EFFECTIVENESS OF WORKPLACE HEALTH AND SAFETY PROGRAMS IN UNIVERSITY SETTINGS

By

©Zakia Nahin Hoque

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ABSTRACT

A study was conducted among the faculty members, staff, graduate students and researchers of Memorial University (MUN) through well-designed surveys to evaluate the effectiveness of the health and safety programs provided by the Environmental Health and Safety (EHS) Unit at MUN. To establish a benchmark and to understand Memorial's environmental health and safety programs relative to other institutions, we have reviewed the health and safety programs of ten universities across Canada and performed a comparative study with Memorial's safety programs based on the publicly available information on university webpage. We have conducted two identical online surveys of MUN employees and graduate students on their knowledge, attitude, and behavior regarding health and safety in October, 2016, and in April, 2017. A quantitative analysis was done to understand the health and safety awareness with reference to different demographic factors and the effect of the dissemination of the health and safety information on knowledge, attitude, and behavior of employees and graduate students. Our survey results were compared with the result of a previous survey, conducted in 2013 on safety culture of Memorial University. The surveys were followed by Key Informant Interviews (KII) of eight officials of Memorial University to understand the causes of some of the findings from the surveys and get the views of the university administration on some of the comments made by the survey respondents. Overall, the survey results show that Memorial University has progressed significantly in communication and in the use of online tools to manage the environment, health, and safety. Also, Memorial has a good health and safety policy in place, and the health and safety program is at par with other Canadian universities.

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List of Abbreviations

EHS	Environmental Health and Safety
WHS	Workplace health and Safety
WHSC	Workplace health and safety Committee
OHS	Occupational Health and Safety
OSHA	Occupational Safety and Health Administration
CCOHS	Canadian Center for Occupational Health and Safety.
WHSCC	Workplace Health and Safety Compensation Commission
NSC	National Safety Council
NIOSH	The National Institute for Occupational Safety and Health.
AWCBC	Association of Workers' Compensation Boards of Canada.
CDC	Centers for Disease Control
CSA	Canadian Standards Association
PEP	Program Evaluation Profile
OHSMS	Occupational Health and Safety Management System
ISO	International Standards Organization
AIHA	American Institute of Hygiene Association
EHSMS	Environmental Health and Safety Management System
MIMS	MUN Incident Management System
RMS	Risk Management Services
WSEP	Workplace Safety and Environmental Protection

JHSC	Joint Health and Safety Committee
LASH	Local Area Safety and Health.
OSHAC	Organizational Safety and Health Advisory Committee
UHSC	University Health and Safety Committee
ULSC	University Laboratory Safety Committee
FM	Facilities Management
FSC	Facilities Safety Committee
LSC	Local Safety Committee
CAIRS	Centralized Accident/Incident Reporting System
VTRA	Violence Threat Risk Assessment
AED	Automated External Defibrillator
ICS	Incident Command System
IST	Information Services and Technology
WHIP	Workplace Hazard Information Placard.

CHAPTER 1

1.1 Introduction

Safety is a condition where risk is controlled to an acceptable level. Occupational Health and Safety (OHS) refers to a multidisciplinary field that promotes the improvement of working conditions and environmental hygiene to ensure people can safely complete their tasks. OHS is an essential element in the workplace as it has a strong focus on the prevention of accidents and diseases. OHS improves the working conditions, health and safety of all employees [World Health Organization, 2018].

Accidents or incidents range from small injuries such as slipping on the ground to life-threatening injuries caused by exposure to hazardous materials or fires occurring in laboratories or other areas in the workplace. According to a report from the Association of Workers' Compensation Boards of Canada (AWCBC), in 2015, about 852 deaths occurred in the workplace in Canada, and the majority of the workers were aged fifteen to twenty-four years [AWCBC, 2017]. Between 1993 and 2005 in Canada, work-related deaths rose by 45% [Sharpe and Hardt, 2006]. According to the National Safety Council (NSC) of the USA, workplace accidents and injuries have become a major public health concern. In 2016, there were nearly 2.9 million nonfatal injuries and illnesses in private industries in the United States. These incidents occurred at a rate of 2.9 cases per 100 full-time employers [The U.S. Bureau of Labor Statistics, 2017]. In 2015, in the United States, there were approximately 18.4 million cases of injury and illness in state and local government

sectors including schools, hospitals, and police and fire departments. These cases occurred at a rate of 5.1 per 100 full-time employers [The U.S. Bureau of Labor Statistics, 2016].

In the USA, the Occupational Safety and Health Administration (OSHA) has developed safety standards in the Code of Federal Regulations and applies them to compliance inspections. The National Institute for Occupational Safety and Health (NIOSH) works with OSHA and provides research support to most of OSHA's policies [CDC-NIOSH, 2016]. In Canada, workers are covered by provincial or federal labor codes, depending on the sectors in which they work. Workers in mining, transportation, and the federal government are covered by the Canada Labor Codes. Other workers including employees of universities are covered by provincial health and safety legislation. The Canadian Center for Occupational Health and Safety (CCOHS) is a governmental agency of Canada that was established in 1966 by an Act of Parliament. The CCOHS promotes safety to prevent workplace injuries and illnesses. The CCOHS follows a list of OSH (Occupational Safety and Health) regulations for the Canadian provinces [Canadian enviro OSH Legislation plus Standards, 2016].

Similar to the situation in industry, safety has become a growing concern in university settings that needs to be addressed. There are no statistics available on workplace fatalities and injuries in Canadian or US university settings. In recent years, there have been a few accidents in some prominent universities. In 2008, a 23-year-old lab assistant at UCLA died from a burn injury while conducting tests using an auto-igniting chemical called tert-butyllithium. In Texas in 2010, a graduate chemistry student lost three fingers and damaged

one eye while conducting experiments in a lab. In 2011, a Yale undergraduate asphyxiated when her hair got caught in a lathe in a lab [Kate Allen, 2014, a report on ‘A young lab worker, a professor and a deadly accident’]. Though anecdotal, these examples underscore the severity of the problem in university settings.

Universities are considered the dominant growth sectors for education; therefore, activities within universities are expected to be well-regulated for safety [Drucker, 1999]. The Canadian Center for Occupational Health and Safety (CCOHS) has workplace legislation for 10 provincial and 3 territorial jurisdictions. Specific regulations exist for some industrial sectors only, such as offshore oil and gas, mining, etc. No results have been found on safety standards specific to universities. OH&S in industries and in universities fall under the same workplace legislation [CCOHS, 2016]. In Canada, all major universities have Environment Health and Safety (EHS) or similar departments through which Occupational Health and Safety (OH&S) is administered. Some universities also offer certification on OH&S through academic units.

In the overall scope of EHS, health and safety training programs are considered the most effective method for managing occupational health and safety. Most organizations including universities spend a significant portion of their occupational health and safety resources on conducting training programs and information dissemination of the existing safety programs for people in their organizations. These safety training and information dissemination sessions are sometimes highly structured, while other times they are informal. Evaluating the effectiveness of a training program is particularly important to

identify the factors of training that influence the effectiveness of the program and to ensure that the program is meeting its objectives. According to OSHA voluntary training guidelines, the evaluation of program effectiveness should be an integral part of the training program to make training effective [OSHA, 2016].

1.2 Background and Literature Review

We start with the historical account of occupational health and safety legislation in Canada and in the province of Newfoundland and Labrador. Subsequently, we will describe the essential elements of health and safety programs, methodologies used to evaluate health and safety programs, and the evaluation strategies of the training programs.

1.2.1 Health and Safety Legislation in Canada

Canada has a long history of health and safety legislation. In the early days, acts and legislation were industry-specific; for example, the mining sector was regulated by a strict set of guidelines. The first comprehensive occupational health and safety legislation was implemented in Saskatchewan in 1972. Following this, other provinces adopted comprehensive legislation similar to Saskatchewan's laws. Safety laws are usually imposed on all the people whose conduct affects workplace safety such as employers, employees, supervisors, owners, suppliers, general contractors, professional engineers, and architects. Each province has also adopted Canadian hazard communication laws that require employers to label hazardous products and provide material safety data to chemical workers [Rabinowitz et al., 2000].

Each provincial government regulates occupational safety and health within their own jurisdiction and operates safety programs independently. In some provinces, two separate agencies take responsibility for overseeing workplace safety and health. The labor ministry is responsible for regulation and inspection, and a board is responsible for workers' compensation for on-the-job injuries [Rabinowitz & Hager, 2000]. Canadian safety standards encourage employee participation and are officially established through labor-management negotiation. In the Canadian system, employees have the right to participate in policy making and gradually become the first-line inspectors for hazard recognition [Rabinowitz et al., 2000].

1.2.2 Occupational Health and Safety Legislation in Newfoundland and Labrador

According to Occupational Health and Safety (OH&S) legislation in Newfoundland and Labrador, workplaces with ten or more employees require an OH&S committee and an OH&S program to be in place. The program should be developed in consultation with the OH&S committee and must be in a clear written form. An OH&S program requires a statement of the employer's commitment to cooperate with the employees and the OH&S committee, procedures of safe work practices and emergency responses, a plan for safety training for workers and supervisors, a system for controlling hazards and a mechanism to evaluate the effectiveness of safety programs [WHSCC, 2016].

Much of Newfoundland and Labrador's OH&S legislation refers to parts of codes and standards from other regulatory authorities; for example, CSA (Canadian Standards Association) standards are referenced in Newfoundland OH&S regulations. Also, there is

legislation to cover specific health issues; for example, it is mandatory for employers to take precautions to protect workers from hazards that may cause musculoskeletal injuries (MSIs) [WHSCC, 2016].

1.2.3 Essential Elements of a Health and Safety Program

A health and safety program must include all minimum essential components required by the health and safety legislation [CCOHS, 2016]. According to Canada's Federal Labour Code, an OH&S program is required when there are more than 20 workers in a workplace. The program must be developed in consultation with the OH&S committee and the employer is responsible for implementing the OH&S program in the workplace. OSHA (Occupational Safety and Health Administration) has identified four elements of a health and safety program: 1) Management commitment and employee involvement; 2) worksite analysis; 3) hazard prevention and control; and 4) safety and health training. The CCOHS (Canadian Center for Occupational Health and Safety) has identified twelve essential elements: 1) Individual responsibility; 2) the Joint Occupational Health and Safety Committee; 3) health and safety rules; 4) correct work procedures; 5) employee orientation; 6) training; 7) workplace inspections; 8) reporting and investigating accidents/incidents; 9) emergency procedures; 10) medical and first aid; 11) health and safety promotion; and 12) workplace specific items. The WHSCC (Workplace Health, Safety and Compensation Commission) in Newfoundland has identified ten elements for a safety program, which are in line with the CCOHS guidelines. The OSHA, CCOHS, and WHSCC have described the

safety program elements in detail on their websites. Below, we discuss the core concepts of a safety program:

Management Commitment, Leadership, and Administration: The management of an organization should provide leadership, sets goals, and communicate their commitment to health and safety to workers, contractors and staffing agencies through a clear written policy. Management should provide the necessary resources for maintaining health and safety programs and encourage workers to communicate about health and safety concerns without any fear of repercussions. The goals of management should be to emphasize the prevention of illness and injury due to workplace hazards [OSHA, 2016]. There are two main safety management behaviours: i) caring and ii) controlling [Cooper D., 1998]. Caring includes involving all the employees in safety, trusting the employees and showing appreciation for correct work. Controlling includes setting a clear written statement of action; a clear indication of expectations and responsibilities; and maintaining safety objectives. It is important to balance both caring and controlling to achieve excellence in management [Cooper D., 1998]. Carrillo (2002) suggested a three-dimensional model for safety management: 1) Build trust and communication, 2) increase capabilities for safety excellence, and 3) move from vision to practical work.

It is important to motivate employees of all ranks, especially the top management, as it plays an important role. A lack of knowledge, motivation, and directives by the top management can be a major cause of accidents and the poor safety record of a company (Booth, 1993). To assess safety culture within an organization, it is important to ask

employees about their safety concerns and respond to their problems [S.G. Minter, 1991]. Bailey and Peterson (1989) stated that safety reviews, audits, and inspections alone are not effective to measure safety efforts within an organization. Perception surveys of employees can be another useful tool to use to identify the strengths and weaknesses of a safety system [Bailey and Peterson, 1989].

Barling (2002) quantitatively investigated the relationship between workplace safety and safety-related transformational leadership, keeping in mind that there are significant differences between industries when it comes to occupational health and safety. The study was conducted in the food industry on two job categories: the first group were workers in a restaurant, and the second group were workers at fast food outlets. The study revealed that there is a strong indirect relationship between transformational leadership and occupational injuries. Transformational leadership strongly influences the perceived safety climate of an organization, which directly affects safety-related events and ultimately the number of occupational injuries [Barling, 2002].

