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A New Perspective on Identifying and Addressing Risk Factors Associated with Low Back Musculoskeletal Disorder (LBMD): Contribution to Improving Prevention Programs in the Workplace

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Abstract

Background: Low Back Musculoskeletal Disorder (LBMD) is the most prevalent and costly in the United States (U.S.) and accounts for a significant amount of Back Pain (BP) and suffering, leading to increased worker absenteeism and workers' compensation (WC) claims. LBMD is not a simple one-to-one relationship, but rather the combination of key risk factors within a complex system.

Method: Logistic regression model with retrospective data (2006-2009) from 9,149 employees who participated in a work-life program at a Midwestern university was generated to determine the risk factors for the 15.5% (n=1,414) who reported that they had self-reported on-going back pain (SOBP) serious enough to interfere with their daily activities. To understand the complexity surrounding SOBP, the dataset contained WC claims, Occupational Safety and Health Administration 300 Logs, biometric and lifestyle risk factors. To identify LBMD risk factors, SOBP risk factors will be compared to risk factors for CLBP and LBI.

Results: Five risk factors associated with SOBP serious enough to interfere with their daily activities are medical diagnosis of CLBP, persistent neck and wrist pain (tingling or numbness), previous LBI, and overall bodily pain. The risk factors associated with LBMD (SOBP, CLBP, LBI): Age, gender, lifting/twisting/bending, stress, person with high blood pressure, physical health (bodily pain), emotional health (level of depression) and fatigue.

Conclusion: LBMS is a combination of key risk factors within a complex system that consists of SOBP, CLBP, and LBI. Identifying and understanding the risk factors for SOBP and its relationship with CLBP and previous LBI is essential to contribute to the current efforts when developing new and improving existing Workplace Preventative Strategies (WPS). Implementing WPS to reduce LBMD must not only consider traditional ergonomics equipment and training but consider strategies to reduce the risk factors for SOBP, CLBP and LBI.

Keywords: Low back pain; Lifestyle risk factors; Prevention; Chronic low back pain; Musculoskeletal disorder

Abbreviations: BP: Back Pain; CLBP: Chronic Low Back Pain; EDA: Exploratory Data Analysis; HRA: Health Risk Appraisal; LBI: Low Back Injury; LBMD: Low Back Musculoskeletal Disorder; OSHA: Occupational Safety and Health Administration; SOBP: Self-reported on-going back pain; SPSS: Statistical Package for Social Science; WC: Workers' Compensation; WPS: Workplace Preventative Strategies

Introduction

Back Pain (BP) is by far the most prevalent and costly musculoskeletal disorder among United States (U.S.) industries today. BP, also referred to as Low Back Musculoskeletal Disorder (LBMD), is defined as "pain in the lower back area that can relate to problems with the lumbar spine, the discs between the vertebrae, the ligaments around the spine and discs, the spinal cord and nerves, muscles of the low back, internal organs of the pelvis and abdomen, or the skin covering the lumbar area" [1]. The duration of LBMD varies from a few days, more than a few days to a few weeks (acute or short-term BP) or persists for more than three months (chronic BP) [2]. Eighty percent of people will experience BP over their life time [3]. BP is the fifth most common health problem for physician visits in the U.S. [4,5], with 26% of American adults reporting pain on at least one day every three months [6]. LBMD creates a substantial personal, community, and financial burden [7-9] where the direct and indirect costs incurred cost Americans approximately $50 billion each year [10]. In an occupational setting, LBMD accounts for a significant amount of pain and suffering, and workers' compensation (WC) claims which often lead to an increase in worker absenteeism rates [11]. LBMD claims are the most common category of WC losses, accounting for 15-25% of all claims and up to 40% of costs [12,13]. The recurrence rate of LBMD is significantly high as reported in various studies, with a lifetime recurrence rate even higher ranging from 70-80% where 60-70% need up to six weeks to recover from back pain, and 80-90% need up to 12 weeks [14].

Research has shown that when ergonomic prevention strategies are applied appropriately, often times they can result in substantial cost savings for companies [15-18] and strong empirical evidence suggests that early prevention and intervention are more effective at preventing chronic pain and disability than attempts to treat pain and disability once it has been established [19]. Available treatments for LBMD focus on detecting relevant subgroups of patients with BP with a different

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prognosis and susceptibility to specific treatments [9]. However, the cause of LBMD problems remains obscure in most patients, and the generalized primary prevention does not appear to be feasible [20,21]. It is the author's intention to make a contrast between single-cause models of health accident outcomes and the need for approaches that are more complex to raise awareness for prevention or mitigation methods, as other studies have done [22-27].

A range of individual conditions, such as psychosocial and occupational factors, have been identified as risk factors either for the occurrence of LBMD or for the development of chronicity [9,28,29]. However, it is not necessarily clear whether an individual difference is a cause or an effect. Hence, LBMD is best explained in relation to three categories, which are the topics of the author's three-part series: low back injury (LBI) documented in WC claims [30], Chronic Low Back Pain (CLBP) diagnosed by a medical professional [29], and self-reported on-going back pain (SOBP). The goals of this manuscript are to: 1) Outline the occupational and lifestyle risk factors that may contribute to SOBP; and 2) Discuss a more in-depth understanding of LBMD based on the risk factors previous determined for CLBP and LBI based on a similar population and the risk factors for SOBP from this study.

The findings from this study are focused on making a contribution to Workplace Prevention Strategies (WPS) to help catch LBMD early, when treatment is most effective, resulting in healthier employees, higher productivity [31], fewer sick days [32], and a greater sense of well-being [33]. This study does not attempt to present a hypothesis-driven model (testing specific factors) to understand the risk factors associated with SOBP but rather a visual picture based on a data mining process. This process provides an opportunity to "learn from data" where information (i.e., important patterns and trends) are extracted from a data set and transformed into an understandable structure for future use.

Materials and Methods

Study approach

The approach used an analytic process outlined by Bidassie [34] to explore the large amounts of retrospective data available in the Health Risk Appraisals (HRA) [35], WC and Occupational Safety and Health Administration (OSHA) Logs dataset; in search of consistent patterns, and/or systematic relationships between variables based on the conceptual principles of statistics including the traditional Exploratory Data Analysis (EDA).

This SOBP study used the "potential effects" fatigue, stress, physical health (e.g., bodily pain), and emotional health (depression and anxiety) as outlined by Bidassie [34] to understand the association of occupational and lifestyle risk factors associated with SOBP. Depending on an individual's physical [36] or emotional health [29], potential effects may contribute to impairment [37,38] or inhibit concentration [39].

While this model gave insight into valid predictions, it did not identify the specific nature of the interrelations between the risk factors. The focus produced a solution approach (the role of the input variables in explaining the outcome in a search for a parsimonious model involving a subset of the variables) that can generate useful predictions in future studies, rather than determining the nature of the underlying functions or the types of interactive, multivariate dependencies between risk factors. The model can be used for classifying high-risk groups for guiding early-detection screening for SOBP among university employees'.

Conceptual framework

Figure 1 is a modification based on the original conceptual framework outlined by Bidassie [29,33,34] their time and engagement with this study.

