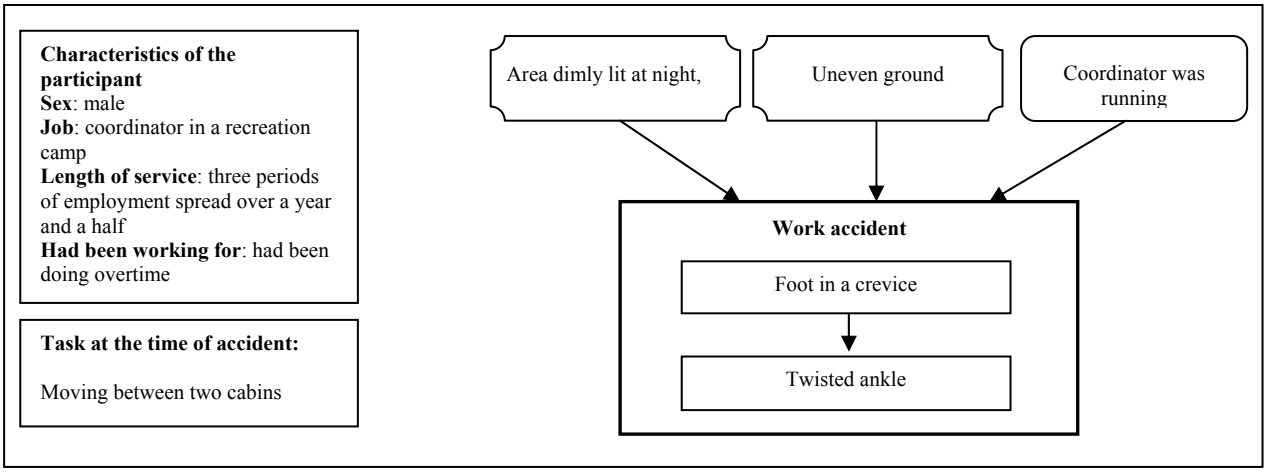


Case 3: The participant was shelving clothes in a store. Following a fall from a stepladder, she experienced pain in the back and hip. Several factors influenced the occurrence of the accident. The small size of the store meant that the clothes had to be stacked high. In addition, this person only had limited time in which to shelve the clothes, so that she was obliged to handle many clothes at height.

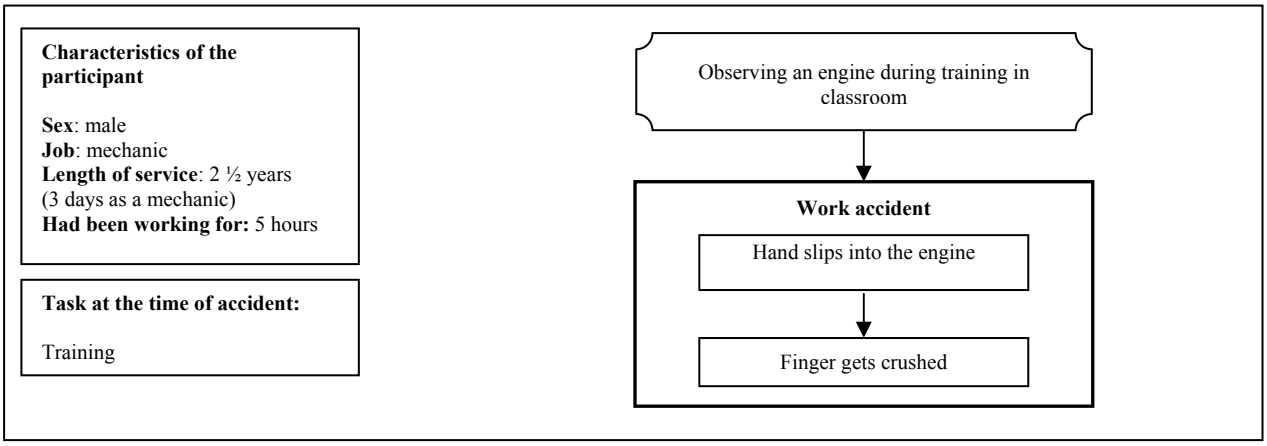


APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 4: The participant was working in a recreation centre as a vacation coordinator. While running between two cottages his foot got caught in a crevice. He limped for two days.