Individual Responsibility: Health and safety is the joint responsibility of management and workers. Every individual, from entry-level workers to the chief executive officer, has responsibilities in promoting health and safety in the workplace [CCOHS, 2016].

Joint Occupational Health and Safety Committee: An effective health and safety program needs the co-operation of all employees. A Joint Health and Safety Committee (JHSC) is an

advisory group representing both workers and management. The committee maintains a written statement of purpose and duties, a proper schedule for meetings and adequate resources to function [CCOHS, 2016].

Safe Work Practices and Procedures: Safe or correct work procedures are the safest way of doing a job. Rules are essential to perform correct work procedures. For example, rules should be stated in understandable terms and should be available to the employees in a written form, the reasons behind the rules must be explained, rules should be specific to safety concerns, and they should be periodically reviewed to evaluate their effectiveness [CCOHS, 2016].

Health and Safety Orientation and Training: Health and safety orientation is important when an employee joins an organization. The orientation should include health and safety responsibilities according to legislation; emergency procedures; the reporting of injuries, unsafe conditions, and acts; and the right to refuse hazardous work [CCOHS, 2016]. Training is considered an important tool for informing workers, employers, and managers about workplace hazards and controls. The objectives of training are to implement health and safety procedures into specific job practices, increase skill levels to an acceptable standard, and enable workers and managers to participate in the development and implementation of the safety program [OSHA, CCOHS, 2016]. Some specific training may enable employers, supervisors, and managers to fulfill their leadership roles, such as instructions on responding to workers' reports on incidents, injuries, illnesses; instruction on fundamental concepts for controlling hazards including the hierarchy of controls; and training on the techniques used in incident investigation and root cause analysis [OSHA,

2016]. Hakkinen (1995) discussed the need for designing training programs according to the needs and aptitude of the target audience. The paper specifically focuses on the training of executives and top management. It indicated that the traditional classroom approach may not be effective for training executives and people in top management, and a more hands-on approach should instead be used. Training should be integrated into the decision-making situation and should be specific to the existing problems. To have the intended impact it is important to highlight the economic aspect of safety violations and to use phrases that link safety violations to management decisions. In this respect, it is often effective to bring in external insurance personnel to deliver the message since they have the unique preparedness to link safety violations or accidents with cost, and assertions from insurance companies often carry more weight for the organization management. However, it is also important to have a certain amount of flexibility in the training program so that it can be adapted according to the unique work culture of the organization [Hakkinen, 1995]. The above methodology was used in more than 100 organizations, where it successfully aroused or revived the interest of top management regarding workplace safety.

Communication: Proper communication and coordination among employers, contractors, and workers is important for maintaining adequate safety in the workplace. It is the employer's responsibility to establish effective mechanisms to protect all workers equally against injuries and illnesses. Inadequate communication about hazards may undermine safety programs [OSHA, 2016].

Workplace Inspections: To ensure health and safety in the workplace, health and safety legislation recommends using workplace inspections as a preventive action. The management and safety committee should be responsible for carrying out formal inspections. Their roles in workplace inspections are to: schedule workplace inspections in consultation with the employer, review workplace inspection reports and provide recommendations for corrective actions, review controls that are in place to minimize hazards, and act as a resource for the workplace inspection team in developing recommendations [WHSCC, 2016].

Hazard Recognition, Evaluation, and Control: Hazard recognition is necessary as a hazard (refers to a dangerous object**,** condition or behavior) may cause injury, illness or property damage in the workplace. A healthy and safe environment can be maintained through identifying, monitoring and controlling hazards [WHSCC, 2016]. There are two types of hazards: health hazards and safety hazards [OSHA, 2016].

Investigating accidents and incidents: In Canada, Occupational Health and Safety legislation recommends that some categories of accidents/incidents require legal investigation [CCOHS, OSHA, 2016]. For proper investigation, management should develop a clear procedure to start investigations immediately; conduct investigations with both management and workers; circulate the results of investigations to managers, supervisors, and workers; and provide recommendations for corrective actions [OSHA, WHSCC, 2016].

Emergency Preparedness and Response: An emergency preparedness plan is important to prevent accidents and incidents in the workplace [CCOHS, 2016]. The safety committee and management have some responsibilities in developing emergency plans such as maintaining a list of possible hazards; reviewing the maintenance of equipment and inspecting work activities to determine if an emergency response plan is needed; reviewing workers' training regarding their responsibilities in emergency situations; posting a site map of the facility and emergency contact information in the workplace; and providing resources for the necessary actions (e.g. to provide to the rescue team, medical equipment, and trainers) [CCOHS, WHSCC, 2016].

Medical and First Aid: The health and safety program includes information about the location of first aid stations, the provision of first aid training, the policy of medical examination, and procedures for transporting injured employees to outside hospitals [CCOHS, 2016].

Health and Safety Promotion: It is important to develop health and safety awareness and interest among the employees toward the safety program. This procedure should include setting realistic goals and monitoring progress; distributing all relevant information; and continuing hands-on training, tailgating talks and meetings [CCOHS, 2016].

Disability Management: The return-to-work program and services are for workers who were absent from work due to injuries and illnesses [WHSCC, 2016].

1.2.4 Methodologies for Evaluation of the Effectiveness of a Health and Safety Program

Today, there is more emphasis on using 'internal control' than 'external or regulatory control' to improve safety within an organization. Organizations with good safety management have mechanisms in place to measure safety performance, gather safety-related information and bring people together to educate them on how to work more safely. In a good safety culture, employees are expected to seek available information to improve safety performance [Booth, 1993].

Many standard organizations and governments around the world have developed Occupational Health and Safety Management Systems (OHSMSs). Canada, United Kingdom, Australia, and Japan, to name only a few, have developed an OHSMS. OSHA, the ISO (International Standards Organization), the American Institute of Hygiene Association (AIHA), and the CCOHS all have developed or endorsed an OHSMS model [Redinger & Levine, 1998]. However, there are very few guidelines or studies on methodologies used to evaluate the effectiveness of OHSMSs.

In August 1996, OSHA published a Program Evaluation Profile (PEP), though this directive was subsequently cancelled in November 1996. Still, the PEP along with "Form OSHA-195" remains a widely-used instrument and a useful source of information for evaluating occupational health and safety programs. The PEP is consistent with the OSHA Voluntary Safety and Health Program Management guidelines created in 1989. It serves several purposes: it can be used to gather information in a systematic way, to evaluate the

program, as a source of information for regulatory bodies as well as for employers and employees, and as a tool for communicating the findings to various stakeholders. Evaluation of the safety program is done using six elements: (i) management leadership and employee participation, (ii) workplace analysis, (iii) accident and record analysis, (iv) hazard prevention and control, (v) emergency response, and (vi) safety and health training. Elements (i) to (v) are further divided into several factors. A quantitative scoring method is used to evaluate each element of the program. Detailed guidelines with examples are provided for assigning the scores. The final score is an average of all six elements rounded to the nearest integer [OSHA, 1996].

The University of Michigan has developed a very general tool called the Michigan OHSMS Assessment Instrument (MAI) for assessing various OHSMS programs. The instrument was developed by analyzing three OHSMS models and one EHS model, namely OSHA's VPP, the British Standards Institute's BS 8800:1996, AIHA's OHSMS, and ISO's EMS model. These models were divided into single reviewable clauses. Clauses from different models were then regrouped into five categories according to their themes and given a new label to reflect the collective content. The five organizing categories are Initiation, Formulation, Implementation, Evaluation, and Improvement. OHSMS principles were developed for each group along with measurement criteria [Redinger & Levine, 1998]. The MAI assessment system was tested for different types of OHSMSs; for example, OHSMSs developed based upon standard models (e.g. ISO 9001, OSHA, etc.); OHSMSs which got certification after development; and OHMS systems developed completely organically to

address the needs of the specific organization and to meet safety regulations. The assessment tool showed that all of these OHSMSs can be a valid OHSMS.

1.2.5 Health and Safety Training

Training has been widely regarded as an essential element of a successful Occupational Health and Safety (OHS) program [CSA 2006; BSI 2007; AIHA 2005; Redinger et al. 1998]. According to OSHA and CCOHS guidelines, employee orientation and training are some of the main elements of a successful OH&S program. Training is regarded as a powerful element for expanding the capabilities and profitability of an organization [Islamshar Cosh, Duncan & Hughes, 1998]. OHS training generally consists of safe work practices, hazard recognition and control, the proper use of personal protective equipment, and emergency preparedness. In contrast to education, training includes hands-on practice, which is a very effective learning strategy for preventing hazards [Robson et al. 2010]. Most organizations including universities spend a significant portion of their occupational health and safety resources on conducting training programs for workers. Training can provide information that allows employees to increase their knowledge and skills to improve job safety [Islamshar Dessler, 2005; Beardwell & Holden, 2003; Cascio, 1998; Ivancevich, 2003; Mondy & Noe, 2005; Torrington & Hall, 2005].

Burke et al. (2006) examined the relative effectiveness of three different methods of worker health and safety training to improve safety knowledge and performance and reduce accidents. The first intervention method was least engaging and included videos, lectures, and pamphlets. The second was moderately engaging and included programmed instruction

and feedback intervention. The third one was most engaging and included hands-on training and training on behavioral modeling. A total of 95 quasi-experimental studies were included in the meta-analyses. These 95 studies were conducted between 1971 and 2003 in 15 countries. The studies comprised 126 independent samples, 20,991 participants, and 147 safety training effect sizes. The results indicated that the most engaging training (i.e. hands-on training and behavioral modeling) is more effective in improving workers' safety knowledge and performance than other methods of training. The findings challenge the current learning methods of computer-based distance training for public health workforce members [Burke et al., 2006].

Over the years, researchers have done extensive studies on various aspects of training programs and evaluated the effectiveness of training programs in different settings, especially industrial settings. These researchers discovered important factors for safety training and the mechanisms through which safety programs affect health and safety in an organization. Osterman (1995) reported that training increases the problem-solving skills of employees. Organizations with better safety programs [Zahar, 1980] and safety records [Cohen, 1977; Smith et al., 1978) were characterized by more open discussion between management and employees. It was also found that when employees discussed safety issues more with their supervisors, they followed safety procedures and practices more closely, which minimized the occurrence of workplace injuries [Hoffman & Morgeson, 1999]. Studies have shown that employees who receive safety training get less injured than employees who do not receive safety training [Colligan & Cohen, 2004]. An effective training program will guide and inspire trainees to find additional information about

potential hazards, make them more safety conscious and empower workers and managers to make positive changes in the workplace [Parker, Wall & Jackson, 1997]. Several researchers and practitioners have indicated the importance of ergonomic training programs [Brission et al. 1999; Green and Briggs, 1989; Verbeek, 1991]. Researchers have also suggested that workstation design and ergonomics training together can reduce musculoskeletal injuries [Bayeh & Smith, 1999; Robertson & O'Neill, 2003; Sauter et al.1991].

1.2.6 Methodologies for Evaluation of the Effectiveness of Health and Safety Training

Evaluating the effectiveness of a training program is particularly important in identifying the important factors of training that influence the effectiveness of a program and ensure that the training program is meeting its objectives. According to OSHA voluntary training guidelines, the evaluation of program effectiveness should be an integral part of a safety training program to make training more effective [OSHA, 2016]. There should also be continued efforts to evaluate the effectiveness of the training. Montatante (1996) has identified a lack of training objectives and the failure to evaluate training as two major causes of ineffective training [OSHA, 2016].

The Kirkpatrick model is the most widely-used model for evaluating training effectiveness [Alliger & Janak, 1989]. According to this model, the evaluation of training effectiveness is done in four steps or levels: reaction, learning, behavioral change, and results. Evaluation forms typically filled out immediately after conducting any training program provide

insight into the trainees' reactions on the effectiveness of the delivery method, e.g., organization of materials, relevance to the trainee's needs, instruction quality, etc. The evaluation of knowledge gained requires pre/post-paper-and-pencil tests or quizzes. Alternatively, tests on an untrained group can be used to establish a baseline and the difference between the two groups can give a quantitative measure of the knowledge gained. Behavioral change is a more long-lasting effect of the training program, and it can be evaluated through self-appraisal from employees or observation by peers and supervisors of their on-the-job performance. To ensure that trainees have the time needed to put knowledge into practice, the evaluation should be done at least three months after conducting the training. Results are the more tangible effects of the training program, quantified by reduced injuries or illnesses, lower medical costs, etc. These can be evaluated through the long-term monitoring of pre- and post-training statistics. However, care should be taken to minimize the effect of other organizational factors on the results. This can be done by analyzing periods where other factors were relatively unchanged or through the use of control groups [Cohen and Colligan, 1998].