Similar to employees with LBI and/or CLBP, employees with BP may experience difficulty in the execution of tasks in the workplace, and inability to participate in social activities and routine work both in and outside of the workplace [29,30,34,37-39].

Study design

The Human Resource Services at a Midwest university unveiled a university-wide health improvement initiative for benefit-eligible faculty, staff, and their spouses [29,34]. Participants were given the opportunity to complete a voluntary standardized HRA questionnaire to evaluate their health risk factors [34]. Once the employee completed an HRA and a wellness screening, he/she received a financial incentive, a personal health report, one-on-one telephonic coaching for health and lifestyle risk factors, and additional print resources.

This retrospective study was based on three years of data from January 2006 through December 2008. Available WC claim and OSHA 300 Logs data for employees who completed an HRA were also included. In the United States, an approved WC claim allows an employee who is injured at work or acquires an occupational disease to receive benefits; including wage replacements, medical treatment, vocational rehabilitation and others [40]. When an injury occurred in the workplace (e.g., LBI), an authorized safety professional documented the first incident and cause of the injury in the OSHA 300 Logs. If the incident received an approved WC claim for LBI, the case was added to the study. Details of the incident location, a reported cause of the injury, and a description of the nature of the injury were stored in the OSHA logs data. This research was approved by the university's Institutional Review Board (IRB).

Study sample

From January 2006 through December 2008, 9,149 employees participated in the university's work-life program, of which 15.5% (n=1,414) reported that they had an on-going problem with back pain that was serious enough to interfere with their daily activity. These people were then compared to the remaining 84.5% (n=7,735) of the employees who also participated in the university's work-life program and reported that they did not have an on-going problem with back pain that was serious enough to interfere with their daily activity.

Data collection

This study modeled the data collection process outline by Bidassie [34]. The encrypted de-identified final dataset used in the analysis consisted of OSHA logs, WC claims, and HRA data for the employees who participated in the university's work-life program from January 2006 through December 2008.

OSHA 300 logs: OSHA 300 logs provided information on employees' job status, department, date of injury or onset of illness, location where incident occurred, description of injury or illness, cause of accident, type of injury, eligibility of injury for WC, job transfers, missed or restricted workdays, and employee death [11].

Workers' compensation (WC) data: WC data provided the following data: age, gender, employment status, job status, marital status, number of dependents, years of work experience, cause of workplace injury, and part of body affected, date of workplace injury, lost days and WC paid.

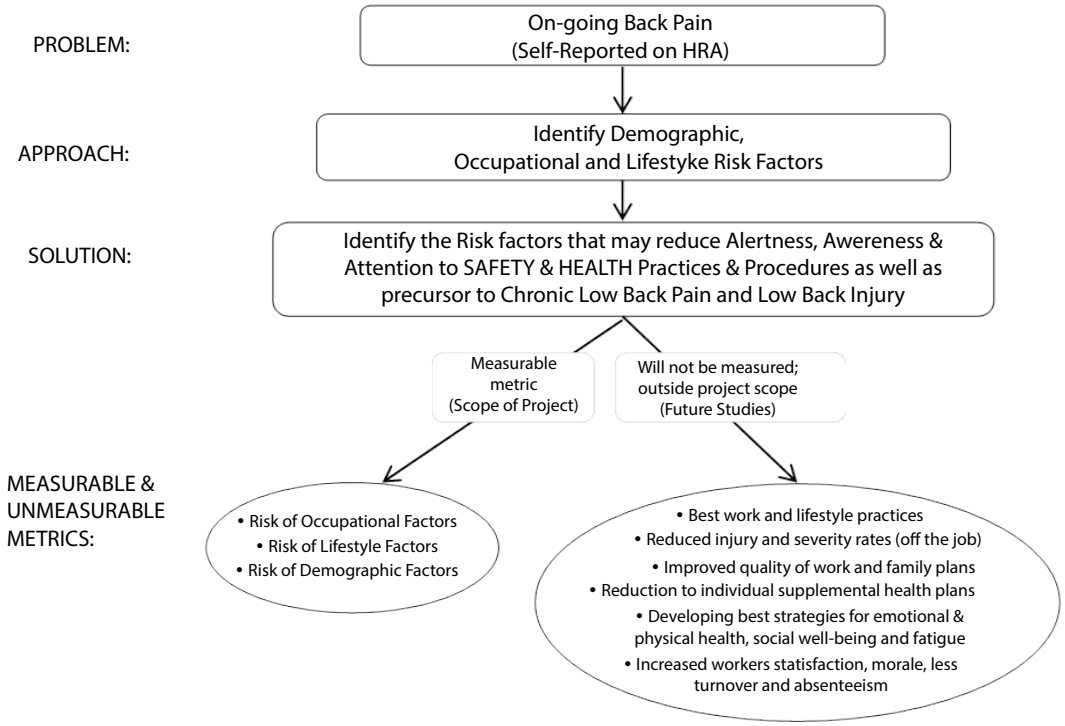

Figure 1: Systematic problem solving process.

HRA data: The HRA data provided biometric data and the following lifestyle risk factors: 1) Occupational and Lifestyle Risk Factors: socio-demographics, occupational, physiological, psychological, psychosocial factors, family health history, alcohol use, smoking or tobacco use, sleeping habits, self-care, suggested examination/immunization, medication usage, physical activity, and attitude toward daily safety precautions; 2) Biometric data: height, weight, cholesterol, glucose, and blood pressure measurements; 3) Potential Effects: Fatigue, level of stress from minor annoyances to fairly major pressures, problems or difficulties; physical health (perceived health and physical condition), and emotional health (feeling depressed, down or hopeless); and 4) Impairment: Emotional health and/or physical capability.

Framework for statistical analyses

Dependent (response) variable: The dependent variable had two-response option: "Do you have an on-going problem with back pain that is serious enough to interfere with your daily activities?" The responses are Y=1 (reported have on-going problem with back pain was serious enough to interfere with daily activities) and Y=0 (they did not have an on-going problem with back pain that was serious enough to interfere with their daily activity).

Independent (predictor) risk factors: Independent risk factors included: demographic information, occupational factors, and non-occupational factors as listed in section 2.5.

Statistical analysis

The data mining process using the Statistical Package for Social Science (SPSS) 16.0.1 consist of three stages: (1) The initial exploration; (2) Model building or pattern identification with validation/verification; and (3) recommendations in deployment (i.e., the application of the model to new data in order to generate predictions).

Stage 1: Stage 1 (Exploration) focuses on data preparation which may involve cleaning data, data transformations, selecting subsets of records since our data sets consisted of large numbers of variables. To bring the number of variables to a manageable range, this first stage may involve anywhere between a simple choice of straightforward predictors for a regression model to elaborate exploratory data analysis using a wide variety of graphical and statistical methods (e.g., descriptive and t-test) to identify the most relevant variables and determine the complexity of the models that can be taken into account in the next stage.

