

An Investigation into the Etiology of Injuries in Ski-area Employees

EXECUTIVE SUMMARY

Introduction and Rationale: Injury rates in the young workers that staff snowsport resorts are well above the provincial average. Previous work has shown that exercises to correct poor body postures and improve physical fitness can help to prevent injuries, even when the work performed is physically demanding. In addition, many accidents resulting in injuries can be attributed to momentary loss of attention. Since the brain and spinal nerves are dependent on blood sugar levels and adequate hydration for optimal function, it may be that dietary changes to stabilize blood sugar and maintain hydration levels can also enhance vigilance and reaction time, and thus decrease the number of injuries resulting from slips, falls or struck by or against an object. Hence, the first purpose of this study was to characterize the physiological demands experienced by young workers employed at snowsport resorts. Specifically we aimed to characterize the factors that contribute to injuries in ski patrols, lift operators and snowsport instructors, including poor control of joint stability, poor dietary practices, inattention and fatigue. The second purpose was to use this information to develop and test a specific dietary and fitness intervention program for snowsport resort employees, with the intent of determining if such a program could be effective in reducing injury rates.

Methods: During the first year of the study 25 patrols, 25 lift operators and 25 instructors at 5 snowsport resorts in western Canada volunteered to participate in the study. Prior to the start of the season each worker underwent a functional movement assessment designed to evaluate whether or not the worker could perform the types of tasks required at their job while maintaining good posture and joint stability. Demographic information and activity and injury histories were also collected. Once the season was underway, each participant was monitored during a typical day at work including wearing a continuously recording heart rate monitor for the assessment of the overall physical demand of the work; completing a series of reaction time tests and a blood sugar test every two hours; monitoring daily hydration level; and recording all food and drink consumed for that day as well as for an additional two days of their normal food consumption pattern.

Following completion of the data collection phase the findings were utilized to construct a corrective program specific to the needs of the worker demographics, culture, and lifestyle that addressed areas of mismatch between movement strategies and the demands of the work tasks, general fitness practices and dietary and hydration habits. The *Fit for Snow* program consists of a small handbook; *The Top Ten Tips*, as well as a parent book; *Fit for Snow* (coil backed 21.5 by 14 cm), workshops, a pre-season fitness program and in-season support strategies.

During the second year of the study the *Fit for Snow* books were made available to 75 employees at the five test ski areas, along with training sessions during scheduled staff orientations. In addition, supervisors were coached on how to support the program with

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practical strategies and weekly tips. Outcome measures included surveys and a comparison of injury rates at the 5 test ski areas over time, as well as to similar areas that did not utilize the program.

Results: Findings of the first phase of the project were somewhat surprising. Although patrols, instructors and lift operators work mostly out of doors, the actual physical demands varied widely. Heart-rate data indicated that for the most part the physical load was quite low, 39% of employees did not even meet the minimum recommended daily activity level of 30 minutes of moderately vigorous activity/day. Patrols had the highest activity level, and this was reflected in the finding that they had the lowest level of body fat as well as the highest level of recreational activity. A shocking proportion of lift operators and instructors were overweight (38% and 42% respectively) and even obese (27% and 20% respectively).

The functional movement assessments indicated that the vast majority of workers tested utilized strategies for stabilization that may contribute to the risk of injury. The results of a test designed to load the lumbar spine (lifting a pair of skis) with destabilization (single leg-stance) indicated that only 7% of tested employees could control movement at the lumbar spine, hips and knees while performing this action. The endurance test designed to mimic loading of the lumbar spine, hips, and knees while travelling downhill indicated that only 3% of tested employees could control these joints when fatigued and only 11% of tested employees could control movement at the shoulder joint when load was applied to the the thoracic spine. Part of these poor results may be that 91% of participants reported some level of chronic pain from a previous injury as muscle imbalances or incompletely rehabilitated injuries can lead to altered movement patterns. In addition the cultural postures associated with snowboard stance, or the shift in posture and center of gravity from wearing a backpack and/or stiff ski boots can all have contributed to the observed movement patterns.

Blood glucose and reaction time testing also revealed a pattern that could be contributing to the high injury rate in snowsport resort employees, with 25% of employees experiencing at least one hypoglycemic event/day. When questioned regarding the symptoms of hypoglycemia (fatigue, confusion, poor concentration, anxiety, irritability, sudden change in body temperature, shakiness, loss of coordination) 51% of employees reported experiencing symptoms. An examination of 5 years of injury records at the 5 test ski areas based on time of day indicated that 60-80% of injuries occurred when blood sugar levels could have been expected to be low.

Overall, ski area employees did not practice good nutritional or hydration strategies. Eighty-five percent of employees studied did not meet the minimum Recommended Nutrient Intake (RNI) for water, 43% had water intakes less than half of this value. The intake of saturated fat, total fat and sugar were more than twice the RNI. Intakes of many important nutrients were inadequate including fiber, the vitamins D and E, minerals potassium and magnesium and unsaturated fatty acids including omega-3 Fatty Acids.

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The results of the surveys to evaluate the second or implementation phase of the study indicated that the program was well accepted and widely used at the resorts where management supported the program. Workers participated in the workshops with great enthusiasm, and there were many requests for the information in the program to be shared amongst co-workers. In areas where weekly coaching was provided it was very well received, many workers commented that they would have liked even more information, more access to continued coaching to achieve the lifestyle modifications and more evidence of internal support such as healthier staff meals. Workers reported subjective feelings of less fatigue, an increased ability to stay alert, less joint and muscle pain and improvements in skiing and riding performance with better hydration, improved quality and timing of food intake, and utilization of the joint stability and fitness programs.

The objective evidence for the effectiveness of *Fit for Snow* in injury prevention comes with the highly significant reduction in the number and severity of injuries at the participating resorts. Worker compensation claims were reduced by 70% from the 2010/11 season to the 2011/12 in participating resorts while claims in 4 resorts that did not utilize the program increased by 25%. In addition, the number of incidents that occurred at times of day when the worker was likely to be low in blood sugar (late morning and afternoon) also declined to 32% from the 5 year average of 66% in the 5 test areas.

As with most applied research, there are some considerations regarding the findings of the current study. Due to the nature of the subject group there are many uncontrolled variables including but not limited to weather, equipment, extracurricular activities and a seasonal work force. In addition, each resort has its own procedure for classifying and recording injury events, making it difficult to compare results between areas. These factors notwithstanding both the subjective reports from the workers that were exposed to the program and the objective observations in the number of injuries sustained in participating resorts speak strongly in favour of the positive effect of a culturally and contextually specific health and wellness program in reducing injuries in patrols, instructors and lift operators working at snowsport resorts. The study findings indicate that providing these young people with quality information in a format that is interesting to them was effective in promoting behavioral change. The *Fit for Snow* program is a strong beginning to the development of such a program and warrants further consideration.

Although there is a significant initial cost in implementing a program like *Fit for Snow*, both the study findings and previous work have clearly shown that financial consideration for adoption of the program must include the rising insurance and compensation costs that result from the high injury rates in these workers. The work of the study author among others has also shown a strong financial argument for the implementation of such a health and wellness program in employee productivity as well as decreased employee turnover, especially important in this type of industry. Developing healthy nutritional habits that stabilize blood sugar, encouraging workers to stay well hydrated and incorporating movement awareness exercises to correct posture and develop good joint stability will help to reduce accident and injury events in snowsport resort workers.