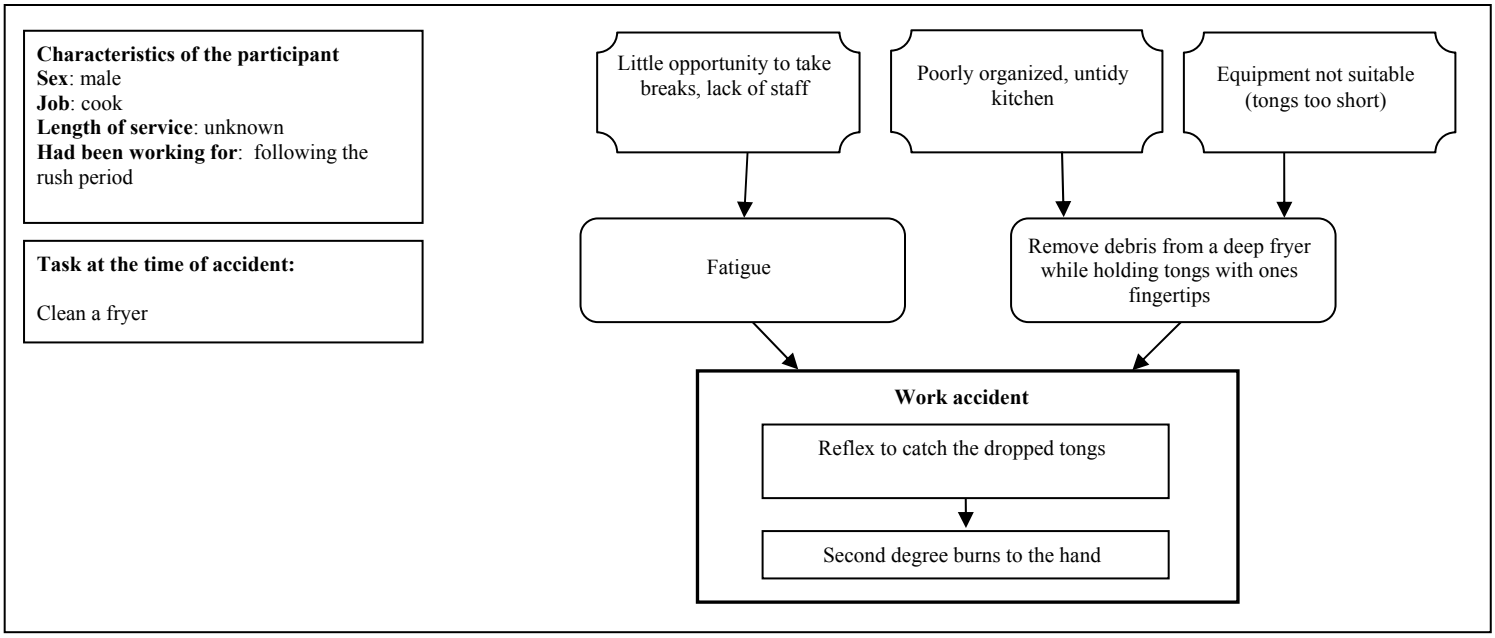


Case 5: The participant was being trained as a mechanic. In turn, each student was required to observe a running engine. When it came to his turn, his hand got caught in the engine and crushed a finger.



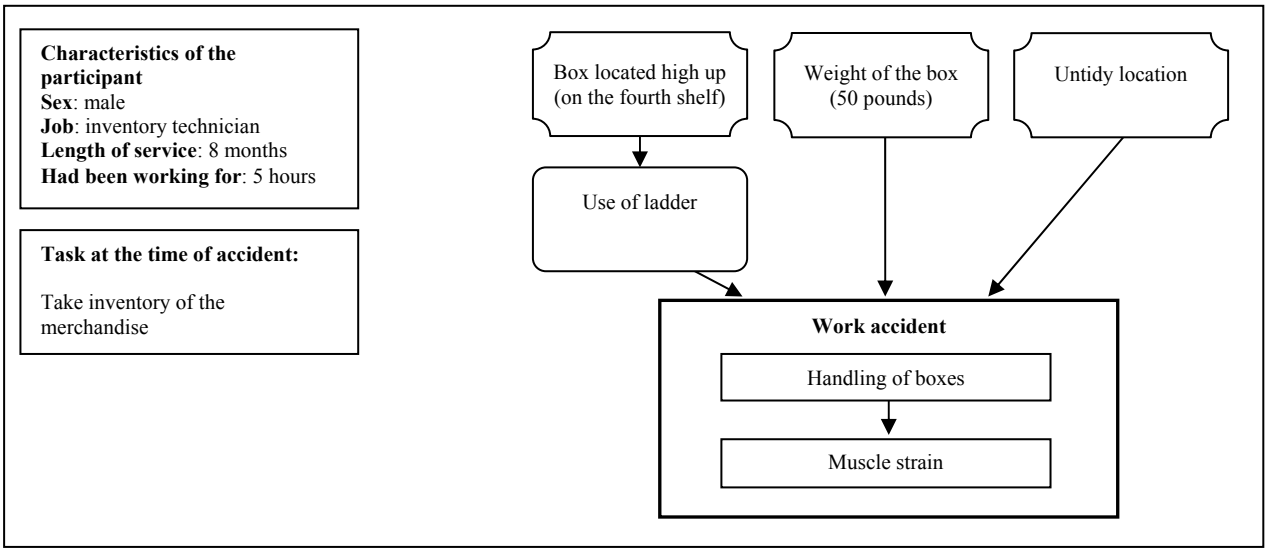
APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 6: **The participant was working in a kitchen and, using tongs that were much too short, had to remove debris that had fallen to the bottom of the fryer; these tongs were the only ones available to the worker. Employees had reported to their supervisor the potential danger of using these tongs, but to no avail. The participant had dropped the tongs and by reflex had tried to catch them. His hand sustained second degree burns. In his view, the few opportunities to take breaks, the lack of personnel and the way the kitchen was organized all contributed to the accident.**

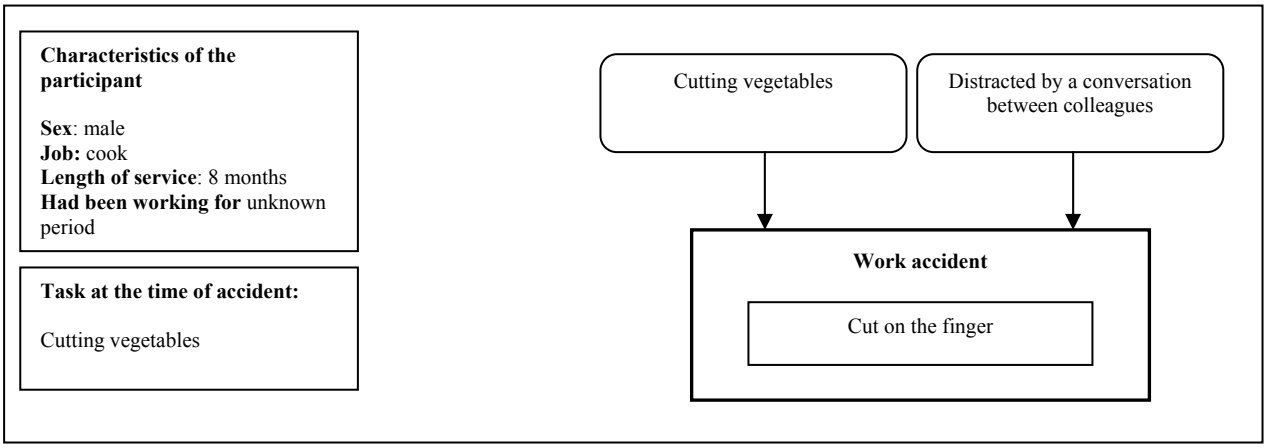


APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 7: The participant was working in a warehouse as an inventory technician. While working at a height, he had to handle a fifty-pound box. He was on a ladder working in a space that had not been not properly organized. This manoeuvre caused a muscle strain requiring his absence from work for seven weeks.