Descriptive statistics are used to describe the main features of a collection of occupational and lifestyle risk factors (predictor variables) with the aim to summarize this sample, rather than use the data to learn about the population that the sample of data is thought to represent. A two-sample t-test is used to compare means to determine if two sets of data are statistically significantly different from each other. Pearson Chi-square ($\chi 2$) tests are used to determine the relationship between SOBP (y) and predictor risk factors (x's) with two or more categories.

Stage 2: Stage 2 (Model building and validation) focuses on an elaborate process of applying different models to the same data set and comparing their performance to choose the best model based on their predictive performance (i.e., explaining the variability in question and producing stable results across samples). Backward stepwise logistic regression method factors [41,42] (a model for classification rather than regression) will be used to predict the probability [43,44] whether an employee has SOBP and measure the relationship based on observed characteristics of the individual; for

example: age, sex, body mass index, blood cholesterol level, systolic blood pressure, relative weight, etc. [41,45,46] using probability scores as the predicted values of the dependent variable being positive [47-53]. If the odds of SOBP increase when the predictor risk factor (independent variable) increases, this is signified by an odds ratio greater than one. Conversely, if the odds of SOBP decrease when the predictor risk factor increases, this is indicated by an odds ratio less than 1 [54,55]. A probability level of $p<0.05$ was considered statistically significant. Lastly, risk factors in the final model with $\beta>1$ will be considered manageable risk factors that are recommended to be considered and incorporated into preventative strategies in the workplace.

Stage 3: Stage 3 focuses on the understanding of LBMD by comparing the risk factors from the LBI model [30], the CLBP model [29] and the SOBP model to gain insight into LBMD for consideration for future BP studies.

Results

The following are the results of the statistically significant risk factors that were considered the model based on 56 risk factors investigated in stage 1 to determine each association with SOBP. Detailed statistics of all the variables are included in the Appendices.

Risk factors for SOBP

Employees with SOBP tended to work as service and operations staff, worked the evening shift and their regular job required regular lifting at work (Appendix 1). They tended to consume more than one alcoholic drink per day and tended to smoke one or more packs of cigarettes a day. Their physical condition tended to limit their ability to get physical exercise (moderate, vigorous, strength-building); however, they tended to do stretching exercises to improve flexibility. The number of hours that participants slept varied (Appendix 2). Biometric indices such as high blood pressure and body mass indexes in the obese range were also associated SOBP (Appendix 3). The majority rated themselves to be in poor to fair health; they tended to have been diagnosed with more than 3 chronic diseases, (i.e., arthritis, low back pain, insomnia), suffered from bodily pain and reported other on-going problems with wrist pain, tingling and numbness, and neck pain (Appendix 4). Participants' daily lives were also affected by their health conditions (Appendix 5). Participants suffering from SOBP tended to have the knowledge about how to treat CLBP and reported regular medication usage, such as use of prescriptions, non-prescriptions and/or herbal remedies (Appendix 6).

Participants with SOBP tended to be more stressed than participants with no SOBP. They reported an average of three major sources of stress (SD=2) with the most commonly cited stressors being financial difficulties, work responsibilities & relationships, death and/or family illness, care of love ones, and coping with stress (Appendix 7). They indicated feeling depressed, feeling down or having a lack of interest or pleasure in doing thing (Appendix 8).

Backward stepwise logistic regression analysis

The final model for SOBP (Table 1) consists of 22 risk factors with coefficients ($\beta\geq0.1$; containing 18 socio-demographic, occupational, lifestyle and physical and emotional health risk factors, and four potential risk factors ($\chi2=2593.99$, df=21, $p<000$). Five (5) risk factors appeared to have the most impact in this study of SOBP: diagnosis of CLBP, persistent neck pain, persistent wrist pain including sensations of tingling or numbness, previous LBI, and on-going bodily pain.

Figure 2 represents the final model of occupational and lifestyle risk factors for SOBP employees' serious enough to interfere with their daily activities.

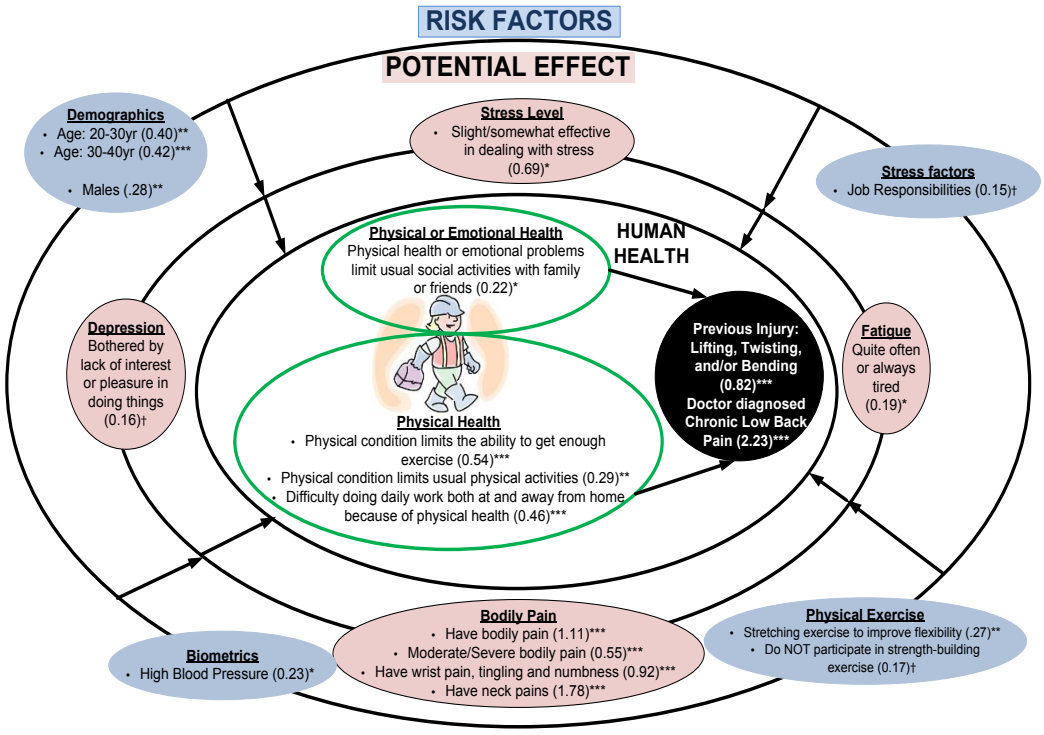

Figure 2: Risk Factors associated with SOBP (Socio-demographic, occupational and non-occupational risk factors). †p<0.06; *p<0.05; **p<0.01; ***p<0.0001.