O'Toole, M. (2002) used an employees' perception survey as a predictive tool to assess the effectiveness of safety programs. The study also examined the relationship between management's approach to safety and employees' perception of how essential safety is to the company. For this purpose, an employee safety perception survey was conducted at eight manufacturing sites in the southwest region of the United States by using a modified version of the Minnesota Perception Survey that was originally developed by Bailey and Peterson for the railroad industry. Injury data were collected from a large ready-mix

concrete producer industry over a 45-month period in the same region. A total of 3116 surveys were distributed to all employees including plant office employees during safety meetings, where employees could complete the survey on a voluntary basis during work time. 1414 (45.3%) employees returned a complete survey. The study result indicated that employees' perceptions of the safety management process were positively influenced by management's commitment to safety through action. The positive perceptions had a great impact on the reduction of injury rates. In the survey, the experienced managers could recognize that an employee's safety perception is highly predictive in compliance with safety standard and practices. The study revealed that there is a connection between management's approach to safety and employees' perceptions of safety [O'Toole, M. 2002].

Two comprehensive reviews on OH&S training were published by the National Institute for Occupational Safety and Health (NIOSH), which systematically reviewed the literature that was published between 1980 and 2010 [Cohen & Colligan, 1998; Robson et al., 2010]. These two reports point towards the many methodological limitations of the evaluation techniques. Harden et al. (1999) report that fewer than half of the evaluations were methodologically sound. Some of the common flaws in the evaluations were not allowing an adequate time gap between training and evaluation and using a control group that is different than the intervention group in terms of socio-demographic characteristics. Effectiveness is also dependent on differences in organizational structures, which was ignored in most studies.

Robson et al. (2012) reviewed the assessment of the effectiveness of Occupational Health and Safety (OHS) training for workers in Canada, the USA and Scandinavian countries. The review paper also compared the effectiveness of higher engagement OHS training with lower engagement OHS training. For the study purposes, ten bibliographic electronic databases for pre-post randomized trial studies including training interventions were searched. The databases were published in both English and French journals between 1996 and 2007. Only twenty-two studies met the criteria. Training interventions were classified according to the level of the learners' engagement such as low, medium and high engagement. Low engagement includes videos, lectures with minimal interaction, and computer instruction with no feedback. Training considered as 'medium engagement' included computer instruction with interaction, problem-solving activities, and lectures with discussion afterward. The 'high engagement' training included behavioral modeling and hands-on training in the actual workplace. The training was classified according to the category of hazards such as ergonomics, safety, physical, chemical or biological. The relevant studies were assessed on their methodological quality. In each study, existing data were used to calculate standardized mean differences to describe the effectiveness of OHS training. The assessment of the strength of evidence was for knowledge; attitudes (beliefs; perceived risk, self-efficacy); behaviors (behavior-dependent hazards, behavior-dependent exposures); and health (early symptoms, injury, illnesses). Five studies were related to the effectiveness of training on knowledge. Only two of the five studies were found to be methodologically sound. Therefore, application of the algorithm classified the evidence of the effectiveness of training on knowledge as insufficient [Robson et al., 2012]. Only two studies that examined the effectiveness of training on attitudes were found to be

methodologically sound and the evidence was classified as insufficient [Robson et al. 2012]. Six studies on the effectiveness of training on behaviors were found to be methodologically good. Therefore, there is sufficient evidence for the positive effects of training on behaviors. Five studies that examined the effectiveness of training on health were found to be methodologically sound. As the direction of the effects was inconsistent and the effect sizes were small, the evidence was not classified as sufficient [Robson et al., 2012]. The review team delivered recommendations to continue providing occupational health and safety training to employees, as training has a positive effect on workers' behaviors. There was not sufficient evidence to support that higher engagement training was more effective than lower engagement training for improving workers' safety behaviors [Robson et al., 2012].

Though workplaces have become safer over the years due to various reasons including improved safety training, the safety of young and unskilled professionals still remains a concern. Statistics collected in Quebec show that since 2000, although injuries in the workplace in Quebec have been declining [CSST, 2012], some young workers who hold unskilled jobs, leave school early, or have learning difficulties are still at a high risk of injury [Breslin, 2008; Breslin & Pole, 2009]. This issue further underscores the need for effective health and safety programs at universities.

1.2.7 Studies on the Evaluation of Health and Safety Programs in University Settings

Universities are large sectors of possible occupational hazards and must be taken into consideration in planning for the provision of health services [Venables et al., 2006]. Our

search did not return any large-scale studies on the OH&S status of Canadian universities. In fact, very few studies to evaluate health and safety programs were conducted in university settings globally. There were two large-scale surveys, one in the USA and the other in the UK, that examined OH&S in academic institutions [Emery et al., 1998; Venables et al., 2007]. Emery et al. (1998) evaluated the relative status of health and safety programs for minority academic and research institutions in the USA. The main objective of this study was to compare the relative status of health and safety programs of minority academic and research institutions with those of nonminority institutions through cross-sectional survey data on reported injuries and illnesses. The second purpose was to gather information on the hazards, the programs that aimed to address the hazards and the medical surveillance to examine the health status of exposed employees [Emery et al., 1998]. The survey was limited to state-funded research institutions and state-funded minority and nonminority schools of undergraduate and graduate science programs. The survey questionnaire addressed five areas: descriptive institutional information, health and safety program staffing, hazards present, occupational medicine programs and health outcomes measures. A total of 54 institutions participated in the study. Of all the institutions, 88% indicated that health and safety-related programs are present in the institutions. The survey outcome showed that 72% of minority institutions and 80% of nonminority institutions indicated that 0 to 10% of the health activities are performed by consultants from other institutes; 89% of all the institutions could identify the presence of physical, biological and chemical hazards on their campuses; 57% of minority institutions identified radiological hazards; and 75% of nonminority institutions identified the same hazards on their campuses. Only 57% of the institutions provided data on lost time injuries and illnesses,

and among these institutions, 13% were from minority institutions and 87% were from nonminority institutions. Most of the participants could not answer regarding specific information on health evaluation, as they did not know much about that. The study results indicated that there is a need for health and safety professionals at the minority institutions as only one person was in charge of managing a wide range of potential hazards [Emery et al., 1998].

Venables and Allender (2007) described the occupational health services in 117 universities in the UK through surveys which were carried out in 2002, 2003 and 2004. Of the 117 universities, 93 universities responded to the questionnaire. More responses were received from larger universities and from in-house services. The surveys requested self-completed information on occupational health services from each university. The results indicated that 50% of the universities had an in-house health service, 32% relied on a contractor, 9% used the campus student health service, and a further 9% had an ad hoc arrangement or no arrangement. On average, the service was poor, as usually only one half-day doctor with one full-time nurse and a part-time clerk were available to provide service. The wide variation among universities in staffing levels suggested that some universities might have less adequate services than others. The study results did not clarify if the universities have adequate occupational health provision for employees and students [Venables et al., 2007].

A study conducted by Nyren, D.E. in 2002 investigated teachers' safety training within their current teaching assignment. The study purpose was to obtain the perception of technology educators about health and safety training within their current teaching assignment. All the participants in the study were teaching at a public school and had active

memberships in the Minnesota Technology Education Association. A survey questionnaire was sent to 203 active members of the association via e-mail. Most of the questions on the survey used a five-point Likert scale to assess the opinions of the participants. Only 45 people returned a complete survey. The survey data analysis indicated that though technology education teachers received some safety training through their employer, more training is needed to create a safer environment within laboratories. The study concluded that the technology education teachers are not trained enough in their current employment according to the standards of the Occupational Safety and Health Association (OSHA). The study recommended further research be conducted to determine the effectiveness of the training [Nyren, D.E. 2002].

A study conducted by Sheeran and Silverman (2003) aimed to increase staff attendance at fire safety training courses in a university at the United Kingdom. For this purpose, three types of intervention were assessed: i) a motivational intervention designed to encourage participants to attend the training; ii) a volitional intervention to increase the chances of participation by specifying the time and place of the fire training course; and iii) a combined motivational and volitional intervention. The potential participants were employees in that university who were eligible to attend any one of the six fire safety training courses. Before the first course, a few randomly selected employees were sent a questionnaire. The participants were assigned randomly to four groups; some received the motivational intervention only, some received the volitional intervention only, some received both the interventions and some in a control group received neither intervention. The study results indicated that the volitional and combined interventions increased much

of the attendance compared to the motivational and control conditions [Sheeran et al., 2003].

An online survey of faculty, staff and students was conducted in a study on 'Montana Tech Campus Safety, Security' by Kristine Witt (2011). The survey was a voluntary internet survey of students, faculty and staff members aged 18 and over who attended the school or were employed at Montana Tech in 2011. All eligible subjects (3,373) were sent an e-mail with a web link to access the survey. The study result indicated that Montana Tech is overall a safe campus during different times of the day and according to annual security reports, very few crimes actually happened on the campus. The findings from this study stated that some issues need to be addressed to improve safety, such as lighting on campus, and snow and ice removal from campus sidewalks and walkways. Based on the results, some recommendations were made for the Montana Tech campus, such as to increase the awareness of campus services and encourage the reporting of crimes to authorities, provide more safety seminars to the campus community, and administer a safety survey each year or every two years [Witt K., 2011]. The study revealed that most of the students in the campus are aware of the resources, but very few of them used the campus resources and services. Kelly and Torres (2006) believe this could be due to students' feeling that they do not need assistance for safety or that students do not have a relationship with the members of the safety committees or access to the safety resources at the campus.

Bryden and Fletcher (2007) also found that the majority of the participants in their studies were aware of campus security (e.g. security patrol, safety escort services, emergency

phone systems), but few people actually used the services. The study examined the safety concerns of faculty members (both male & female) on a small university campus in Alabama. A questionnaire of hundred and sixty items was distributed to faculty members asking about socio-demographic information, daily campus activities, personal safety protection taken while on campus, awareness and attitudes about safety on campus and reported cases of victimization on campus. The results revealed that women took more personal safety precautions than men and felt more strongly about the need for the improvement of safety features on campus. A few months later, the authors examined the safety awareness of male and female staff members in the same university with the same questionnaire. The results indicated that although female staff members reported more about acts of violence against them than male staff members, there was not much difference in their attitudes towards improving safety features on campus. Faculty and staff members identified that they like to use avoidance strategies such as walking with a friend or using a key or other objects as a weapon rather than contacting campus security [Fletcher and Bryden, 2007].

Another study was carried out at Eslamshahr University at Tehran in 2012 to evaluate the effectiveness of job-based training. The study focused on the effectiveness of training courses on the performance of university employees and teachers. The method was descriptive-survey and a questionnaire was distributed among employees, teachers, and managers. 'Descriptive statistic' was used for the data analysis. The effectiveness of the training programs was evaluated at all levels (i.e., reaction, knowledge gained, behavior changes, and results) as outlined in the Kirkpatrick model. The overall ranking was "almost

acceptable". The research identified several factors for the improvement of the effectiveness of the training program; for example, making training more specific to trainee needs, delivering training regularly and maintaining continuity, and staff awareness as the objective of the training program [Farjad, S., 2012]. Though the research outcomes are interesting, very little information was provided on how these conclusions were reached. No details on the training program, questionnaire or analysis were provided in the article.

A study by Laberge et al. (2014) aimed to gain insight into the actual educational process of the occupational health and safety of young workers during a 6-8-month internship in a high school-level semi-skilled vocational training center in Quebec. The study included nine apprentices and five experienced coworkers for auto- and allo-confrontation interviews for an ergonomics intervention. In auto- and allo-confrontation devices, one can reflect on his/her own activities [Mollo and Falzon, 2004]. The study results indicated that teaching and learning are not the same. The interviews clearly indicated that learning a semi-skilled trade required more practice on actual hazards than only classroom lessons about tasks and procedures. The approach of ergonomic actual work activities had built an association between educational theory and preventive strategies for injuries to improve vocational training programs for young workers [Laberge et al., 2014].

1.2.8 Studies on University Laboratory Safety Assessments

University laboratories have become a great concern for occupational health professionals since 1978, when a death from smallpox occurred as a result of a laboratory transmission in

Birmingham University UK [Pennington H., 2002]. Goodwin et al. (1996) conducted a large survey focusing on the institutional responses to transmission risks in university laboratories. The survey included all 33 Australian universities where chemistry courses were offered. The study had two objectives: first, to identify different departmental approaches regarding education and training on OHS for students and staff; and second, to create a resource document of techniques used by the different departments. The study identified that OHS training for staff and students was inconsistent in terms of content. The study findings indicated that funding and departmental initiatives are crucial for proper occupational safety and laboratory safety programs.

In Taiwan, a study was conducted in 2008 on the effects of organizational and individual aspects of safety leadership in university laboratory settings. Two colleges and two universities were included in the study. Among them, two were publicly owned and the other two were owned privately. A questionnaire was mailed to 754 people in all four colleges and universities and 465 were returned valid. The questionnaire was divided into two sections. The first section asked about information on the size of the organization, ownership, location, gender, age, job position, worksite accidents, safety committee and safety training. In the second section, the perception of safety leadership was assessed using a safety leadership scale. The study result indicated that the safety leadership perceptions of the employees differed with the size of the university, location, ownership, and presence or absence of the safety committee [Wu et al., 2008].