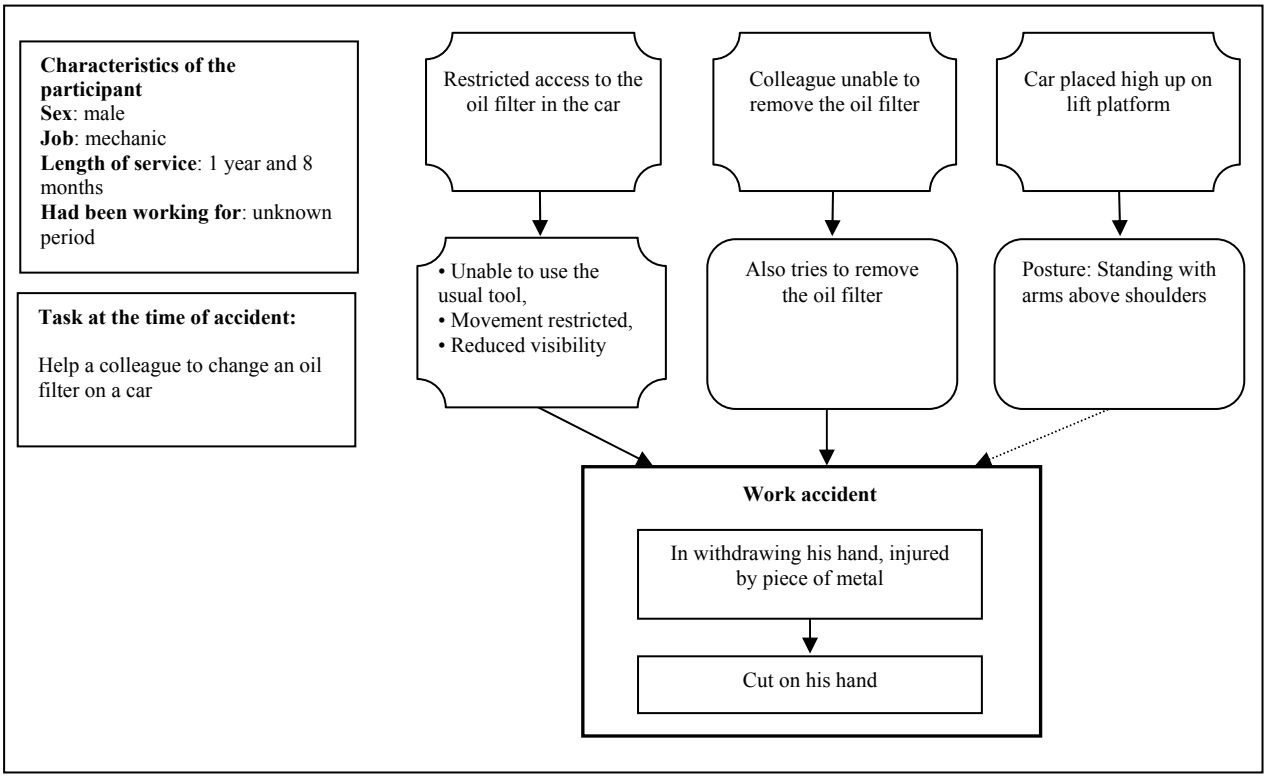


Case 8: The participant was working as a cook and cut his finger while slicing vegetables. He said he had been distracted by a stressful conversation between two colleagues.



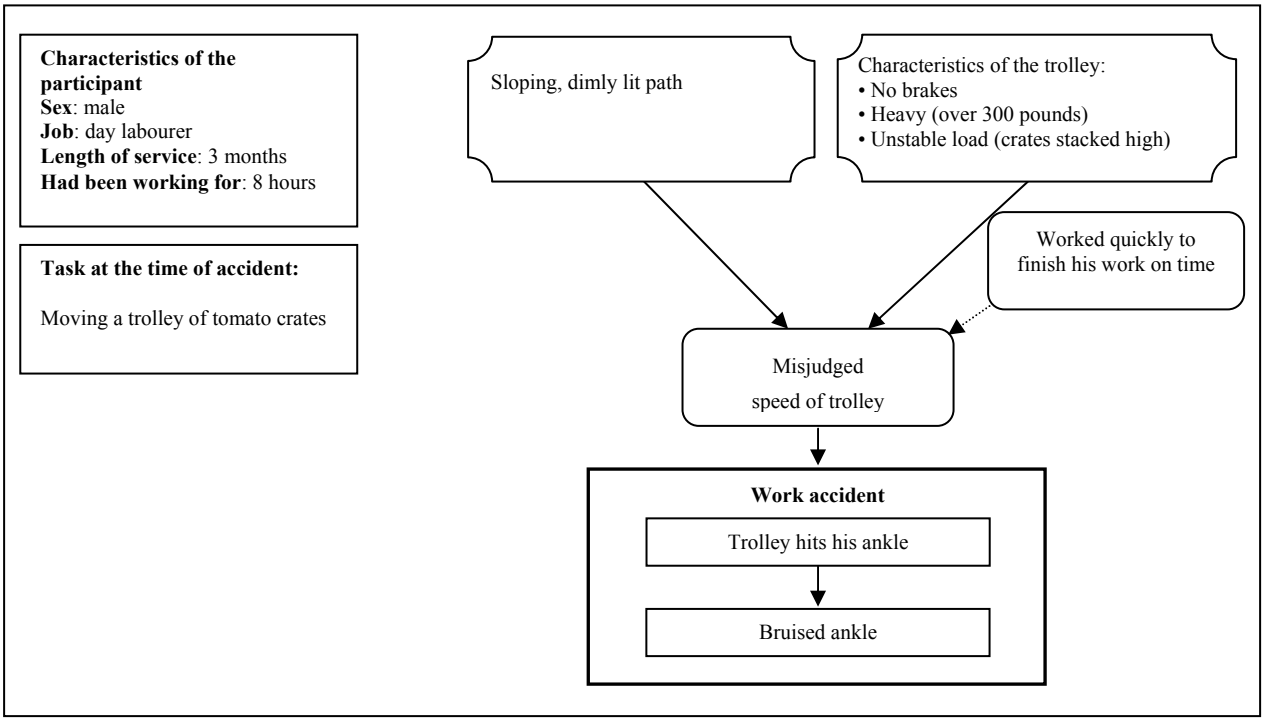
APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 9: **The participant was working in a garage as a mechanic. He was trying to help a colleague who was unable to unscrew an oil filter. The design of the car did not allow easy access to the filter. The workspace was narrow, which reduced visibility and did not allow use of the usual tool. He was injured by a piece of metal while withdrawing his hand, causing a cut that required stitches.**