	On-going problem with Back Pain serious enough to interfere with your daily activities						
	Chi-Square=2593.99, df=21, p<0.000						
Risk Factor (Predictors Variables)	**n**	**B**	**Exp(B)=OR**	**95% C.I. for Exp(B)**		**p-value**	**Level of Risk**
				Lower	**Upper**		
Constant	-5.091	0.01	-	-	***	-	-
Demographic Factors							
Age group: 20-30 years	1045	0.397	1.49	-2.523	3.317	**	-
Age group: 30-40 years	1619	0.421	1.52	-2.558	3.4	***	-
Gender: Male	2918	0.283	1.33	-2.324	2.89	**	-
Health History Factors							
Completed an OSHA Logs or WC from 1999-2008 for Lower Back Injury (LTB)	238	0.823	2.28	-3.646	5.292	***	HIGH
Doctor diagnosed Chronic Health Condition: Lower Back Pain	1206	2.234	9.34	-16.072	20.54	***	HIGH
Lifestyle Factors							
Stretching exercises to improve flexibility	2802	0.274	1.32	-2.313	2.861	**	-
NOT participate in strength-building exercise	4373	0.174	1.19	-2.158	2.506	†	-
Physical Health							
Quite often or always tired	1710	0.19	1.21	-2.182	2.562	*	-
On-going problem with Wrist Pain, Tingling, or Numbness serious enough to interfere with daily activities	358	0.913	2.49	-3.967	5.793	***	HIGH
On-going problem with Neck Pain serious enough to interfere with daily activities	408	1.777	5.91	-9.807	13.361	***	HIGH
Calculated blood pressure: Higher than normal	1857	0.226	1.25	-2.224	2.676	*	
Have much bodily pain	4881	1.113	3.04	-4.845	7.071	***	HIGH
Have moderate to very severe bodily pain	980	0.554	1.74	-2.856	3.964	***	-
Stress and Emotional Health Factors							
Not at all effective in dealing with Stress	92	-	-	0	0	†	-
Slightly/somewhat effective in dealing with Stress	3936	0.69	1.99	-3.21	4.59	*	-
Job Responsibilities been a major source of stress	3574	0.151	1.16	-2.123	2.425	†	-
Holistic Well-being and Workplace Performance Factors							
Difficulty doing daily work both at and away from home because of your physical health	1854	0.46	1.58	-2.637	3.557	***	-
Physical health problems limit your usual physical activities (such as walking or climbing stairs)	2161	0.29	1.34	-2.336	2.916	**	-
Physical health or emotional problems limit your usual social activities with family or friends	2738	0.221	1.25	-2.229	2.671	*	-
Physical condition limits your ability to get enough exercise	736	0.54	1.72	-2.831	3.911	***	-
†p<0.06; *p<0.05; **p<0.01; ***p<0.0001; IGH risk factors: OR ≥ 2							

Table 1: Risk factors associated with SOBP.

Insight into LBMD

It is important to note that LBMD is a combination of key risk factors within a complex system that consists of SOBP, CLBP and LBI. When we view the multifaceted LBMD (SOBP, CLBP and LBI) we can see that the risk factors are: gender, lifting/twisting/bending, stress, person with high blood pressure, physical health (bodily pain), emotional health (level of depression) and fatigue. While it is important to be specific when labeling the different facets of LBMD, because they all have unique risk factors, these are the ones in common. Table 2 shows the complete comparison of the risk factors of SOBP, CLBP and LBI

Discussion

The findings in this study offer a new perspective on the association of lifestyle risk factors for SOBP serious enough to interfere with daily activities and the risk factors associated with LBMD. These may help explain why traditional engineering solutions [56] may not have the desired impact. It also supports the findings in the literature where a comprehensive understanding of LBMD cannot be based solely on simple one-to-one relationships, but rather the combination of key risk factors within a complex system, and its relationship to the wellness and safety of the entire human system [28]. However, there seems to be an indication that people with SOBP serious enough to interfere with their daily activities tend to have greater odds of have had previous or may have future LBI or CLBP. Preventative strategies focus on the risk factors for SOBP, may reduce the incidence for future LBI and CLBP.

The results in this study support the following finding in the literature. The impact from psychological factors in the development of LBMD include depression, anxiety, passive coping strategies, and work-related factors such as high physical job demand, low expectation of return to work, low job satisfaction, low social support, and perception of stress at work [57]. Especially noticeable are the reported physical conditions relevant to muscle, joints and skeleton problems, such as CLBP, neck pain, bodily pain, wrist pain, tingling and/or numbness, and fatigue [29,58]. BP could be affected by psychosocial factors like lack of social activities and contact/support from friends and relatives, but not significantly. Fatigue may come from three sources: time on task, lack of sleep or sleep interruption, and a justification for escaping from a task that could be stressful or onerous in other ways, e.g. a stress reaction [59-66].

In an attempt to increase employees' awareness of ergonomics and physical work environment to prevent SOBP and LBI, employers may consider integrating lifestyle preventative strategies into their

	On-Going Back Pain (BP)	(β)	Chronic Low Back Pain (CLBP) ♦	(β)	Low Back Injury (LBI) ♠	(β)
Risk Factors	**Demographics**					
	Age					
	20-30	0.40**	20-30	0.62***	20-30	1.99**
	30-40	0.42***	30-40	0.44***	30-40	1.65**
			40-50	0.23**	40-50	2.02***
					50-60	1.9**
	Gender					
	Male	0.28**	Male	0.38***		
	Cause of Injury (based on WC Claims)					
	Lifting, twisting, and/or bending	*0.82***	Lifting, twisting, and/or bending	0.62***	Lifting, twisting, and/or bending	4.57***
			Slip, trip, and/or fall	0.76**	Slip, trip, and/or fall	2.14***
	Source of Stress					
	Source of stress job responsibilities	0.15†				
			Personal illness or injury	0.22*		
					Source of stress child care	0.8*
					Source of stress divorce or separation	0.87*
	Chronic Health History					
	Doctor diagnosed LBP	*2.23***				
			Chronic insomnia	0.78***		
			Chronic arthritis	0.62***		
			Chronic headaches	0.46***		
	Biometrics					
	High Blood Pressure	0.23*			High Blood Pressure	0.74**
	Physical Exercise					
	Stretching exercises to improve flexibility	0.27**				
	Do NOT participate in strength-building exercises	0.17†				
	Bodily Pain					
Potential Effects	Have much bodily pain	*1.11***	Have bodily pain	0.77***		
	Have moderate to very severe bodily pain	0.55***	Have moderate and/or severe bodily pain	0.26**		
	On-going problem with neck pain that interferes with daily activities	*1.78***	0ngoing neck pain interferes with daily activities	0.38**		
	On-going problem with wrist pain, tingling, numbness that interferes with daily activities	*0.93***				
			On-going back pain interfere with daily activities	2.19***		
	Depression					
	Bothered by a lack of interest or pleasure in doing things	0.16†				
			Chronic depression	0.31**	Does NOT have chronic depression	0.6*
					Bothered very little by emotional problems	1.4**
	Fatigue					
	Quite often or always tired	0.19*			Almost always feeling tired during waking hours	1.01**
	Stress					
	Slightly/somewhat effective in dealing with stress	0.69*				
					Somewhat stressed (from minor annoyance to fairly major pressures, problems, difficulties)	0.55*
					Stressed (from minor annoyance to fairly major pressures, problems, difficulties)	1.69***

	Physical Health					
Potential Impairment	Physical condition limits ability to get enough exercise	0.54***	Physical condition limits ability to get enough exercise	0.37***		
	Physical condition limits usual physical activities	0.29**	Physical condition limits usual physical activities	0.19*		
	Difficulty doing daily work both at and away from home because of physical health	0.46***				
	Emotional health					
					Emotional problems (anxious, depressed, irritable) does NOT limit one's ability to do usual work, school, or other activities	0.99*
	Physical or Emotional Health					
	Physical health or emotional problems limit usual social activities with family or friends	0.22*			Physical health or emotional problems limit usual social activities with family or friends	1.01*
†p<0.06; *p<0.05; **p<0.01; ***p<0.0001; HIGH risk factors (OR ≥ 2) source text for citations 29, 30 as shown in original proof						

Table 2: Comparison of risk factors for LBMD (BP, CLBP, LBI).