1.3 Problem Statement

Safety training is vigorously promoted by CCOHS and OSHA in an effort to provide a safe workplace to employees. Studies have been conducted on various aspects of safety training including assessment of the training program [O'Toole, 2002; Cohen & Colligan, 1998; Robson et al., 2012]. Most in-house assessments of training programs measure only immediate reactions of trainees and ignore more important factors such as the extent to which the knowledge was absorbed, the effect on changing trainees' behavior and the impact on organizational performance [Smeltzer, 1979; Parker, 1984; Smith, 1989]. Therefore, it is important to design a systematic method to evaluate the effectiveness of health and safety programs.

Also, the reviewed literature is focused predominantly on industrial settings and very few studies were based on university settings. Further, none of these studies were based on a Canadian university. It has, therefore, become important to review workplace health and safety in universities to establish a baseline. In 2013, MUN contracted a third-party consultant to conduct an impartial assessment of the safety culture at the university. The consulting group was asked to do a complete assessment of the current state of health and safety programs offered by MUN through the Office of the Chief Risk Officer and to identify gaps in the program. The consulting group surveyed about 10% of the permanent employees of MUN in 2013 and produced a report in 2014. The Office of the Chief Risk Officer called the report a GAP analysis (See Appendix A for the GAP analysis results). To address the identified gaps and to increase awareness about the health and safety programs at MUN, in 2015, the Office of the Chief Risk Officer conducted several health and safety

presentations at MUN. We were curious to see if these presentations had any effect on the knowledge, attitude and behavior of the employees and graduate students at MUN and if their level of knowledge, attitude and behavior are sustainable. As a result, in consultation with the EHS Unit in 2016, we administered two identical online surveys of employees and graduate students at MUN (See Appendix B for our survey instrument). The intent of conducting the surveys is to gain insight into important factors that could make MUN's health and safety programs more effective. This research is also aimed at conducting a comparative study of health and safety programs among Canadian universities including the occupational health and safety programs offered by MUN.

1.4 Objectives of the Study

To achieve the goal, we have set the following specific objectives of the current research.

1) Review and compare the Workplace Health and Safety (WHS) programs of 10 major Canadian universities (including MUN) using publicly available information.

2) Collect information on safety knowledge, attitudes towards safety and the day-to-day practice of safety protocols of the faculty members, staff, graduate students and researchers of Memorial University through well-designed surveys.

3) Evaluate the effectiveness of safety programs provided by the EHS Unit of the Office of the Chief Risk Officer of MUN.

4) Conduct a key informant survey of MUN officials responsible for the operation of the health and safety unit to address the issues raised in the surveys.

1.5 Research Questions:

The study has been designed to answer the following research questions:

1) Is the EHS Unit at MUN offering sufficient safety programs and safety services compared to other Canadian universities?

2) What are the levels of knowledge, attitude, and practices of the faculty members, staff, graduate students and researchers regarding workplace health and safety programs offered at MUN and do they differ with respect to demographic variables?

3) Has there been any significant improvement in the perception of the workplace health and safety of MUN employees since 2013 when the survey on gap analysis in safety culture was conducted?

4) Is there any significant difference in the perception of safety practices between those who attended safety presentations facilitated by the EHS Unit at MUN and those who did not attend these presentations?

5) Have the knowledge, attitude and behavior of the employees about health and safety changed over the period of 6 months?

6) What are the responses of the officials to the issues raised in the surveys?

1.6 Organization of the Thesis

The thesis has five chapters in total including the current chapter. The rest of the thesis is organized as follows:

Chapter 2: This chapter describes the methodology of the study. The research methodology has four steps. In the first step, we have reviewed the health and safety programs of ten prominent Canadian universities including Memorial University and have compared the

safety programs of other universities with the safety programs of Memorial University. Next, we have analyzed two identical survey data spaced six months apart, which we gathered in October 2016 and in April 2017 from MUN employees' opinions on workplace health and safety. We have then compared the results of our two surveys with the result of the survey on gap analysis in safety culture conducted in 2013 at Memorial University. Further, we conducted key informant interviews (KII) of several officials who are responsible for developing health and safety programs and resolving safety concerns at Memorial University. The KII questionnaire is based on the results of our two surveys.

Chapter 3: In this chapter, we present the results of the research. It includes the comparison of the safety programs of ten Canadian universities, the results of the data analysis of the two identical online surveys, the comparison of the results of the two surveys with the results of the previous survey on the safety culture of MUN, and an analysis of the key informant interviews.

Chapter 4: In this chapter, we discuss the study results with reference to the previous studies.

Chapter 5: Chapter 5 summarizes the study results with some concluding remarks.

CHAPTER 2

Research Methodology

In this research study, we used both quantitative and qualitative methods for assessing the health and safety programs of MUN. The steps of the research methodology are described below.

2.1: Comparing health and safety programs among ten Canadian universities.

First, to establish a benchmark for the comparative study, we have reviewed publicly available information on the health and safety programs of ten major universities across Canada and performed a comparative study with Memorial's safety programs. This is a qualitative review of the information collected from the university webpages and other reports that are available online. For this comparative study, we have used the 'Program Evaluation Profile (PEP)' established by OSHA (Occupational Safety and Health Administration). The PEP is an auditing tool mostly used for industrial purposes. We have used the PEP as a management framework to explain the comparison. The intent of the comparative study is to help improve MUN's health and safety programs in the future.

2.2: Cross-sectional surveys of MUN employees on Workplace Health and Safety Programs.

In the second step, we have conducted two identical online surveys of faculty members, staff, researchers and graduate students of Memorial University about the effectiveness of the dissemination of information on workplace health and safety at MUN as well as the

dissemination of the programs offered by the EHS unit. The first survey was conducted between October 19, 2016 and November 30, 2016, Our intent for the first survey was to assess the level of knowledge, attitude and behavior (practice) of the faculty, staff and graduate students/researchers about the information on health and safety provided by the EHS unit to the Memorial community through their safety workshops in 2015-2016 as well as through their broader reach-out mechanisms. Further, we wanted to understand the retention of knowledge over a time span of six months and to see whether the knowledge, attitude and behavior of the employees have changed over time. We, therefore, conducted the second survey six months after the first survey between April 10, 2017 and June 10, 2017 with the same questionnaire, same target group and following the same methodology as the first survey. Our survey questionnaire was developed through several meetings with the EHS unit. Earlier in 2013, a survey was conducted by a third-party consultant to study the gaps in the safety culture of MUN. The survey was known as the Gap Analysis (GA) survey. Some questions in our survey questionnaire were based on the questions from the 2013 GA survey with the intent to compare the results. We borrowed some questions from the survey questionnaire of the study 'Montana Tech Campus Safety, Security and Safety Awareness Survey' conducted by Kristine Witt in 2011 at Montana Tech University. In addition, we developed some questions based on input from the EHS unit. The questionnaire with the references is presented in Appendix B. In addition to the supervisory committee, three other people involved in health and safety-related activities have checked the flow of the questionnaire to finalize it. We conducted a pilot survey of several faculty members, staff and graduate students to ensure the readability, clarity, and organization of the survey questionnaire. Based on their feedback, we made some adjustments in the

organization and wording of the survey questionnaire. We submitted an ethics application together with the survey questionnaire to the Health Research Ethics Board (HREB) for ethics approval. After screening, our project was exempted from HREB review because the project was categorized as a program evaluation. We excluded undergraduate students since they were not the main target group of the safety presentations. We kept the survey population similar to the population that was surveyed in 2013 at Memorial University. This allowed us to compare the results with those of the previous survey to determine the changes in the knowledge level of the employees on health and safety-related information disseminated by Memorial University through the EHS unit. We included graduate students/researchers, faculty members and staff in our research as they work for the university as employees. We conducted an online survey using Survey Monkey®. We sent e-mails detailing the nature of the survey and provided a web-link (Survey Monkey) to access the survey. We circulated the survey with a further preamble and consent form to all faculty and departments of the St. John's and Grenfell campuses of MUN. The e-mail was sent to the contact person of each department or faculty, and the contact person circulated the survey to all faculty members, staff, researchers and graduate students through group email. We ensured through phone calls and in-person visits to the departments that the survey emails were circulated to the target groups.

2.3: Key Informant Interviews

After completing the cross-sectional surveys, we conducted key informant interviews (KII) with eight officials who have been responsible for the development and implementation of health and safety programs at MUN. The primary motivation of the KII was to collect

further information related to the survey questionnaire and to find answers to some of the comments made by the participants in the surveys. For this part of the study, we sent an invitation letter to the individual through e-mail to obtain his/her consent. We then arranged a suitable place and time for each interview. We obtained the participants' written consent before the interviews. Each interview took about 45 minutes to complete. The KII questionnaire was informed by the outcomes of the survey results, as we needed to clarify some issues which emerged from the survey data analysis. The questionnaire is provided in Appendix C.

CHAPTER 3
Analysis and Results

This chapter provides analysis of all three parts of the study: (i) Health and safety programs of 10 Canadian universities using a scan of publicly available literature, (ii) Cross-sectional surveys and (iii) key informant interviews. We use the qualitative analysis technique for parts (i) and (iii) and the quantitative analysis technique for part (ii). Qualitative and quantitative methods are complementary [Jick, 1979]; therefore, we used both qualitative and quantitative methods to gain an in-depth understanding of the safety programs and to get clarification on some issues raised in the surveys.

3.1 Health and Safety Programs in Canadian Universities

In this section, we address the first objective of the research, namely, to review and compare Workplace Health and Safety (WHS) programs of ten major Canadian universities using publicly available information. We have selected the universities in such a way that it will cover all the provinces in Canada. The universities are Memorial University of Newfoundland (MUN), Dalhousie University (Dal), University of New Brunswick (UNB), University of Toronto (U of T), McGill University (McGill), University of Ottawa (U Ottawa), University of Manitoba (U of M), University of Saskatchewan (U of S), University of Alberta (U of A), and University of British Columbia (UBC).

We have reviewed the health and safety programs of ten Canadian universities to establish a benchmark and evaluate whether there are adequate health and safety programs and policies in place to reduce workplace hazards at MUN. Based on the information from

publicly available university websites, we have evaluated the health and safety programs of the universities following the popular methodology, the Program Evaluation Profile (PEP). The PEP consists of six elements: 1) Management, Leadership and Employee Participation; 2) Workplace Analysis; 3) Accident and Record Analysis; 4) Hazard Prevention and Control; 5) Emergency Response; and 6) Safety and Health Training [OSHA 2016]. Each element is divided into factors and these factors are scored. As we were not able to find detailed information on health and safety programs on the university websites, we have not used the scoring part. Based on the six elements, we have compared the health and safety programs of the ten Canadian universities below. For the convenience of presentation, we have split each table into two parts. In each part we have compared the health and safety programs of five universities.

3.1.1 Management, Leadership, and Employee Participation: This is divided into factors such as leadership (refers to the goals and leadership of the institution), management and implementation (refers to authority and assigned responsibility), employee participation (refers to employees' and students' participation in the safety committee and hazard control procedures), and contractor safety. It is clear from the review that the goals of all universities are to protect all members of the university community from occupational injuries and illnesses and promote a safe work environment by providing information, supervision and training. In what follows, we describe how they achieve this through leadership, management and implementation. To begin, we look at their leadership, then employee participation and at the end the management and implementation of ten universities.