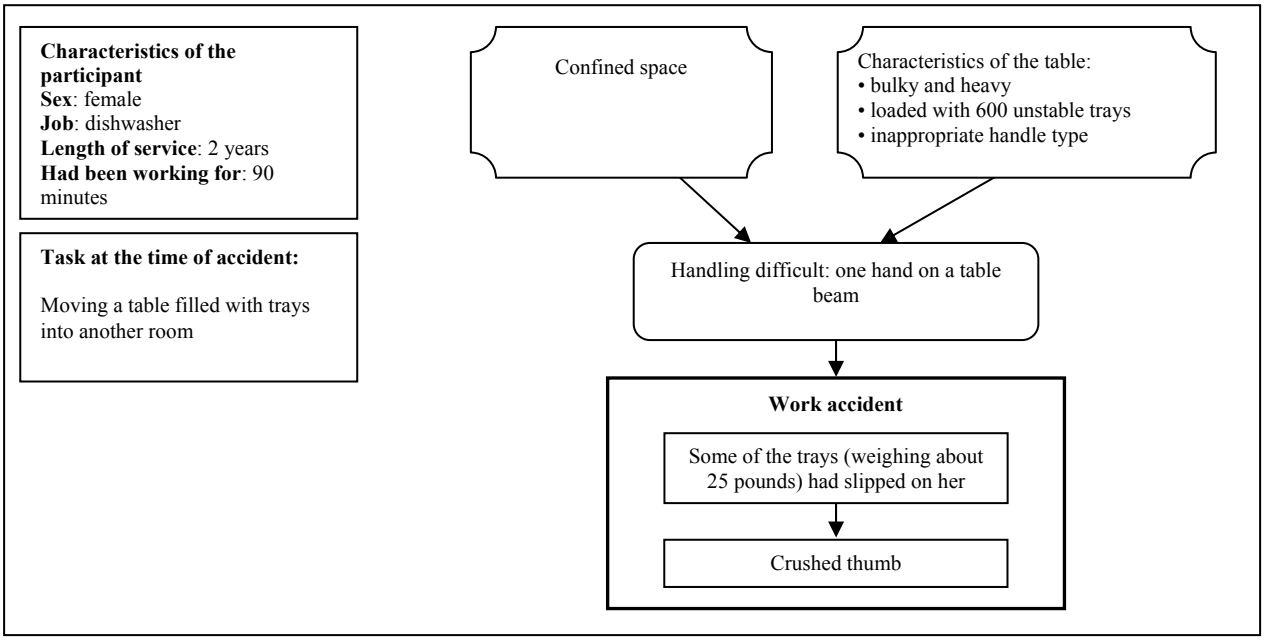
APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 10: The participant was working as a labourer. He was working quickly to complete his work on time before the end of his day. He was handling a trolley weighing more than 300 pounds, loaded with crates of tomatoes, on a dimly lit slope. The trolley had no brakes and the load was unstable (3 crates wide by 10 crates high). While pulling the trolley, it began to move faster than he had expected and struck his ankle causing a bruise (a day off followed by pain).



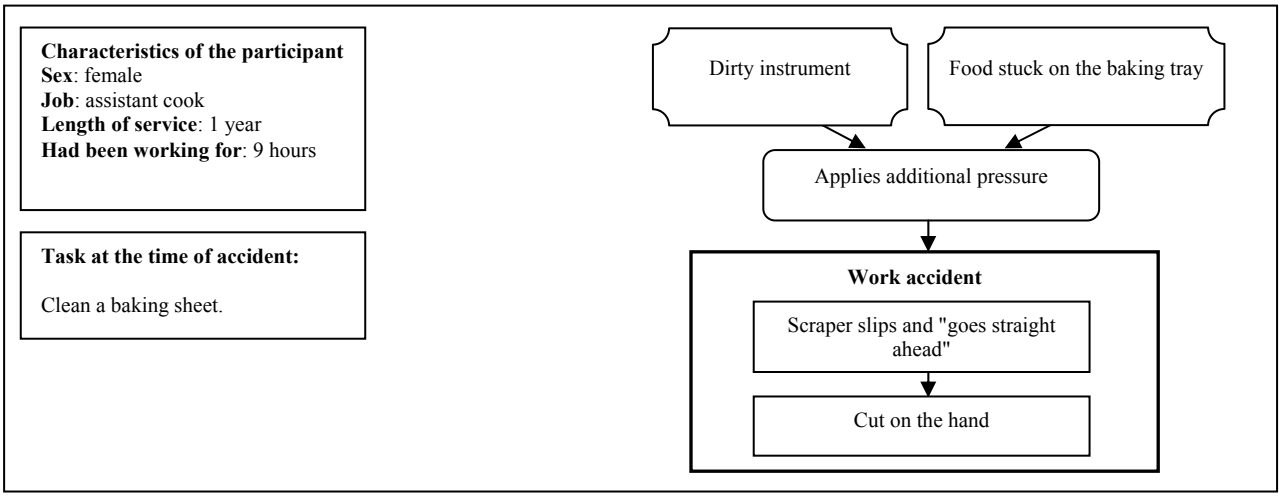
APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 11: The participant was working as a dishwasher. She was moving a table on which about 600 trays had been placed. The table design did not allow the trays to be stored stably. Also, the space available to handle the table was too small relative to the size of the room, forcing her to rotate the table 45° in a small space so that she would then be able to carry the trays into another room. However, the handles, specially designed for handling the table, did not permit sufficient rotation of the table. To perform the manoeuvre, therefore, the respondent placed one hand on a handle and her other hand on one of the table's beams. Some of the trays (weighing about 25 pounds) slipped onto the second hand. This resulted in an injury to the participant that prevented her from writing properly; she continued to experience pain in the thumb a month and a half after the accident.