Demographics			**On-going problem with Back Pain serious enough to interfere with your daily activities**					
			No	**Yes**	**Total**	**χ^2**	**df**	**p-value**
Gender	Male	n	3242	567	3809	1.62	1	ns
		%	85.1%	14.9%	100.0%	-	-	-
	Female	n	4493	847	5340	-	-	-
		%	84.1%	15.9%	100.0%	-	-	-
Ethnicity	American Indian/Alaska Native	n	60	12	72	7.05	4	ns
		%	83.3%	16.7%	100.0%	-	-	-
	Asian, Hawaiian or Pacific Islander	n	421	53	474	-	-	-
		%	88.8%	11.2%	100.0%	-	-	-
	Black/African American	n	148	25	173	-	-	-
		%	85.5%	14.5%	100.0%	-	-	-
	Hispanic/Latino	n	132	31	163	-	-	-
		%	81.0%	19.0%	100.0%	-	-	-
	White/other	n	5644	898	6542	-	-	-
		%	86.3%	13.7%	100.0%	-	-	-
Staff Type	Administrative	n	3087	473	3560	97.67	4	***
		%	86.7%	13.3%	100.0%	-	-	-
	Clerical	n	1388	250	1638	-	-	-
		%	84.7%	15.3%	100.0%	-	-	-
	Faculty	n	1657	248	1905	-	-	-
		%	87.0%	13.0%	100.0%	-	-	-
	Operations	n	113	54	167	-	-	-
		%	67.7%	32.3%	100.0%	-	-	-
	Service	n	1489	389	1878	-	-	-
		%	79.3%	20.7%	100.0%	-	-	-
Age Group	30 yrs and younger	n	1066	163	1229	6.88	3	***
		%	86.7%	13.3%	100.0%	-	-	-
	30-40 yrs	n	1663	295	1958	-	-	-
		%	84.9%	15.1%	100.0%	-	-	-
	40-50 yrs	n	2235	414	2649	-	-	-
		%	84.4%	15.6%	100.0%	-	-	-
	50 yrs	n	2771	542	3313	-	-	-
		%	83.6%	16.4%	100.0%	-	-	-

Annual Income	Less than $33,800 annually	n	3242	663	3905	16.44	2	***
		%	83.0%	17.0%	100.0%	-	-	-
	$33,800 - $52,000 annually	n	2210	393	2603	-	-	-
		%	84.9%	15.1%	100.0%	-	-	-
	$52,000 or more annually	n	2267	348	2615	-	-	-
		%	86.7%	13.3%	100.0%	-	-	-
Work Experience Grouping	1 yr or less	n	1081	128	1209	45.04	5	***
		%	89.4%	10.6%	100.0%	-	-	-
	1 yr-5yrs	n	1667	358	2025	-	-	-
		%	82.3%	17.7%	100.0%	-	-	-
	5 yr-10yrs	n	1281	286	1567	-	-	-
		%	81.7%	18.3%	100.0%	-	-	-
	10 yr-15yrs	n	748	142	890	-	-	-
		%	84.0%	16.0%	100.0%	-	-	-
	15 yr-20yrs	n	726	175	901	-	-	-
		%	80.6%	19.4%	100.0%	-	-	-
	20 yrs or more	n	1158	201	1359	-	-	-
		%	85.2%	14.8%	100.0%	-	-	-
Shift Work	Daytime	n	7161	1251	8412	24.44	1	***
		%	85.1%	14.9%	100.0%	-	-	-
	Evening, Night or Rotating	n	511	145	656	-	-	-
		%	77.9%	22.1%	100.0%	-	-	-
Daily work require regular lifting	No	n	5977	991	6968	39.11	1	***
		%	85.8%	14.2%	100.0%	-	-	-
	Yes	n	1678	416	2094	-	-	-
		%	80.1%	19.9%	100.0%	-	-	-
	ns: not statistically significant				*** p<.0001			

Appendix 1: Association between demographics and SOBP.

Lifestyle			**On-going problem with Back Pain serious enough to interfere with your daily activities**					
			No	**Yes**	**Total**	**χ^2**	**df**	**p-value**
Alcohol Use								
Number of Drinks per day	1-2 drinks	n	3966	**668**	4634	9.08	1	**
		%	85.60%	**14.40%**	100.00%	-	-	-
	3 or more drinks	n	680	154	834	-	-	-
		%	81.50%	18.50%	100.00%	-	-	-
Safety Precautions								
How often do you wear a seatbelt when you drive or ride in a motor vehicle?	Almost never	n	57	25	82	16.75	2	***
		%	69.50%	30.50%	100.00%	-	-	-
	Sometimes	n	212	49	261	-	-	-
		%	81.20%	18.80%	100.00%	-	-	-
	Almost or almost always	n	7447	**1337**	8784	-	-	-
		%	84.80%	**15.20%**	100.00%	-	-	-
Smoking/Tobacco Use								
Smoker: smokes either cigarettes, cigar, pipe, smokeless or chewing tobacco	non-smoker	n	6562	1138	7700	17.48	1	***
		%	85.20%	14.80%	100.00%	-	-	-
	smoker	n	1168	276	1444	-	-	-
		%	80.90%	19.10%	100.00%	-	-	-
Do you smoke Cigarettes	No	n	7084	1245	8329	17.04	1	***
		%	85.10%	14.90%	100.00%	-	-	-
	Yes	n	642	165	807	-	-	-
		%	79.60%	20.40%	100.00%	-	-	-