Table 3.1.1: Management, Leadership and Employee Participation in ten Canadian Universities

Leadership				
MUN[a]	Dal[b]	U NB[c]	McGill[d]	U of T[e]
MUN has a commitment to meet all requirements of various regulatory agencies. A detailed frame-work is documented in Health and Safety Management System (HSMS). A well-defined organogram lays out the responsibilities of different parties that start from staffs/students/contractors and ultimately to the board of regents.	Dal has a commitment to provide appropriate environment for work, study and campus life. The policy is endorsed by the president and the board of governors. Roles and responsibilities of each member are well-documented on the university website.	The role of EHS is to assist all parties in the campus in adhering to safe work practice. Ensuring safe workplace is a joint responsibility of students, employees and visitors. Roles and responsibilities are not well documented.	The mission of the EHS is to develop safety culture through programs, training, supervision, and technical support. Occupational health and safety is a shared responsibility of all parties and relies on every ones understanding of safety and compliance. Roles and responsibilities are not well documented.	EHS mission is to ensure safe and healthy work, research and study environment for everyone. All levels of management are required to cooperate to implement OHS Management System, comply with the health and safety regulations and develop health and safety programs. Roles and responsibilities

				are not well documented.
Management and Implementation				
MUN has a total of 27 WHSC Committees on the campus. These Committees communicate with EHS unit to resolve health and safety issues at their own workplaces. MUN's new OHS system has two Tiers. Tier1 is a university-wide committee. Tier2 is made up of union-based joint committees.	Dal has established local committees. These committees advise the unit head to resolve and operate internal safety programs properly. The director of Health and Safety Department supports the Health and Safety Committees and is liaison with other agencies.	The EHS Manager of U NB is responsible for ensuring that UNB complies with the provincial safety codes and standards. The EHS committee members participate in the development and implementation of health and safety policies at U NB.	McGill has three university- wide health and safety committees such as, University Health and Safety Committee (UHSC), the University Laboratory Safety Committee (ULSC) and the Facilities Safety Committee (FSC). There are also Departmental Health and Safety Committees to promote health and safety within the departments.	U of T has local health and safety committees in the campuses for departments, faculties and employee unions. The EHS office co-ordinates and provides support to these committees on health and safety related issues.
Employee Participation				
Both employees and workers are members of the Work Place Health and Safety	Employee participation is through the Dalhousie Health and Safety Committee. It works on	Employee participation is only through the UNB Joint Health and Safety Committee	At McGill, in addition to the management and safety officers, the	U of T has a multiple JHSC in the university campuses where

Committee (WHSC). The members participate in workplace inspections, receive complaints, and promote health and safety programs. "Tool Box Talks" is a way of engaging into safety conversation.	developing health and safety programs; participates in investigations of accidents. Through a website, the members of the committee can communicate with each other globally.	(JHSC). The committee has equal representatives from worker groups and management or supervisory personnel. It also has representative from students' union as an observer. The members participate in workplace inspections, accident investigations, make recommendations.	safety committees have representatives from faculty, staff and key personnel from different workshops and labs.	management, worker and EHS facilitators participate. All the members of the committee provide equal consultations on health and safety related issues.
Contractor Safety				
All works at MUN property must be performed in accordance with the OHS Regulations. The Safety & Environmental Services will assess the contractor's written Safety Management Plan and participate in safety inspections of the site.	At Dal, the Contractor Safety Policy applies to all contractors, sub-contractors and their employees who undertake maintenance, construction or related works at university property.	The contractors are required to follow the provincial and U NB safety regulations.	The contractors are expected to maintain safe construction rules for construction projects in and around McGill community.	The U of T EHS department provides contractor safety program through project coordinator. The project coordinator will ensure that, contractors follow the Ontario OHS Act.

Leadership				
u Ottawa [f]	U of M [g]	U of S [h]	U of A [i]	U BC [j]
No clear mission statement. Policies are developed in-line with the Ontario provincial health and safety guidelines. Policies are listed in "enterprise risk management" section under the administration and governance. The roles and responsibilities of administration and staff are well documented. The committee is headed by Vice President Resources	A strong mission statement to establish a culture of enterprise risk management and emergency preparedness, with a vision to ensure a safe workplace for staff and students. A well laid organization structure for the office of risk management headed by Chief Risk Officer.	The university has a strong commitment to creating a healthy and safe working and learning place. Board of governors is the ultimate authority, responsibilities are delegated to the president, vice-president all the way down to the students.	EHS is administered under the bigger umbrella of risk management with a vision to make risk management a part of all decision making. A well structured Environment Health and Safety Management System is present to communicate and manage health and safety procedure. Risk Management Services is headed by Associate Vice President risk management.	EHS services are provided under risk management services with a goal to ensure health and safety for people and environment. The university operates through safety committees at different level. Roles and responsibilities are well documented.

reporting to the board of governors.				
Management and Implementation				
u Ottawa has a joint Occupational Health and Safety Committee (UJOHSC) and three Functional Occupational Health and Safety Committees (FOHSC) such as, Laboratory Committee, Office Committee and Protection and Physical Resources Committee. The different committees allow the employees to deal with the concerns related to their own works.	The U of M has two different committees to undertake different safety responsibilities such as, Local Area Safety and Health Committee (LASH), Organizational Safety and Health Advisory Committee (OSHAC). The OSHAC committee manages the issues that have not been resolved in the LASH Committee.	In U of S, there are two statutory committees. One is a central Occupational Health Committee and the other one is a specific Occupational Health Committee for the Plant Sciences Field Facilities and Agriculture Green House. In addition the university has twenty local safety committees	The faculty/portfolio EHS Committees of U of A make a faculty annual report about incidents, lessons learned and provide recommendations to senior administrators. The supervisors address and review safety concerns and provide safety training to students and staff.	The UBC has Advisory Committees. The members of the committees work for the safety improvement in their specific field of expertise. UBC has Local Safety Committees (LSC). The LSC communicate with the University Health and Safety Committee through the RMS.
Employee Participation				
The members of UJOHSC and FOHSC are representatives from	Representatives from worker and management groups make up the local and	Employees participate through the safety committees, which have representatives	U of A Safety committees comprise of representatives from management,	The university has a clusters of Joint OHS Committee that are accountable

the management, different worker unions, and an observer from undergraduate students. The committee members participate in workplace inspections and provide recommendations.	organization wide safety committees. Employees with skills are encouraged to participate in the committees. The members evaluate the effectiveness of health and safety programs, conduct workplace inspections, review incident investigation reports and provide recommendations.	from different worker unions and management. There is no strong solicitation for employee participation documented.	employees with supervisory roles and safety designates, and EHS representatives. There is no strong solicitation for employee participation documented.	directly to their VP portfolio. The committees have representatives from teaching, research staffs, and different unions. There is no strong solicitation for employee participation documented. .
Contractor Safety				
In u Ottawa, workers and employees are required to receive safety orientation, safety refresher and WHMIS training course.	The U of M provides site safety plan for the contractors to minimize hazards. All the university contractors for construction and maintenance services are required to attend a two hours health and safety orientation prior to their projects.	The Department of Safety Resources of U of S provides the Contractor Health and Safety Orientation for all the contractors who work in or near the university properties. The orientation is mandatory prior to begin the projects.	In U of A, contractors should submit their company health and safety program for review and attend a contractor safety orientation at the university health and Safety Office. The university will then issue a health and safety prequalification registration number to perform the work.	In U BC, contractors are required to work in accordance with the Work Safe BC OHS Regulations. Contractors must visit the UBC Technical Guidelines for detail information.

[a] EHS (Environmental Health and Safety) Memorial University, 2017; [b] EHS: Dalhousie University, 2017; [c] EHS: University of New Brunswick, 2017; [d] EHS: McGill University, 2017; [e] EHS: University of Toronto, 2017; [f] Health, Safety and Risk Management: University of Ottawa, 2017; [g] EHS: University of Manitoba, 2017; [h] WSEP (Workplace Safety and Environmental Protection): University of Saskatchewan, 2017; [i] EHS: University of Alberta, 2017; [j] RMS (Risk management Services): University of British Columbia, 2017.

The above comparison shows that MUN has a well-laid-out Health and Safety Management System for effective health and safety programs in the university. MUN has established 27 Workplace Health and Safety Committees (WHSCs) through which the management and workers participate in resolving health and safety-related issues. This is similar to the Joint Health and Safety Committee (JHSC) or Joint Occupational and Health Committee (JOHC) in most other Canadian universities. Similar to other Canadian universities, MUN's health and safety regulations are governed by provincial law. Most of the universities have different functional health and safety committees to manage local (building) and university-wide health and safety issues. All the universities follow provincial OHS regulations for contractor safety. Like most other universities, MUN has a contractor management plan and orientation to ensure the project works are performed safely.

3.1.2 Workplace Analysis: The factors of the workplace analysis are the survey and hazard analysis, inspection and reporting. Information on the workplace survey is not provided on the university websites. Also, no detailed information on the policy or procedure of hazard inspection is available on the university websites. Usually, in universities, the EHS Unit and the members of safety committees take the responsibility for arranging and participating in hazard inspections in the workplace. Other employees and students can also participate in the inspections if necessary. The people who participate in the inspections are required to have safety-specific training. The accident/incident reporting system is only available on the university websites. In most of the Canadian universities, the immediate supervisor is the primary contact for reporting any accident or incident. We have compared the accident/incident reporting systems of ten universities below:

Table 3.1.2: Workplace Analysis (Hazard Reporting) in ten Canadian Universities.

Hazard Reporting				
MUN	Dal	U NB	McGill	U of T
When supervisor is unavailable, employees are required to report serious incidents to EHS Department directly and call emergency to seek medical attention. Incidents can be reported to MUN's Incident Management System (MIMS).	The incident must be reported through Accident Report Form. Departmental Safety Committee, Director of EHS, the office of Insurance and Employee Benefits will receive the copies of accident reports. The OHS Division of the Nova Scotia Department of Labor will be informed of a serious life threatening accidents.	Any incident must be reported to the UNB security immediately. The incident report form will be signed by the head of the department where the incident has occurred. The form will then be submitted to the EHS office with the completed Occurrence Report Form.	If medical assistance is required, the supervisor will submit the completed Accident, Incident & Occupational Disease Report Form with the medical documentation to the HR advisor.	Students, contractors, and visitors must report incidents to a U of T contact. The U of T contact will submit the completed online accident/incident e-form for students, contractors, and visitors.
Hazard Reporting				
u Ottawa	U of M	U of S	U of A	U BC
The students must report all incidents to the Health, Safety and Risk Management Unit through the 'Accident, Incident and Occupational	The accident/incident report form will be completed by the involved worker, the supervisor with the help of a member of the LASH Committee.	A person involved in the incident must submit a completed accident/incident report form with the participation of the supervisor. In the	Students or employees must submit the completed U of A incident report form to the EHS department. The	The university employees and student must submit an online centralized Accident/Incident Reporting System (CAIRS) form. If the

Disease Form'. Incidents may also be reported to the Protection Services, and to Facilities Office. U Ottawa has an online tool 'Alert Us' for students to report emergency incidents.	When the accident is serious in nature, it should be reported to the Workplace Safety and Health Division of Manitoba Labor.	event of a sexual misconduct, the victim may report it to the University Protective Services or to the Criminal Justice System.	EHS department will then contact the supervisor for the second part of the form. An injured staff or student must contact the organizational health and effectiveness unit for medical treatment.	accident is very serious in nature, the RMS should be notified immediately and the RMS will report it to the Work Safe BC for the compensation.

In the above table, we can observe that all the universities have formal online accident/incident report forms. In all the universities, in the event of a serious accident or death, fire or explosion, the employees and students can directly contact the EHS unit, risk management services or provincial government for medical treatment and compensation. Therefore, Memorial University (MUN) has similarities with other universities in accident/incident reporting.

3.1.3 Accident and Record Analysis: The factors in this section are the investigation of accidents and near-miss accidents and data analysis. The results of survey data analysis on workplace hazards are confidential and are not available in the public domain. Therefore, we are only describing the policy/procedure of accident investigation in ten Canadian universities.

Table 3.1.3: Policies to investigate accidents and near-miss accidents

Policies to Investigate accidents and near-miss accidents				
MUN	Dal	U NB	McGill	U of T
The Department of Health and Safety will participate in the investigation procedure. The Department Chair, Supervisor are responsible for evaluating the seriousness of the accident. The EHS Unit is responsible for reviewing all investigation reports and provide recommendations. The university performs investigations on major incidents.	The Accident Investigation Committee is responsible for investigating accidents and providing recommendations to prevent re-occurrences of the accidents. The EHS Committee, The Chair of the Department, the Safety Committee of the Department will receive the report of the accident investigation. The Committee investigates all accidents that may cause serious injuries or hospitalization; all major spills, fires, explosions or release of chemicals.	An Accident Investigation Report Form must be completed by an assigned university employee, who is in charge to review the logistics and make recommendations for corrective actions. An accident investigation is a joint responsibility of university security office and EHS Office. The University Human Resource Department resolves the problems related to the Workers' Compensation.	The EHS Department at McGill is responsible for investigating the accident/incident to identify the root cause and will provide recommendations for corrective actions.	The supervisors and members of JHSC will review the incident and send a report to the OH&S department. The department will investigate the incident and will provide recommendations for preventive measures. Staff, who are injured or has witnessed the incident will participate in the investigation if required.
Policies to investigate accidents and near-miss accidents				

u Ottawa	U of M	U of S	U of A	U BC
The investigation procedure will follow information on the incident, determine the underlying causes; provide recommendations and writing the investigation report. If it is a physical hazard, the report will be submitted to the Functional Occupational Health and Safety Committee. A copy of the report may go to the Office of Risk Management if necessary.	The Environmental Health and Safety Office (EHSO) is responsible for the accident or near miss investigation. If it is a death of a worker, collapse of a construction, explosion or a fire, it needs to be reported to the Workplace Safety and Health Division of Manitoba Labor. The EHSO will conduct the serious accident investigation with the help of Workplace Health and Safety Advisory Committee (WHSAC).	The Incident Report form will be reviewed by the safety resources for the investigation and corrective action. When the incident report is about sexual misconduct, the university protective services will conduct the investigation with the interim measures such as, separation in living and workplace between the reporting and accused person; relocation or temporary suspension of the accused person and prohibition from all part of the university campus.	The EHS department or government agency is responsible for the accident or incident investigations and recommendations. The person or people involved in the incident are required to assist the investigation.	The supervisor is responsible to conduct the accident investigation. The supervisor has the skill and authority to change the preventive measures for the workplace. The preliminary investigation and corrections are required to be completed within 48 hours of the incident. A member of LHSC and the RMS can provide assistance and resources to complete the investigation.