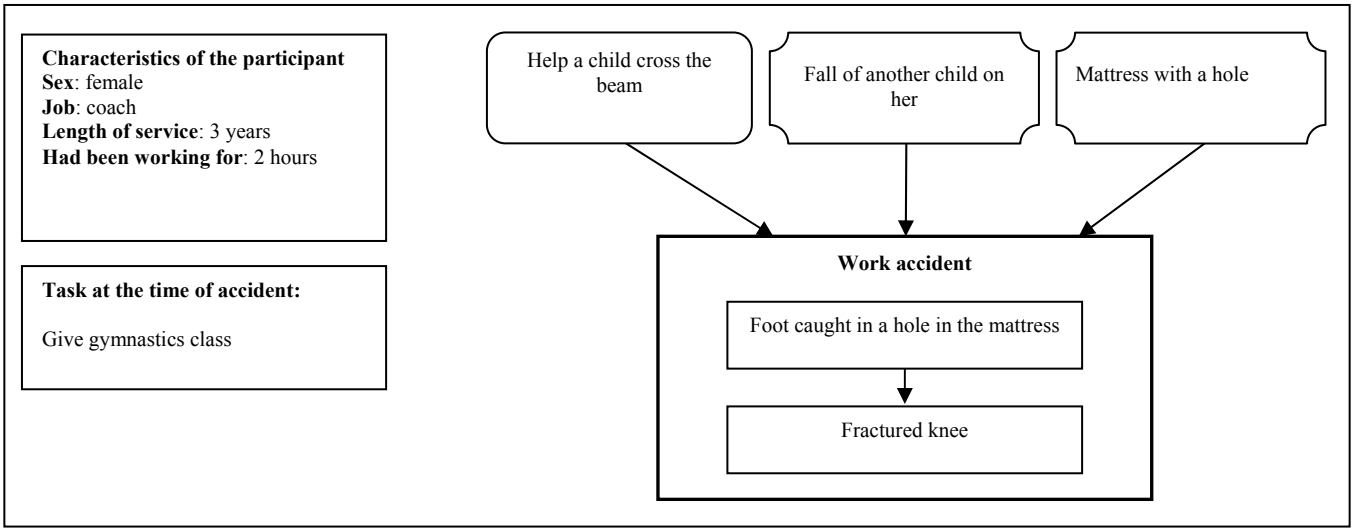


APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 12: The participant was working in a kitchen and had to clean a baking sheet. She was using a scraper for this purpose and applied some pressure to dislodge a deposit stuck on the sheet. Eventually, the scraper hit her other hand and she cut herself. The participant reported having lost sensation in her hand and could not use her finger for "a little while."

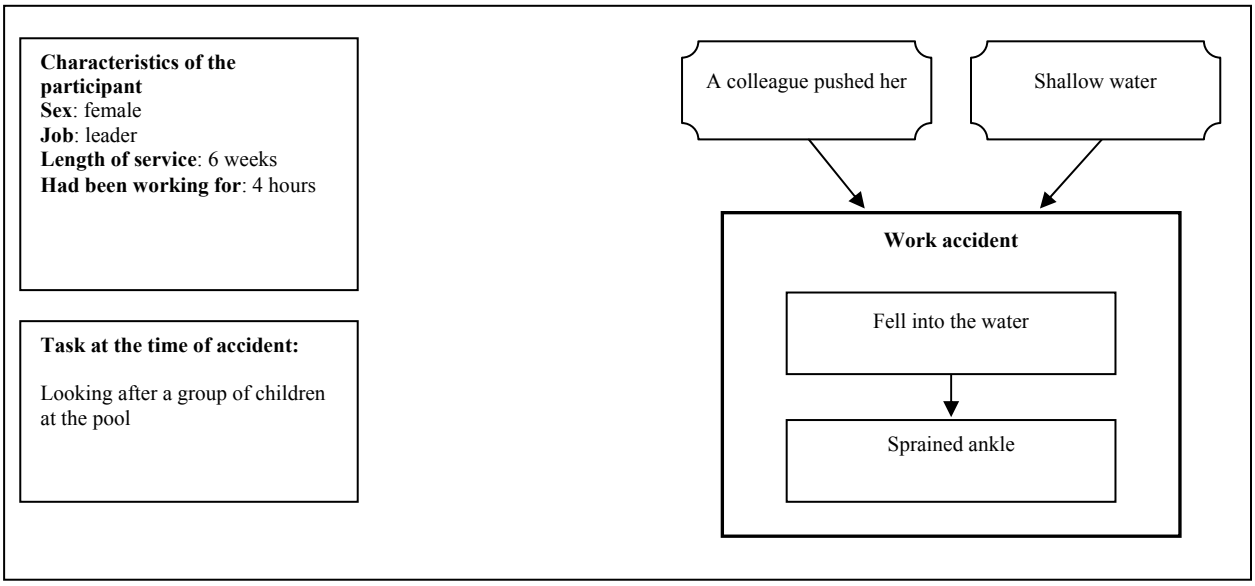


Case 13: The participant was working as a gymnastics coach and was in charge of a group of children. While she was helping a child walk along a beam, another child fell on her, another child fell on her. In catching the child, her foot got caught in a hole in the mattress, causing a fracture of the knee.



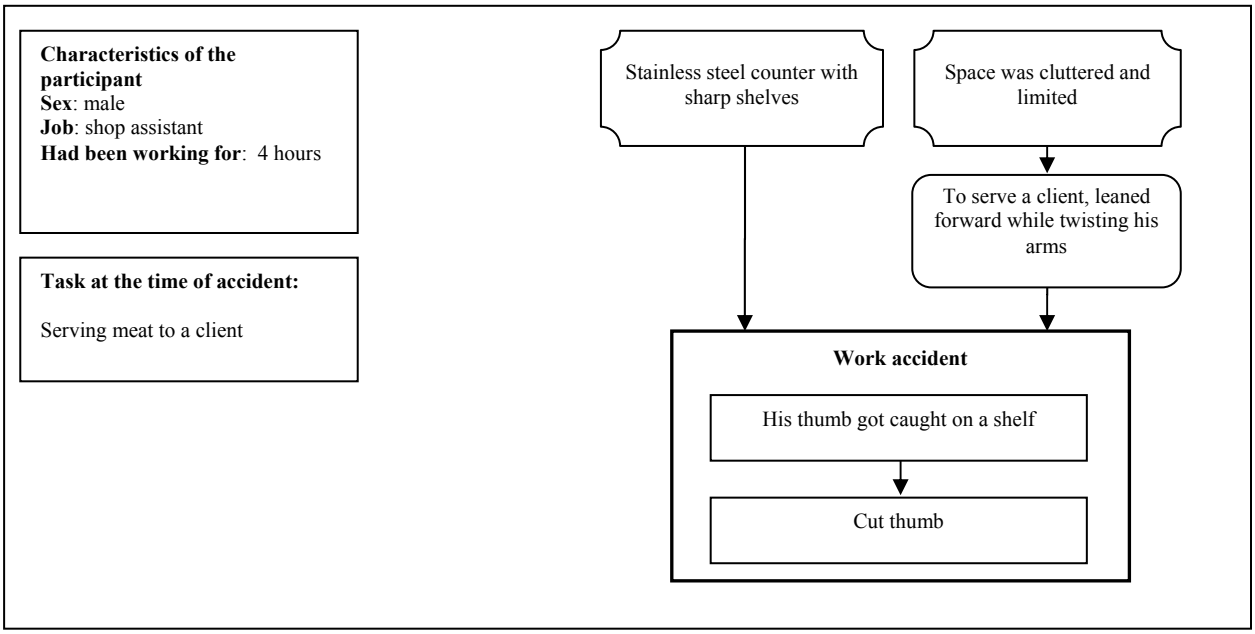
APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 14: The participant was working as a group leader for children. The accident occurred beside a pool. To make the children laugh, a colleague pushed her into the water, which, it turned out, was shallow. She sustained a sprained ankle and was off work for three weeks.