Do you use Tobacco Products of Any Kind?	No	n	6562	1138	7700	13.45	1	***
		%	85.20%	14.80%	100.00%	-	-	-
	Yes	n	707	171	878	-	-	-
		%	80.50%	19.50%	100.00%	-	-	-
How many cigarettes do you smoke in a normal day?	I do not smoke cigarettes	n	7084	1245	8329	38.22	2	***
		%	85.10%	14.90%	100.00%	-	-	-
	Less than a pack	n	501	103	604	-	-	-
		%	82.90%	17.10%	100.00%	-	-	-
	one or more packs	n	141	**62**	203	-	-	-
		%	69.50%	**30.50%**	100.00%	-	-	-
Physical Activity								
Do you have a physical condition that limits your ability to get enough exercise?	No	n	7018	969	7987	614.53	1	***
		%	87.90%	12.10%	100.00%	-	-	-
	Yes	n	580	423	1003	-	-	-
		%	57.80%	42.20%	100.00%	-	-	-
30 mins or more of moderate-intensity physical activity	No	n	750	203	953	27.95	1	***
		%	78.70%	21.30%	100.00%	-	-	-
	Yes	n	6964	1206	8170	-	-	-
		%	85.20%	14.80%	100.00%	-	-	-
20 mins or more of vigorous exercise	No	n	2973	631	3604	19.21	1	***
		%	82.50%	17.50%	100.00%	-	-	-
	Yes	n	4734	778	5512	-	-	-
		%	85.90%	14.10%	100.00%	-	-	-
Strength-building exercises	No	n	4861	965	5826	16.4	1	***
		%	83.40%	16.60%	100.00%	-	-	-
	Yes	n	2838	438	3276	-	-	-
		%	86.60%	13.40%	100.00%	-	-	-
Stretching exercises to improve flexibility	No	n	4635	767	5402	16.52	1	***
		%	85.80%	14.20%	100.00%	-	-	-
	Yes	n	3077	645	3722	-	-	-
		%	82.70%	17.30%	100.00%	-	-	-
Sleep Habits								
Hours of sleep	6 hrs or Less	n	2501	568	3069	40.95	2	***
		%	81.50%	18.50%	100.00%	-	-	-
	7- 8hrs	n	4990	788	5778	-	-	-
		%	86.40%	13.60%	100.00%	-	-	-
	More than 8 hrs	n	228	57	285	-	-	-
		%	80.00%	20.00%	100.00%	-	-	-
Safety Precautions								
Use Proper care seats in car	No	n	54	20	74	5.79	1	*
		%	73.00%	27.00%	100.00%	-	-	-
	Yes	n	2707	534	3241	-	-	-
		%	83.50%	16.50%	100.00%	-	-	-
Pull over to use cell phone when driving	No	n	4667	843	5510	5.59	1	*
		%	84.70%	15.30%	100.00%	-	-	-
	Yes	n	1316	284	1600	-	-	-
		%	82.30%	17.80%	100.00%	-	-	-
	*p<0.05; ***p<0.0001							

Appendix 2: Association between lifestyle and SOBP.

Current Health			On-going problem with Back Pain serious enough to interfere with your daily activities					
			No	Yes	Total	χ^2	df	p-value
Self-rating of Health	Good-Excellent	n	7091	1135	8226	174.2	1	***
		%	86.20%	13.80%	100.00%	-	-	-
	Very Poor - Fair	n	632	**277**	909	-	-	-
		%	69.50%	**30.50%**	100.00%	-	-	-
BMI	Underweight	n	159	23	182	70.48	3	***
		%	87.40%	12.60%	100.00%	-	-	-
	Normal	n	2522	355	2877	-	-	-
		%	87.70%	12.30%	100.00%	-	-	-
	Overweight	n	2600	430	3030	-	-	-
		%	85.80%	14.20%	100.00%	-	-	-
	Obese	n	2454	**606**	3060	-	-	-
		%	80.20%	**19.80%**	100.00%	-	-	-
Total number of on-going problems serious enough to interfere with your daily activities	1 problem	n	546	884	1430	126.24	2	***
		%	38.20%	61.80%	100.00%	-	-	-
	2 problems	n	72	350	422	-	-	-
		%	17.10%	82.90%	100.00%	-	-	-
	3+problems	n	13	180	193	-	-	-
		%	6.70%	93.30%	100.00%	-	-	-
Do you have much bodily pain?	No	n	2568	63	2631	482.1	1	***
		%	97.60%	2.40%	100.00%	-	-	-
	Yes	n	5167	**1351**	6518	-	-	-
		%	79.30%	**20.70%**	100.00%	-	-	-
Have an on-going problem with Wrist Pain, Tingling, or Numbness that is serious enough to interfere with your daily activities?	No	n	7456	1167	8623	423.9	1	***
		%	86.50%	13.50%	100.00%	-	-	-
	Yes	n	279	**247**	526	-	-	-
		%	53.00%	**47.00%**	100.00%	-	-	-
Have an on-going problem with Neck Pain that is serious enough to interfere with your daily activities?	No	n	7529	1081	8610	940.7	1	***
		%	87.40%	12.60%	100.00%	-	-	-
	Yes	n	206	**333**	539	-	-	-
		%	38.20%	**61.80%**	100.00%	-	-	-
Have an on-going problem with Eye Strain that is serious enough to interfere with your daily activities?	No	n	7491	1238	8729	235.7	1	***
		%	85.80%	14.20%	100.00%	-	-	-
	Yes	n	244	**176**	420	-	-	-
		%	58.10%	**41.90%**	100.00%	-	-	-
	*p<0.05; **p<0.001; ***p<0.0001							

Appendix 3: Associations with Current Health for people with SOBP.

Chronic Illnesses			On-going problem with Back Pain serious enough to interfere with your daily activities					
			No	Yes	Total	χ^2	df	p-value
Chronic Lower Back Pain	No	n	6967	563	7530	2073	1	***
		%	92.50%	7.50%	100.00%	-	-	-
	Yes	n	768	**851**	1619	-	-	-
		%	47.40%	**52.60%**	100.00%	-	-	-
Chronic High Blood Pressure	No	n	6224	1037	7261	37.08	1	***
		%	85.70%	14.30%	100.00%	-	-	-
	Yes	n	1511	**377**	1888	-	-	-
		%	80.00%	**20.00%**	100.00%	-	-	-
High or Unhealthy Cholesterol	No	n	6169	1049	7218	22.26	1	***
		%	85.50%	14.50%	100.00%	-	-	-
	Yes	n	1566	**365**	1931	-	-	-
		%	81.10%	**18.90%**	100.00%	-	-	-
Chronic Depression	No	n	6808	1082	7890	133.11	1	***
		%	86.30%	13.70%	100.00%	-	-	-
	Yes	n	927	**332**	1259	-	-	-
		%	73.60%	**26.40%**	100.00%	-	-	-