In the above table, we observe that in most of the universities (including MUN) the department head and supervisor will first review the seriousness of the accident/incident and then send the report to the EHS office for investigation. Some universities have specific committees for accident investigation such as at Dalhousie University, where there is an Accident Investigation Committee to

investigate and provide recommendations for corrective actions. uOttawa has described the mandatory steps of the accident investigation procedure on its website. At uOttawa, physical hazards are reported to the Functional Occupational Health and Safety Committee and the Building and Risk Management Office. At U of S, the safety resources are responsible for accident investigation and corrective actions. U of S has mainly described the investigation procedure for sexual misconduct. In the University of British Columbia, the supervisor holds the highest authority to change the corrective measures in the workplace with the help of members of the LHSC and the RMS.

3.1.4: Hazard Prevention and Control: The factors considered under this element are hazard control, maintenance, and medical programs. In all of the Canadian universities, there is a health center which provides walk-in services and acts as the first point of contact for the healthcare system. These health care facilities operate under the umbrella of the provincial health care system and the university administrative framework. The most common hazard control policies or protocols in all ten Canadian universities are lockout/tagout; working in hot and cold environments; fire safety; biosafety; laboratory safety; X-ray, radiation and laser safety; WHMIS; working in a confined space; hand, head and face protection; fall protection; hazardous waste disposal; contractor safety; smoking and scent-free policy; first aid; and ergonomics. The other hazard control and maintenance policies of the ten universities are compared below:

Table 3.1.4 Hazard Prevention and Control of ten Canadian Universities

Hazard Prevention and Control				
MUN	Dal	U NB	McGill	U of T
Electronic Health and Safety Management System Software (HSMS); boating and diving safety; transportation of dangerous goods by road; power line hazards; fleet safety; working alone; accidental contact with electrical utilities; trench excavating; working with dust emitting products; radioisotope purchasing procedure; sharp disposal; Ozone Depleting Substances (ODS's); using lead based paints, lead solder, heavy metals.	Asbestos; workshop safety; smoke free policy; workplace violence; AED.	Machine guarding; abrasive cutting and grinding wheels; portable electric equipment and flammable container; vacating facilities; sharp disposal; fuel and gasoline and fuel oil delivery; ozone depleting substances; working alone; HVAC interruption; chemical 91`YDS storage; handling of cryogenic material; diving safety;	Facilities safety; construction safety; workshop safety; fieldwork safety; asbestos policy; AED; smoking policy; equipment advice; office of sustainability; general information for new principal investigators.	Transportation of dangerous goods; cryogens transfer facilities; flammable liquid storage; environmental protection services; occupational health services through medical surveillance programs; asbestos; job safety analysis; lead program and SOPs; lifting devices; machine safety guidelines; mold control program; noise; scaffolds; silica; workplace violence.
Hazard Prevention and Control				
u Ottawa	U of M	U of S	U of A	U BC

Occupational health and safety; controlled goods; transportation of dangerous goods; equipment decontamination and decommissioning; personal protective equipment; welding and cutting equipment; electrical and other energy sources; trenches, cranes, hoisting and rigging.	Mold remediation and control; noise exposure; working safely with lead paint; indoor air quality; AEDs; asbestos medical surveillance; immunization and post-exposure program; workplace hazard information placard (WHIP);	Compressed gas cylinder safe handling; self-inspection checklist master registry; occupational acquired allergies and sensitivities awareness guidelines; manual material handling; facility decommissioning standard; standards for building occupancy; electrical safety guide.	Working alone; helping individuals at risk policy; facilities and operations health and safety program; safety basics for students; safe walk; information services and technology (IST); privacy and security training hazard assessment web application; noise in the workplace;	Working alone; asbestos management; workplace violence prevention; influenza immunization program; hygiene hazards; transportation of dangerous goods; student safety including co-op and practicum/clinical placement.

In the above table, we can observe that MUN has an adequate number of basic workplace hazard prevention programs. Compared with the other universities, MUN has additional boating and diving safety, HSMS, and working with dust-emitting products. Some universities have some additional hazard prevention policies that MUN does not have. For example, Dal has a workplace violence program and an HVAC interruption policy; McGill has a workshop safety policy; U of T has occupational health services through medical surveillance programs, and a noise and mold control program; U of M has the Workplace Hazard Information Placard (WHIP); U of S has a self-inspection checklist master registry; U of A has a helping individuals at risk policy, a facilities and

operations health and safety program, safe-walk policies, and a hazard assessment web application; UBC has a student safety program including a co-op and practicum/clinical placement program.

3.1.5: Emergency Response: The emergency response includes emergency preparedness and first aid. In all ten universities, the departments are responsible for inspecting and restocking the first aid kits. The emergency preparedness and first aid in the ten universities are compared below:

Table 3.1.5 Emergency Preparedness of Ten Canadian Universities

Emergency Preparedness				
MUN	Dal	U NB	McGill	U of T
The St. John's Emergency Management Planning Group (SJEMPG) of Memorial University has developed an Emergency Management Plan. The plan consists of four elements, such as, Preparedness, Prevention, Response, and Recovery.	In the event of a fire, the university has a general Fire Safety Plan for every building with an emergency Response Booklet. There is no information on emergency management plan.	In emergency situation, the university contact with the Critical Incidents Team to initiate the emergency response plan and procedure, otherwise, the EHS and security department employ some students to provide services as campus patrol.	In the event of an exposure to excess radiation, chemical or radioactive spills, fire emergency, the EHS department will prepare for emergency procedure and decontaminate the affected area.	U of T has Emergency Response Teams (ERT) and Crisis Management Team (CMT) across the university. ERT provides chemical spill and fire response, medical services. CMT handle the academic and financial crisis.

First Aid				
Every supervisor at MUN is required to conduct a survey to identify the first aiders. On the basis of the survey, The EHS unit will develop the training program. All employees who work with electrical machinery should hold a valid first aid certificate and a CPR training.	The emergency response teams in Dalhousie University provide preliminary treatment to the employee and the student and arrange for medical treatment. No information is available on the training program on the university website.	The EHS Office provides first aid training in accordance with the OHS Act and Regulations.	McGill University's first aid is subsidized by the Government of Quebec. The first aid course is free for the faculty and staff. Students have to pay for the first aid certification and first aid training.	At U of T, The EHS Department provides the standard first aid courses to the university community.
Emergency Preparedness				
u Ottawa	U of M	U of S	U of A	U BC
u Ottawa provides guidelines for personal emergency preparedness including how to report an emergency to 'protection services'. No information is available on the emergency management system.	The University emergency response plan is supported by emergency management policy; security operating procedures; IT disaster recovery plan; crisis communication plan; labor disruption plan; pandemic plan; emergency procedure toolkit.	The university has an Emergency Measures Planning Committee. The committee provides emergency preparedness training, contingency and recovery planning. The committee will assist departments with risk assessment guidelines and template plans.	The university Emergency Management has four essential elements such as, reduction, readiness, response and recovery. The Operational Continuity Plan will assist the people in an emergency situation.	In U BC, The RMS operates the emergency preparedness. There is an Incident Command System (ICS). UBC has adopted British Columbia Emergency Management System that provides a multiple-jurisdictional response.

First Aid				
In u Ottawa, the employers are responsible to arrange the first aid training for the workers.	U of M offers workplace emergency first aid certificate course for the university staff members. The course includes basic treatment for injuries, CPR for heart and stroke.	The U of S provides a 20 hour certification program in CPR-C/AED /Standard First-Aid. There is also a 40 hours full First-Aid and CPR instructor course that includes a practice teaching component.	The U of A offers standard First Aid/CPR/AED training course to the university staff. This training is a two-day program involving lectures, practical work and a written exam.	In U BC, for quickest response, the employees and students call the Vancouver Fire Department as it has higher certified first aid workers. No information is available on the training program.

The above table shows that Memorial University has a well-organized emergency management plan. Every university has its own unique emergency preparedness plan and procedure such as the Environmental Health, Safety and Security Department at UNB initially manages emergency situations with some students who provide services as campus patrol. At McGill, the EHS department is responsible for emergency preparedness. U of T manages emergency situations with the help of emergency response teams and crisis management teams. At uOttawa, the Protection Services respond to emergency situations. U of S has an Emergency Measures Planning Committee. At UBC, Risk Management Services initially conduct emergency procedures. The U of M emergency response plan is supported and activated by some other emergency policies. Similar to MUN, U of A has some effective elements in the emergency management plan. Most of the universities have a first aid training program in place. Similar to other universities, MUN

requires that employees who work with hazardous materials must maintain a valid first-aid certificate. In addition, MUN has an effective procedure for selecting eligible candidates for first aid training through a survey.

3.1.6: Safety and Health Training: This indicates safety and health training as a whole. Although there are some differences, the Canadian universities provide similar occupational safety-related training. The common types of safety training that are present in all ten Canadian Universities are fire safety; first aid; laboratory safety; biosafety; X-ray, radiation and laser safety; and WHMIS. In the table, we have compared the safety and health training in the ten universities.

Table 3.1.6: Safety and Health Training in ten Canadian Universities.

Safety and Health Training				
MUN	Dal	U NB	McGill	U of T
Lifting and materials handling; asbestos awareness; fall arrest; operation of mobile equipment; transportation of dangerous goods; power line hazards; OHS Committee and WHS representative training; respiratory	The educational video for ergonomics.	Evacuation procedures; dangerous goods handling; traffic safety; practical loss control leadership and supervisory development training.	Safe use of biological safety cabinets; hazardous waste management and disposal; laboratory hazardous materials; asbestos awareness; internal responsibility system; respiratory protection and fit testing.	Basic health and safety awareness training; health and safety orientation for employees; JHSC certification training; office ergonomics; slips trips and falls training; respiratory protection and fit testing.

program; AED online video demonstration.				
Safety and Health Training				
U Ottawa	U of M	U of S	U of A	U BC
Worker health and safety awareness; respect in the workplace; violence prevention; accessibility standards for customer service; working together; the Code and the AODA; supervisor health and safety awareness; autoclave safety;	New worker general orientation; introduction to health and safety programs; safety for supervisors; transportation of dangerous goods; laboratory animal allergens and zoonotic diseases;	Contractor orientation program; fall protection; fieldwork and international travel safety; kids camp safety plan; nanomaterial safety; OH Committee training; office ergonomics; safety orientation for employees and supervisors; transportation of dangerous goods; Violence Threat Risk Assessment (VTRA) awareness; asbestos awareness; lift training.	ATV safety; bear awareness and safety; emergency management training; engineering laboratory orientation; field activities plan; graduate student safety certificate; guide to help individuals at risk; hazardous waste management; transportation of dangerous goods; high school orientation; MICF orientation; provincial radio control center; working alone safely; UV protection; supervisory EHS professional development; WISEST.	Communication campaigns; emergency preparedness training; environmental training; mandatory safety training for all UBC workers; research safety training; safety programs training.

Compared to the other universities, Memorial University has some additional safety training such as training for the operation of mobile equipment and power line hazards training. Some universities have additional safety training than MUN, for example, the University of Alberta has a field activities plan/program, graduate student safety certificate, and a guide to help individuals at risk program. The University of Ottawa has violence prevention, worker health and safety awareness, respect in the workplace, and accessibility standards for customer service training programs. The University of Manitoba has an introduction to health and safety program. The University of Saskatchewan has violence threat risk assessment (VTRA) awareness. The University of Toronto has basic health and safety awareness training. McGill University provides training for the safe use of biological safety cabinets. The University of New Brunswick has evacuation procedures, traffic safety, practical loss control and leadership training. The University of British Columbia has communications campaigns, environmental training, and mandatory safety training for all university workers.