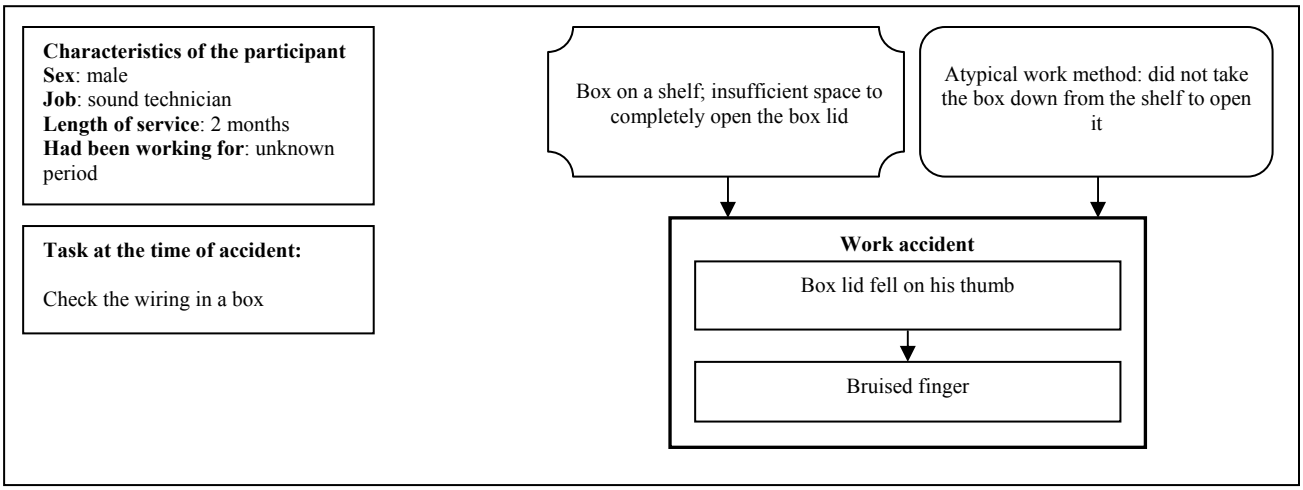
APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 15: The participant was working as a meat-department assistant. While serving a customer, he bent down to grab a piece of meat at the bottom of the display case; the space available to do so was limited. His thumb came into contact with a sharp, stainless steel shelf. He received three stitches on his hand.



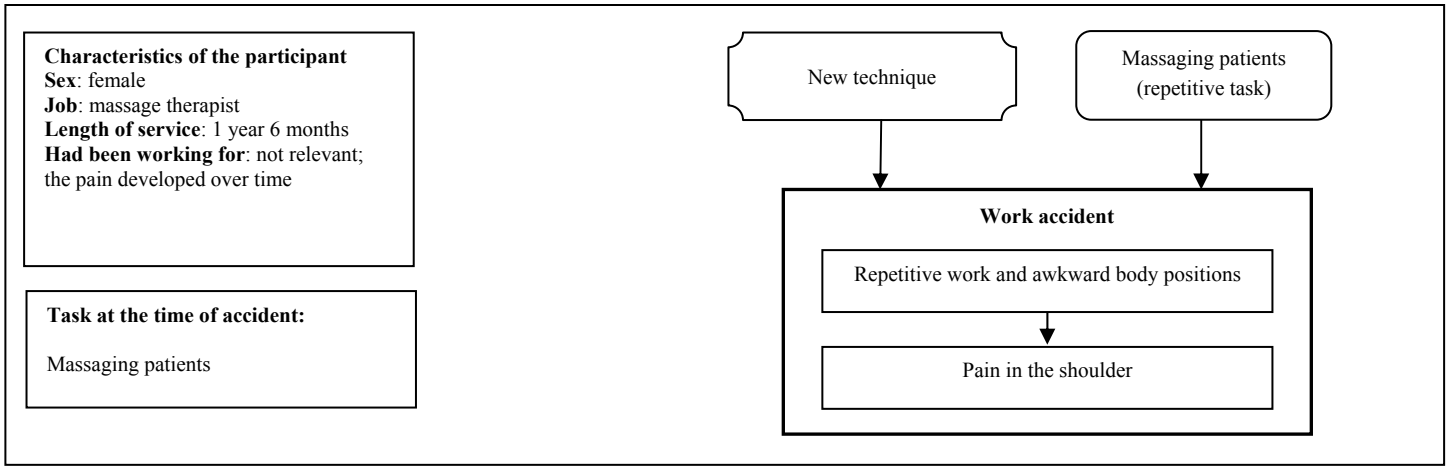
APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 16: The participant was working as a sound technician. At the time of the accident he was in a warehouse and wanted to check the wiring in a box that had been placed on a shelf. Normally, he would have used motorized equipment to retrieve the box from the shelf, but in this instance did not do so to save time. Consequently, he was unable to completely open the lid of the box, which was wedged against the shelf above. While removing his hand to close the box, the lid fell on his thumb. He had pain for several days and still has a scar.