Chronic Migraine or Chronic Severe Headaches	No	n	7011	1178	8189	68.39	1	***
		%	85.60%	14.40%	100.00%	-	-	-
	Yes	n	724	**236**	960	-	-	-
		%	75.40%	**24.60%**	100.00%	-	-	-
Chronic Arthritis	No	n	6786	965	7751	350.61	1	***
		%	87.50%	12.50%	100.00%	-	-	-
	Yes	n	949	**449**	1398	-	-	-
		%	67.90%	**32.10%**	100.00%	-	-	-
Osteoporosis	No	n	7552	1343	8895	31.23	1	***
		%	84.90%	15.10%	100.00%	-	-	-
	Yes	n	183	**71**	254	-	-	-
		%	72.00%	**28.00%**	100.00%	-	-	-
Chronic Asthma	No	n	7077	1213	8290	45.79	1	***
		%	85.40%	14.60%	100.00%	-	-	-
	Yes	n	658	**201**	859	-	-	-
		%	76.60%	**23.40%**	100.00%	-	-	-
Hay Fever or other seasonal allergy?	No	n	6084	1036	7120	20.11	1	***
		%	85.40%	14.60%	100.00%	-	-	-
	Yes	n	1651	**378**	2029	-	-	-
		%	81.40%	**18.60%**	100.00%	-	-	-
Lung Disease (chronic bronchitis oremphysema)?	No	n	7661	1376	9037	29.61	1	***
		%	84.80%	15.20%	100.00%	-	-	-
	Yes	n	74	**38**	112	-	-	-
		%	66.10%	**33.90%**	100.00%	-	-	-
Chronic Heartburn (gastroesophageal reflux disease, GERD)	No	n	7184	1220	8404	69.55	1	***
		%	85.50%	14.50%	100.00%	-	-	-
	Yes	n	551	**194**	745	-	-	-
		%	74.00%	**26.00%**	100.00%	-	-	-
Congestive Heart Failure	No	n	7716	1403	9119	10.36	1	**
		%	84.60%	15.40%	100.00%	-	-	-
	Yes	n	19	**11**	30	-	-	-
		%	63.30%	**36.70%**	100.00%	-	-	-
Heart Disease (coronary artery disease, angina, or heart attack)	No	n	7600	1375	8975	6.57	1	*
		%	84.70%	15.30%	100.00%	-	-	-
	Yes	n	135	**39**	174	-	-	-
		%	77.60%	**22.40%**	100.00%	-	-	-
Chronic Insomnia	No	n	7637	1353	8990	65	1	***
		%	84.90%	15.10%	100.00%	-	-	-
	Yes	n	98	**61**	159	-	-	-
		%	61.60%	**38.40%**	100.00%	-	-	-
Other Chronic Condition?	No	n	7317	1266	8583	52.8	1	***
		%	85.20%	14.80%	100.00%	-	-	-
	Yes	n	418	**148**	566	-	-	-
		%	73.90%	**26.10%**	100.00%	-	-	-
	*p<0.05; **p<0.001; ***p<0.0001							

Appendix 4: Associations with chronic illnesses for people with SOBP.

Constraints Due to Health Conditions			**On-going problem with Back Pain serious enough to interfere with your daily activities.**					
			No	**Yes**	**Total**	**χ^2**	**df**	**p-value**
Due to your Chronic Health Condition, have you visited an emergency room or urgent care center in the last 12 months?	No	n	6893	1082	7975	169.51	1	***
		%	86.40%	13.60%	100.00%			
	Yes	n	842	**332**	1174			
		%	71.70%	**28.30%**	100.00%			
Due to your Chronic Health Condition, have you had an Overnight Hospital Stay in the last 12 months?	No	n	7525	1343	8868	21.36	1	***
		%	84.90%	15.10%	100.00%			
	Yes	n	210	**71**	281			
		%	74.70%	**25.30%**	100.00%			

Miss your job because of illness	Did not miss days	n	2446	291	2737	70.92	1	***
		%	89.40%	10.60%	100.00%			
	Miss 1+ days	n	5219	**1115**	6334			
		%	82.40%	**17.60%**	100.00%			
Health Problem Limit you in the kind or amount of work you can do	Did not limit	n	2143	183	2326	126.56	1	***
		%	92.10%	7.90%	100.00%			
	1+ time	n	5219	**1115**	6334			
		%	82.40%	**17.60%**	100.00%			
How often do you participate in organized social groups	1 per mth - 1per year	n	4216	**850**	5066	15.68	1	***
		%	83.20%	**16.80%**	100.00%			
	1 per wk to 2-3 per month	n	3426	546	3972			
		%	86.30%	13.70%	100.00%			
	* p<.05 ** p<.001 *** p<.0001							

Appendix 5: Constraints Due to Health Conditions for People with SOBP.

Self-Care/Medication Usage			**On-going problem with Back Pain serious enough to interfere with your daily activities.**					
			No	**Yes**	**Total**	**χ^2**	**df**	**p-value**
Home care for Back Pain	No	n	2219	219	2438	106.56	1	***
		%	91.00%	9.00%	100.00%			
	Yes	n	5516	**1195**	6711			
		%	82.20%	**17.80%**	100.00%			
How many Non Prescription Medications are you taking on a daily or regular basis?	None	n	4086	545	4631	161.17	2	***
		%	88.20%	11.80%	100.00%			
	One	n	1703	**400**	2103			
		%	81.00%	**19.00%**	100.00%			
	2 or more	n	787	**280**	1067			
		%	73.80%	**26.20%**	100.00%			
How many Prescription medicines are you taking on a daily or regular basis?	None	n	3188	412	3600	137.82	2	***
		%	88.60%	11.40%	100.00%			
	One	n	1798	**269**	2067			
		%	87.00%	**13.00%**	100.00%			
	2 or more	n	2373	**648**	3021			
		%	78.60%	**21.40%**	100.00%			
How many Herbal Remedies are you taking on a daily or regular basis?	None	n	4913	792	5705	36.79	2	***
		%	86.10%	13.90%	100.00%			
	One	n	485	**121**	606			
		%	80.00%	**20.00%**	100.00%			
	2 or more	n	490	**133**	623			
		%	78.70%	**21.30%**	100.00%			
Amount if Non-Prescription Medications	None	n	4086	545	4631	133.28	1	***
		%	88.20%	11.80%	100.00%			
	1 or more	n	2490	**680**	3170			
		%	78.50%	**21.50%**	100.00%			
Amount if Prescription Medication	None	n	3188	412	3600	70.41	1	***
		%	88.60%	11.40%	100.00%			
	1 or more	n	4171	917	5088			
		%	82.00%	18.00%	100.00%			
Amount of Herbal Remedies	None	n	4913	792	5705	36.33	1	***
		%	86.10%	13.90%	100.00%			
	1 or more	n	975	254	1229			
		%	79.30%	20.70%	100.00%			
	*** p<.0001							

Appendix 6: Association between Self-Care/Medication Usage and SOBP.