3.2 Comparison of the Cross-Sectional Surveys

In 2013, a third-party consultant conducted an impartial assessment of the current state of health and safety programs offered by Memorial University through the Office of the Chief Risk Officer to identify gaps in the program. The consulting group contracted from Memorial University surveyed a total of 293 permanent employees across St. John's Campus, Grenfell Campus and Marine Institute and produced a report in 2014. The Office of the Chief Risk Officer called the report a GAP analysis (GA) (See Appendix A for the GAP analysis results). In 2015, the Office of the Chief Risk Officer at MUN conducted a few safety presentations to address the identified gaps in health and safety programs. We were interested to observe the effectiveness of these presentations on the awareness, attitude and behavior of the employees and graduate students at MUN. In 2016, in consultation with the EHS Unit of the Office of the Chief Risk Officer, we decided to administer two identical online surveys (using Survey Monkey) of employees and graduate students at MUN (see Appendix B for our survey instrument). We conducted the first survey between October 19, 2016 and November 30, 2016. The second survey was conducted six months after the First Survey between April 10, 2017 and June 10, 2017. The survey instrument was prepared to capture the awareness, behavior, and attitude of employees and graduate students toward health and safety programs offered by MUN. Most of our questions in the survey had multiple choices for the respondents to choose from with some open-ended options. We also had a few questions that were similar to the ones in the Gap analysis survey with the intent to compare the responses over time. To match with the Gap analysis (GA) survey, we have

selected only the Yes/No type questions and have divided them into three groups: i) Environmental Health and Safety Office-related questions, ii) Faculty/Building-related questions, and iii) Department/Division-related questions. The results of each group are presented in tabular form and in each table we have compared the frequencies of the similar questions of the three surveys (GA Survey, Survey 1 and Survey 2) in percentages. The tables are presented below:

3.2.1: Results of Environmental Health and Safety Office-related Questions.

In Table 3.2.1, the Environmental Health and Safety (EHS) Office-related questions are presented in the first column, the frequencies of the responses of the Gap analysis (GA) survey are presented in the second column, the frequencies of the responses of the first survey are presented in the third column and the frequencies of the responses of the second survey are presented in the last column. Under the GA survey column, some of the questions are marked as N/A, as there was no similar question in the GA survey.

Table 3.2.1 Comparison of surveys on EHS office related questions

Questions	GA Survey, 2013 n = 293		Survey 1, 2016 n = 148		Survey 2, 2017 n = 103	
	Yes	No	Yes	No	Yes	No
Are you aware of the presence of the Environmental Health and Safety Unit at Memorial University?	62%	38%	90.5%	9.5%	91.5%	8.5%
Do you read newsletters, brochures, bulletins, related to health and	52%	48%	77.3%	22.7%	67.6%	32.4%

safety e-mailed by EHS Unit?						
Were you informed about the Occupational Health and Safety Act?	69%	31%	67.7%	32.3%	67.8%	32.2%
Do you know where to report a safety concern, a safety hazard or accident?	84%	16%	85.4%	14.6%	86.4%	13.6%
Do you know the campus emergency telephone number?	N/A	N/A	73%	27%	72.6%	27.4%
Are you familiar with MUN's Health and Safety Policies?	41%	59%	66.3%	33.7%	75.9%	24.1%
Are you aware of Memorial's online reporting system for health and safety concerns?	66%	34%	61.3%	38.7%	74.6%	25.4%
Are you aware of MUN's Safety Escort Service?	N/A	N/A	49.5%	50.5%	67.8%	32.2%

In response to the question regarding knowledge about the existence of the Environmental Health and Safety (EHS) unit at Memorial University, both Survey 1 and Survey 2 consistently showed that more than 90% of the respondents are aware of the EHS unit, which is a significant increase from the 62% reported in the GA survey. Similarly, we can observe an increase in the percentage of those who read health and safety-related newsletters, brochures, and bulletins. All the surveys indicated that less than 70% of the respondents were informed about the Occupational Health and Safety Act. The respondents' awareness about reporting safety concerns/hazards is consistent in all three surveys. Compared to the first survey, in the second survey, the participants' awareness

about health and safety policies, online reporting systems and MUN's safety escort service have increased.

3.2.2: Results of Faculty/Building-related questions pertaining to health and safety.

In Table 3.2.2, Faculty/Building-related questions are presented in the first column, the second column presents the results of the GA survey, the third column presents the results of the first survey and the last column presents the results of the second survey.

Table 3.2.2**:** Comparison of surveys on Faculty/Building-related questions.

Questions	GA Survey, 2013 n= 293		Survey 1, 2016 n= 148		Survey 2, 2017 n= 103	
	Yes	No	Yes	No	Yes	No
Are you aware of Workplace Health and Safety Committee (WHSC) of the building you work in?	38%	62%	90.6%	9.4%	89.8%	10.2%
Does the WHSC in your building communicate with you?	37%	63%	75%	25%	72.9%	27.1%
Do you know your role in the event of an emergency?	54%	46%	71.6%	28.4%	89.5%	10.5%
Do you know the shortest exit rout from your work area(s)?	N/A	N/A	94.7%	5.3%	94.9%	5.1%
Do you know whom you call first if you get injured at work?	76%	24%	63.5%	36.5%	61.4%	38.6%
Are you aware that there are Automated External Defibrillators (AED) available in campus buildings?	N/A	N/A	87.5%	12.5%	81.4%	18.6%

Do you know where the AEDs are located in the buildings you work?	N/A	N/A	72.9%	27.1%	66.1%	33.9%
If AED training is made available through MUN, would you be interested in participating the training?	N/A	N/A	76.2%	23.8%	73.8%	26.2%
In your experience, do you think safety is a priority within your department/ faculty/office?	72%	28%	81.3%	18.8%	86%	14%
Do you report unsafe acts/conditions if you see them?	94%	6%	85.7%	14.3%	89.8%	10.2%

The survey results from 2016 and 2017 show a marked improvement in the area of knowledge about health and safety issues brought about by communication from health and safety committees as compared to the GA survey results of 2013. The respondents' awareness of emergency situations is also much higher in the first and second surveys than in the GA survey and the proportion of people who gave a positive response is higher in the second survey for some questions. The participants in the first survey were more aware or knowledgeable about the location of an Automated External Defibrillator (AED) than the participants in the second survey. The reason could be that AEDs were installed in different buildings at MUN around the same time that the first survey was conducted. This decrease in the level of knowledge over time from Survey 1 to Survey 2 may be due to a lack of retention of information on AED. In all three surveys, we can observe that most of the participants have supported safety as the biggest priority at their workplace and have also supported the reporting of unsafe acts and conditions.

3.2.3: Results of Department/Division-related questions pertaining to health and safety.

In Table 3.2.3, Department/Division-related questions are presented in the first column, GA survey results are in the second column, first survey results are in the third column and second survey results are in the last column.

Table 3.2.3: Comparison of surveys on Department/Division-related questions.

Questions	GA Survey, 2013 n= 293		Survey 1, 2016 n= 148		Survey 2, 2017 n= 103	
	Yes	No	Yes	No	Yes	No
Do you understand your responsibilities for your and your colleagues' health and safety?	63%	37%	85.3%	14.7%	88.1%	11.9%
Are toolbox talk/safety meeting relevant to your task?	24%	76%	58.7%	41.3%	46.7%	53.3%
Have you participated in a toolbox talk/safety meeting?	29%	71%	37.9%	62.1%	24.5%	75.5%
Is safety discussed in your workplace?	74%	26%	82.4%	17.6%	83.9%	16.1%
Were you provided information/training on the safe use of tools necessary for your job?	43%	67%	81.3%	18.8%	75.9%	24.1%
Have you requested specific safety training that is appropriate to your position?	23%	77%	53.2%	46.8%	44.8%	55.2%
Were you informed about the hazardous materials that are present in your workplace?	55%	45%	71.4%	28.6%	66.7%	33.3%
Are employees given feedback on accidents that occur in your workplace?	73%	27%	58.8%	41.2%	67.9%	32.1%
Do you work after hours at least sometimes?	75%	25%	84.9%	15.1%	81%	19%
Are you aware of MUN's working alone procedures?	81%	19%	44.6%	55.4%	54.2%	45.8%

In the above table, we can observe that in Survey 1 and 2, most of the participants understand their responsibilities for their own and their colleagues' health and safety. A higher proportion of respondents in Survey 1 and 2 mentioned that they received information and training on the safe use of hazardous materials and tools than the respondents in the GA survey. Compared to the first survey, in the second survey, a lower proportion of people said they received information on hazardous materials at their workplaces. The reason might be that the respondents' awareness about the information fades over time. Compared to the GA survey, in the first and second surveys, a higher proportion of respondents mentioned working longer hours at their offices, but were less familiar with MUN's working alone procedures. Respondents' awareness of MUN's working alone procedures has gradually decreased.

We had another study objective to collect information on safety perceptions of MUN employees and graduate students through well-designed surveys to evaluate the effectiveness of safety programs and safety presentations provided by the EHS unit of the Office of the Chief Risk Officer of Memorial University. Therefore, we conducted two identical online surveys (using a Survey Monkey web link) and sought responses from faculty, staff/administrators and graduate students/researchers from Memorial University. Our intent for the study through the first survey was to gauge the level of uptake of the information on health and safety disseminated by the EHS unit through their safety workshops in 2015. Further, we wanted to study the effect of the knowledge about health and safety on the attitude and behavior of the employees and graduate students at MUN.

Our second survey aimed to study the level of retention of knowledge and level of enthusiasm in terms of their attitude and behavior with reference to health and safety matters. The first survey was conducted between October 19, 2016 and November 30, 2016. 153 people responded to our first survey, and among them, 148 were identified as valid respondents. The second survey was conducted six months after the first survey between April 10, 2017 and June 10, 2017 with the same questionnaire. A total of 111 people responded to our second survey, and among them, 103 were identified as valid respondents. For data analysis, we have used SPSS software and have used descriptive statistics to summarize the results. At the beginning of the survey, there is a part on consent. The participants accessed the survey through the Survey Monkey link, provided in the e-mail invitations. The consent part covers the anonymous nature of the survey, the participant's right if they are uncomfortable with answering to ignore the questions, which are not related to their work, and the participant's right to withdraw anytime. On the survey questionnaire, we posed 42 questions to the participants (Please refer to the questionnaire in Appendix B). Questions 1 to 6 were about demographic information. Yes/no-type questions are divided into three groups: 1. Knowledge (refers to the awareness and perception of the participants related to health and safety); 2. Attitude (collects information on the viewpoints and beliefs of the participants about occupational health and safety); and 3. Behavior (collects information on participants' day-to-day safety practices/protocols at the workplace) [Robson et. al., 2012]. Questions 7, 18, 21, 22, 25, 29, 31 and 40 are designed to test the knowledge base of the participants on different aspects of safety on the campus. Questions 19, 20, 26 and 27 are combined to assess the attitude, opinions, and beliefs of the participants about occupational health and

safety. Questions 28, 30, 32, 34, 36 and 41 are grouped under behavioral questions to observe the participants' safety concerns and practices of safety regulations in their jobs (Please refer to the questionnaire in Appendix B).

A staff member from the health research unit has converted the data from Survey Monkey to an SPSS file. We have received the anonymous data from her. We have categorized the data and cleaned the data by removing the incomplete responses. Using descriptive and cross-tabulation analysis, we have studied the association between the demographic variables and the total scores of the three groups (knowledge, attitude, and behavior). We have also done a cross-tabulation analysis to assess the inter-relations among the three groups. We have done a chi-square test for each of the cross-tabulations. The chi-square test results are presented in Appendix C. The last few questions are on the perceptions of the participants about safety in specific areas on the campus; for example, the perceptions of the participants regarding laboratory safety, opinions and suggestions to increase safety on campus, the number of hazards employees could identify in their workplaces in the last year and the number of hazards that have been corrected in a timely manner. These questions were treated separately. This chapter is organized as follows: Section 3.2.4 describes the demographic distribution of the respondents. Section 3.2.5 describes the results of the association between the knowledge, attitude, behavior of the respondents and the different demographic groups. Section 3.2.6 presents the inter-relations among the knowledge, attitude and behavior of the respondents. Section 3.2.7 describes the other miscellaneous specific safety issues, including on-campus and laboratory safety. Section 3.2.8 describes the suggestions of the respondents to improve health and safety at Memorial University.

3.2.4: Demographic Information of Respondents.

The Environment Health and Safety (EHS) unit of Memorial University conducted workshops on safety presentations on the campus. The first question asked about the safety presentations and whether the participants attended the presentations or not. Questions 2 to 6 are on the demographic information of the participants. Question 2 was on employment status and question 3 was about gender. Question 4 was about the faculty affiliation of the participants. Question 5 was about the age of the respondents. Question 6 was about length of employment. Since this question is about the length of employment, we have excluded the graduate students/researchers from the analysis of the length of employment.