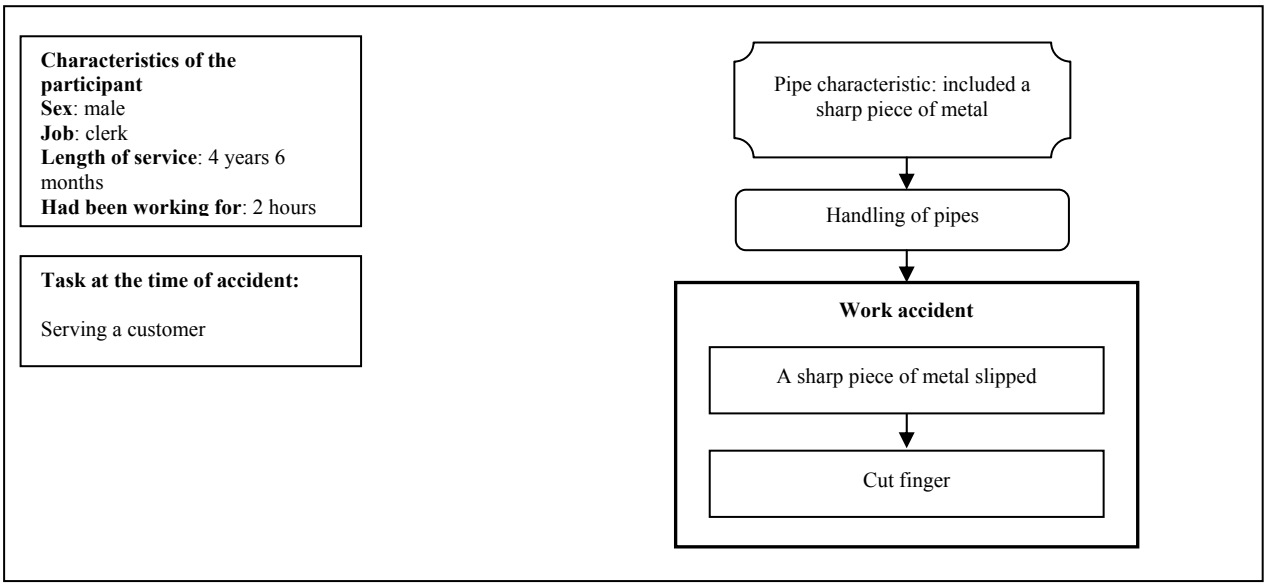
APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 17: The participant was working as a massage therapist. The injury occurred following the introduction of a new treatment technique her supervisor had shown her. After a time, she started to feel pain in her shoulder; she was supposed to use a pulling motion instead of applying the weight of her body in the massaging motion. The injury prevented her from engaging in certain recreational activities for a month, and for a time she had to modify the work methods she employed in her second job. She has since modified her technique so that the posture adopted is less demanding.



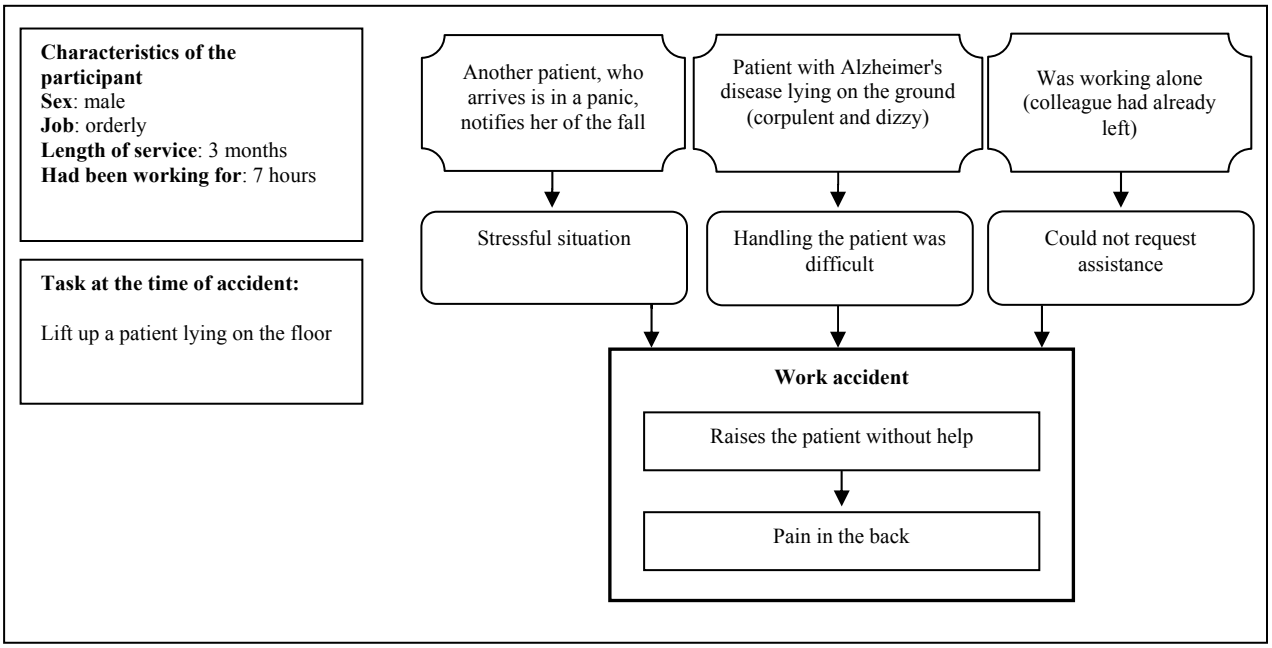
APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 18: The participant was working as a sales clerk. He was serving a customer while handling a stovepipe. The stovepipe parts that the store received were not pre-assembled, and the edges and notches used in assembling the stovepipe were sharp. While handling these various parts, a piece of the metal slipped and cut him in the finger (the description available did not allow us to ascertain whether the young respondent was wearing gloves). He had to work at a different job for two weeks.