Daily Stress Risk Factors			On-going problem with Back Pain serious enough to interfere with your daily activities.					
			No	Yes	Total	χ^2	df	p-value
Are you stressed?	No	n	258	25	283	9.8	1	**
		%	91.20%	8.80%	100.00%			
	Yes	n	7477	**1389**	8866			
		%	84.30%	**15.70%**	100.00%			
Are you effective in dealing with stress?	No	n	93	**36**	129	15.53	1	***
		%	72.10%	**27.90%**	100.00%			
	Yes	n	7642	1378	9020			
		%	84.70%	15.30%	100.00%			
Coping with too much to do been a major source of stress for you?	No	n	4457	721	5178	21.4	1	***
		%	86.10%	13.90%	100.00%			
	Yes	n	3278	**693**	3971			
		%	82.50%	**17.50%**	100.00%			
Stress can range from minor annoyances to fairly major pressures, problems, or difficulties.	Not at all stressful	n	258	25	283	144.68	4	***
		%	91.20%	8.80%	100.00%			
	Only slightly stressful	n	2329	**311**	2640			
		%	88.20%	**11.80%**	100.00%			
	Somewhat stressful	n	3455	**600**	4055			
		%	85.20%	**14.80%**	100.00%			
	Quite stressful	n	1446	**367**	1813			
		%	79.80%	**20.20%**	100.00%			
	Extremely stressful	n	229	**110**	339			
		%	67.60%	**32.40%**	100.00%			
How effective are you at dealing with the stress in your life?	Not at all effective	n	93	36	129	98.16	4	***
		%	72.10%	27.90%	100.00%			
	Only slightly stressful	n	616	183	799			
		%	77.10%	22.90%	100.00%			
	Somewhat stressful	n	3671	**746**	4417			
		%	83.10%	**16.90%**	100.00%			
	Quite stressful	n	2936	**406**	3342			
		%	87.90%	**12.10%**	100.00%			
	Extremely stressful	n	396	**39**	435			
		%	91.00%	**9.00%**	100.00%			
Stress level	not at all stressful	n	258	25	283	101.04	2	***
		%	91.20%	8.80%	100.00%			
	slightly/Somewhat stressful	n	5784	**911**	6695			
		%	86.40%	**13.60%**	100.00%			
	Quite/Extremely stressful	n	1675	**477**	2152			
		%	77.80%	**22.20%**	100.00%			
Dealing with Stress	Not at all effective	n	93	**36**	129	76.45	2	***
		%	72.10%	**27.90%**	100.00%			
	Slightly/somewhat effective	n	4287	**929**	5216			
		%	82.20%	**17.80%**	100.00%			
	Quite/Extremely effective	n	3332	445	3777			
		%	88.20%	11.80%	100.00%			
Dealing with Stress	not at all/slightly/somewhat effective	n	4380	965	5345	66.63	1	***
		%	81.90%	18.10%	100.00%			
	Quite/Extremely effective	n	3332	**445**	3777			
		%	88.20%	**11.80%**	100.00%			
Finances, loans, mortgage	No	n	5288	835	6123	46.83	1	***
		%	86.40%	13.60%	100.00%			
	Yes	n	2447	**579**	3026			
		%	80.90%	**19.10%**	100.00%			
Job Responsibilities	No	n	4567	734	5301	24.97	1	***
		%	86.20%	13.80%	100.00%			
	Yes	n	3168	**680**	3848			
		%	82.30%	**17.70%**	100.00%			

Relationships at Work	No	n	6268	1048	7316	35.71	1	***
		%	85.70%	14.30%	100.00%			
	Yes	n	1467	**366**	1833			
		%	80.00%	**20.00%**	100.00%			
Death of spouse, life partner, or other loved one	No	n	6970	1228	8198	13.68	1	***
		%	85.00%	15.00%	100.00%			
	Yes	n	765	**186**	951			
		%	80.40%	**19.60%**	100.00%			
Illness or Injury of a Loved One	No	n	6308	1089	7397	15.89	1	***
		%	85.30%	14.70%	100.00%			
	Yes	n	1427	**325**	1752			
		%	81.40%	**18.60%**	100.00%			
Personal Illness or Injury	No	n	6794	946	7740	402.03	1	***
		%	87.80%	12.20%	100.00%			
	Yes	n	941	**468**	1409			
		%	66.80%	**33.20%**	100.00%			
Care of an Elderly Parent	No	n	6791	1188	7979	15.31	1	***
		%	85.10%	14.90%	100.00%			
	Yes	n	944	**226**	1170			
		%	80.70%	**19.30%**	100.00%			
Care of a Child	No	n	6924	1236	8160	5.49	1	*
		%	84.90%	15.10%	100.00%			
	Yes	n	811	**178**	989			
		%	82.00%	**18.00%**	100.00%			
Divorce or Separation	No	n	7447	1346	8793	3.77	1	*
		%	84.70%	15.30%	100.00%			
	Yes	n	288	**68**	356			
		%	80.90%	**19.10%**	100.00%			
Family Problem	No	n	6013	976	6989	50.33	1	***
		%	86.00%	14.00%	100.00%			
	Yes	n	1722	**438**	2160			
		%	79.70%	**20.30%**	100.00%			
Legal Problems	No	n	7499	1325	8824	36.7	1	***
		%	85.00%	15.00%	100.00%			
	Yes	n	236	**89**	325			
		%	72.60%	**27.40%**	100.00%			
Other Major Sources of Stress	No	n	6780	1179	7959	19.29	1	***
		%	85.20%	14.80%	100.00%			
	Yes	n	955	**235**	1190			
		%	80.30%	**19.70%**	100.00%			
		* p<.05 ** p<.001 *** p<.0001						

Appendix 7: Association between Daily Stress Risk Factors and SOBP.

traditional engineering preventative strategies.

Limitations

Due to the limitations of this retrospective dataset, each of the LBMD categories (SOBP, CLBP, LBI) was studied individually. Also, our analysis does not permit causative conclusions. Future studies should be designed so that more sophisticated statistical models can be applied. Other limitations are that the HRA was pre-designed, and there was a bias towards participants with an approved WC claim who also participated in a wellness program.

Conclusion

Findings from this study can be used to revise traditional approaches to workplace ergonomics and wellness programs and promote a new focus on the health and lifestyle risk factors associated with LBMD. In order to get a comprehensive understanding of the manageable risk factors associated with LBMD, it is suggested that future studies on occupational preventative strategies should include both lifestyle risk factors and occupational risk factors along with the impact of a previous LBI and/or CLBP (diagnosed by a medical doctor). In sum, in addition to implementing fitness programs and facilities, smoking cessation programs, and obesity programs in the workplace, employers should also offer programs designed to address the risk of emotional stress, improve attention and alertness, increase employee performance to minimize the risk of LBMD.

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Emotional Health (Depression, Anxiety, Irritability)			On-going problem with Back Pain serious enough to interfere with your daily activities.					
			No	Yes	Total	χ^2	df	p-value
How often do you feel depressed?	Most of the time	n	143	88	231	187.66	2	***
		%	61.90%	38.10%	100.00%			
	Sometimes	n	2690	660	3350			
		%	80.30%	19.70%	100.00%			
	Rarely	n	4858	661	5519			
		%	88.00%	12.00%	100.00%			
Felt down, depressed or hopeless?	No	n	6020	899	6919	133.72	1	***
		%	87.00%	13.00%	100.00%			
	Yes	n	1640	499	2139			
		%	76.70%	23.30%	100.00%			
Bothered by a lack of interest or pleasure in doing things?	No	n	6318	924	7242	200.89	1	***
		%	87.20%	12.80%	100.00%			
	Yes	n	1374	485	1859			
		%	73.90%	26.10%	100.00%			
Felt down, depressed, hopeless, lack of interest or pleasure in doing things	No	n	5572	764	6336	188.25	1	***
		%	87.90%	12.10%	100.00%			
	Yes	n	2069	634	2703			
		%	76.50%	23.50%	100.00%			
Bothered by emotional problems (such as feeling anxious, depressed or irritably)?	No	n	5601	737	6338	231.21	1	***
		%	88.40%	11.60%	100.00%			
	Yes	n	2134	677	2811			
		%	75.90%	24.10%	100.00%			
	*** p<.0001							

Appendix 8: Association between Emotional Health (Depression, Anxiety, Irritability) and SOBP.

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