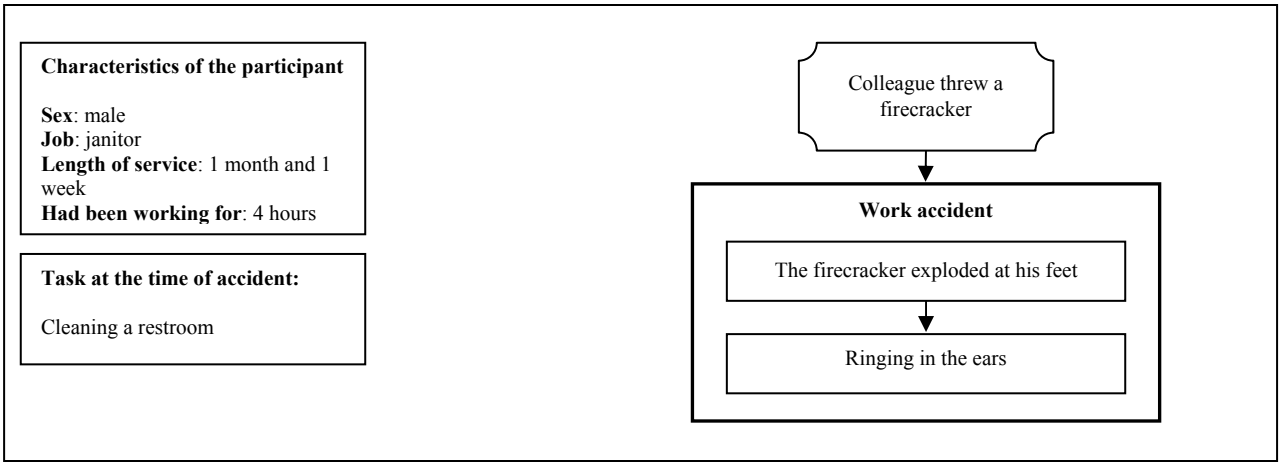
APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 19: The participant was working as an orderly in a nursing home. As she was folding laundry, a patient in panic turned up and reported that another patient had fallen. At that moment, the employee believed the patient could have died. The patient who had Alzheimer's disease and was lying on the floor of her room was difficult to raise as she was corpulent and dizzy, and consequently uncooperative. The orderly had enough room to raise and lift the patient, but would have requested assistance from her colleague (a cook) had the latter not already left. As a result, she injured her back and claimed to "have been stiff" for two days.

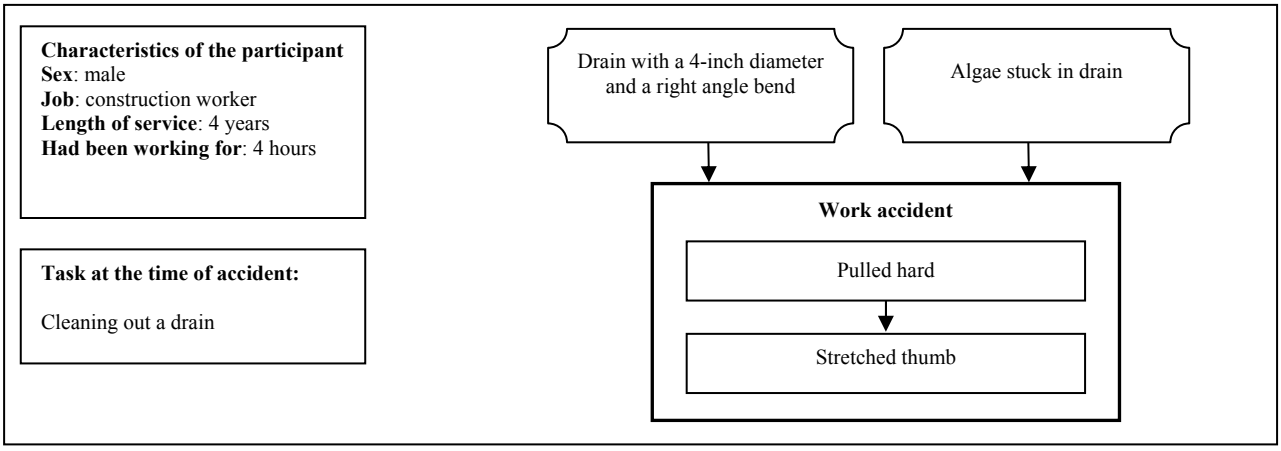


APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 20: The participant was working as a janitor. On arriving at a restroom in order to clean it, a colleague whom he could not identify threw a firecracker at his feet. As a result, he sustained a ringing in his ears lasting one week.

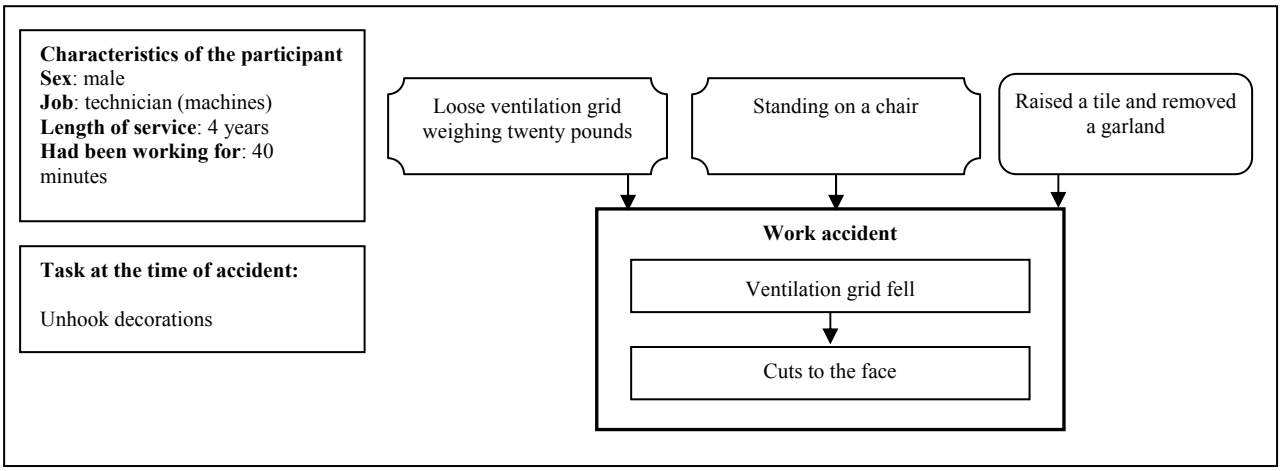


Case 21: The participant was working in the construction field. He was dislodging algae and roots stuck in a right-angled drain (a drain with an elbow bend). After digging a hole to reach it, he put his hand into the drain to unclog it. He pulled hard, which resulted in his stretching his thumb. Two weeks after the accident, he still could not write or apply physical force with his hand. It also bothered him while driving.



APPENDIX I: DESCRIPTIONS OF CIRCUMSTANCES SURROUNDING WORK ACCIDENTS – CONTINUED

Case 22: The participant was working as a technician. At the time of the accident, he was removing decorations (wreaths, balloons, etc.) attached to the ceiling. Normally, the janitor performed this task, but the participant often did it because there was less work on Sunday evenings. He had got up on a chair and was raising a ceiling tile with one hand while removing a garland with the other. As he let go of the tile, a loose ventilation grid nearby (weighing 20 pounds but with no chain to hold it in place), fell on him, lacerating his face. He received seven stitches.



Case 23: The participant was working as an activity leader in a centre for disabled children. When the time came to leave, a child dealt her a blow to the face and broke her nose.