The table of the demographic information of the respondents of the first survey is presented below:

Survey 1

Table 3.2.4.1: Demographic Information of the 148 respondents

Did you attend the safety presentation at MUN?	No	41.9%
	Yes	46.6%
	I don't remember	11.5%
Employment Status	Faculty	19.2%
	Staff/administrator	47.7%

	Graduate student/researcher	33.1%
Gender	Male	50.7%
	Female	49.3%
Which faculty do you belong to?	Medicine	20.7%
	Pharmacy	.7%
	Nursing	.7%
	Science	8.3%
	Engineering	37.9%
	Business	5.5%
	Education	.7%
	Arts	2.1%
	Administrative and other offices	23.4%
In which age group do you fall?	Less than 30	22.4%
	30-39	25.9%
	40-49	23.1%
	50-59	20.4%
	60 or more	8.2%
How long have you been on the campus as an employee?	Less than 4 years	42.8%
	4-9 years	23.8%

	10-14 years	9.5%
	15-19 years	10.9%
	20-24 years	4.8%
	25 years or more	8.2%

Table 3.2.4.1 shows that 46.6% of the respondents attended the safety presentations, while 41.9% did not attend the presentations. 11.5% could not remember whether they attended or not. In the participating group, staff/administrators was the largest group (47.7%). The table indicates that the number of male respondents is a little higher (50.7%) than the number of female respondents. The highest responses were received from the engineering faculty (37.9%). The employees in age group 30-39 responded the most (25.9%), followed by age group 40-49 (23.1%), age group less than 30 (22.4%), age group 50-59 (20.4%), and age group 60 or more (8.2%). Most of the respondents have a length of service less than 4 years (42.8%).

Survey 2

Similar to the first survey, in the second survey, the first six questions were on demographic information. Table 3.2.4.2 presents the demographic information of the respondents of the second survey below:

Table 3.2.4.2: Demographic Information of the 103 respondents

Did you attend the safety	No	43.7%

presentation at MUN?	Yes	40.8%
	I don't remember	15.5%
Employment Status	Faculty	24.3%
	Staff/administrator	34.9%
	Graduate student/researcher	40.8%
Gender	Male	52.4%
	Female	47.6%
Which faculty do you belong to?	Medicine	22.3%
	Pharmacy	1.9%
	Nursing	1%
	Science	7.8%
	Engineering	41.7%
	Business	6.8%
	Education	1%
	Arts	1.9%
	Administrative and other offices	15.5%
In which age group do you fall?	Less than 30 years	19.8%
	30-39	28.7%
	40-49	30.7%
	50-59	12.9%

	60 or more	7.9%
How long have you been on the campus as an employee?	Less than 4 years	53.5%
	4-9 years	18.8%
	10-14 years	12.9%
	15-19 years	5%
	20-24 years	2%
	25 years or more	7.9%

Table 3.2.4.2 shows that 40.8% of the respondents attended the safety presentations, while 43.7% did not attend the presentations. 15.5% could not remember whether they attended or not. The majority of the participants in the second survey did not attend the safety presentations. In the first survey in Table 3.2.4.1, we observe that the majority of the participants attended the safety presentations. This, therefore, indicates that there is a need to increase awareness on workplace safety among employees and students. In the participating group, graduate students/researchers are the largest group (40.8%). In the first survey, the staff was the largest group. Similar to the first survey, in the second survey, the number of male respondents is higher (52.4%) than the number of female respondents (47.6%). In both surveys, the most responses were received from the engineering faculty. In the second survey, the employees in age group 40-49 responded the most (30.7%), and in the first survey the age group 30-39 responded the most. Similar to the first survey, in the second survey, most of the respondents (the number is only for the faculty and staff) have a length of service less than 4 years (53.5%).

3.2.5: Association between knowledge, attitude, and behavior of the participants and different demographic variables.

As mentioned earlier, in the survey, Questions 7-18, 21, 22, 25, 29, 31 and 40 (We refer to Appendix B for the questionnaire) are designed to test the knowledge base of the participants on different aspects of safety on the campus. The responses to the knowledge base questions were divided into two categories: low level of knowledge and high level of knowledge. In the knowledge group, there are 18 questions. For each question we have assigned a score of 1 for the answer 'No' and a score of 2 for the answer 'Yes' [Orth-Gomér et al., 1993]. For the knowledge question, we have added the scores of these 18 questions, which range from 18 to 36. We have divided this range of responses into two categories: the first half as 'Low' scores and the second half as 'High' scores for knowledge following the procedure described in Teddy et al. (2009). We have used a similar procedure for the attitude and behavior group. The purpose of dividing into two categories is to test the association between the level of the knowledge, attitude, and behavior of the participants and demographic groups. Questions 19, 20, 26 and 27 are combined to assess the attitude and beliefs of the participants about occupational health and safety. Questions 28, 30, 32, 34, 36 and 41 are grouped under the behavioral questions to observe the participants' practices regarding safety regulations in their jobs. We have done cross-tabulations and chi-square tests to observe the association between the six demographic questions and the groups of knowledge, attitude, and behavior. The

chi-square results are presented in Appendix C. We have done the same procedure for the second survey. The cross-tabulation tables are presented below:

Survey 1

Table 3.2.5.1: Cross-tabulation between attendance of the safety presentation and knowledge.

		Did you attend the Safety-Presentation?		Total
		No	Yes	
Knowledge Score	Low	23	9	32
	High	23	50	73
Total		46	59	105

Among the 148 participants, 105 answered all knowledge base questions and the question on attendance at the safety presentation. Table 3.2.5.1 indicates that the participants who attended the safety presentation demonstrated a higher level of knowledge on occupational health and safety than those who did not attend the safety presentation. This is validated by the chi-square = 14.73 and p-value 0.000<0.05, which indicate that there is a strong association between attendance of the safety presentation and respondents' knowledge level. The result suggests that the safety presentation is effective at increasing safety perception and knowledge among employees and graduate students.

Table 3.2.5.2: Cross-tabulation between attendance of the safety presentation and attitude towards safety.

		Did you attend the Safety-Presentation?		Total
		No	Yes	
Attitude Score	Low	35	23	58
	High	42	19	61
Total		77	42	119

119 participants answered attitude-related questions and the question on attendance at safety presentations. For Table 3.2.5.2, the chi-square=0.94 and p value=0.33>0.05 indicate that there is no relation between attendance at the safety presentation and attitude towards safety.

Table 3.2.5.3: Cross-tabulation between attendance of the safety presentation and behavior related to safety in jobs.

		Did you attend the Safety-Presentation?		Total
		No	Yes	
Behavior Score	Low	44	39	83
	High	9	23	32

Total	53	62	115

Among the participants, 115 answered all the safety behavior-related questions and the question on attendance at the safety presentation. From Table 3.2.5.3, we can observe that employees who attended the safety presentation have put the safety rules and regulations more into practice in their daily work than those who did not attend the safety presentation. The chi-square=5.76 and p value=0.02<0.05 also support the association between attendance at the safety presentation and safety behavior at the workplace.

Table 3.2.5.4: Cross-tabulation of employment status and knowledge base.

		Employment Status			
		Faculty	Staff/ administrator	Researcher /graduate student	Total
Knowledge Score	Low	6	6	24	36
	High	16	52	13	81
Total		22	58	37	117

117 participants answered the knowledge base questions and the question on employment status. For Table 3.2.5.4, the chi-square=30.58 and p value=0.00<0.05 clearly show that employment status has an effect on the knowledge of the participants about occupational

health and safety. Among the groups, the staff/administrator showed the highest level of knowledge. It is quite concerning that the graduate students/researchers category showed a low level of knowledge, even though they are the most exposed group to different safety critical scenarios.

Table 3.2.5.5: Cross-tabulation of employment status and attitude towards safety.

		Employment Status:			Total
		Faculty	Staff / administrator	Researcher /graduate student	
Attitude Score	Low	16	49	22	87
	High	9	16	21	46
Total		25	65	43	133

133 participants answered the attitude-related questions and the question on employment status. The chi-square=6.45 and p value= 0.04<0.05 indicate that there is an association between employment status and attitude towards safety.

Table 3.2.5.6: Cross-tabulation between employment status and behavior related to safety.

	Employment Status:			Total
	Faculty	Staff / administ	Researcher/ graduate	

			rator	student	
Behavior Score	Low	19	38	36	93
	High	5	27	5	37
Total		24	65	41	130

130 participants answered the behavior and employment status-related questions. The chi-square=12.29 and p value=0.002<0.05 indicate that there is a relationship between employment status and behavior related to safety.

Table 3.2.5.7: Cross-tabulation between gender and knowledge base.

		Gender		Total
		Male	Female	
Knowledge Score	Low	20	17	37
	High	35	44	79
	Total	55	61	116

116 participants answered the gender and knowledge-related questions. In Table 3.2.5.7, females have a marginally higher level of perception and knowledge related to health and safety than male. However, the chi-square= 0.96 and p value= 0.33 > 0.05 show that this difference is not significant. Thus, we can say that there is no significant association between gender and knowledge.

Table 3.2.5.8: Cross-tabulation between gender and attitude towards safety.

		Gender		Total
		Male	Female	
Attitude Score	Low	44	42	86
	High	20	27	47
Total		64	69	133

133 participants answered the gender and attitude-related questions. For Table 3.2.5.8, the chi-square=0.90 and p value=0.34>0.05 indicate that there is no association between gender and attitude towards safety.

Table 3.2.5.9: Cross-tabulation between gender and behavior related to safety.

		Gender		Total
		Male	Female	
Behavior Score	Low	47	47	94
	High	14	22	36
Total		61	69	130

130 participants answered the gender and behavior-related questions. For the above table, the chi-square=1.29 and p value=0.26 >0.05 do not show any association between gender and behavior related to safety.

We have not looked into the associations between different faculties and knowledge, attitude, and behavior as this is not important for the analysis.

Table 3.2.5.10: Cross-tabulation between age group and knowledge base.

		In which age group do you fall?		
		Below 40 years	40 years or more	Total
Knowledge Score	Low	24	13	37
	High	30	50	80
Total		54	63	117

117 participants answered the age and knowledge-related questions. In Table 3.2.5.10, we have combined the last few age groups as they have lower frequencies. In Table 3.2.5.10, the senior employees possess a higher level of knowledge related to occupational health and safety than the junior employees. The chi-square=7.62 and p value=0.006<0.05 indicate that there is an association between age and safety knowledge.

Table 3.2.5.11: Cross-tabulation between age group and attitude towards safety.

		In which age group do you fall?		
		Below 40 years	40 years or more	Total
Attitude	Low	35	52	87

Score	High	28	18	46
Total		63	70	133

133

participants answered the age and attitude-related questions. In Table 3.2.5.11, the attitude towards safety declines with the age. The chi-square=5.14 and p value=0.02<0.05 indicate an association between age and attitude towards occupational health and safety.

Table 3.2.5.12: Cross-tabulation between age group and behavior related to safety.

		In which age group do you fall?		Total
		Below 40 years	40 years or more	
Behavior Score	Low	46	48	94
	High	14	22	36
Total		60	70	130

130 participants answered the age and behavior-related questions. The chi-square=1.06 and p value= 0.30>0.05 do not indicate any association between age and behavior related to occupational safety.

As graduate students spend only a few years on campus completing their programs, the length of stay of the faculty and staff is longer than the graduate students and researchers. We have, therefore, excluded the graduate students/researchers and assessed the knowledge level, attitude, and behavior of the faculty and staff in the tables below.

Table 3.2.5.13: Cross-tabulation of employment duration and knowledge base of faculty and staff.

		How long have you been on the Campus as an employee?		Total
		Less than 4 years	4 years or more	
Knowledge Score	Low	5	8	13
	High	13	53	66
Total		18	61	79

79 faculties and staff had answered the questions. For Table 3.2.5.13, the chi-square= 1.11 and p value= 0.29>0.05 indicate that there is no association between knowledge and employment duration of faculty and staff.

Table 3.2.5.14: Cross-tabulation between on-campus duration of employment and attitude towards safety of faculty and staff.

		How long have you been on the campus as an employee?		Total
		Less than 4 years	4 years or more	
Attitude Score	Low	15	49	64
	High	4	21	25
Total		19	70	89

90 faculty and staff responded to the questions. The chi-square=.59 and p value=.44>.05 indicate that there is no association between employment status and attitude towards the safety of the faculty and staff.

Table 3.2.5.15: Cross-tabulation between duration of employment and behavior related to the safety of faculty and staff.

		How long have you been on the Campus as an employee?		
		Below 4 years	4 years or more	Total
Behavior Score	Low	12	43	55
	High	6	26	32
Total		18	69	87

87 faculty and staff responded to the questions. The chi-square=0.12 and p value=0.73>0.05 indicate that there is no association between employment duration and behavior of faculty & staff related to safety.

We can, therefore, conclude that the duration of employment of the faculty and staff had no effect on their knowledge, attitude, and behavior related to safety.

Survey 2

The cross-tabulations of the second survey are presented below:

Table 3.2.5.16: Association between attendance of the safety presentation and knowledge.

		Did you attend the Safety-Presentation?		
		No	Yes	Total
Knowledge Score	Low	15	8	23
	High	20	28	48
Total		35	36	71

Among 103 participants, only 71 to the attendance of safety presentation and knowledge base questions. Table 3.2.5.16 indicates that the participants who attended the safety presentation had more knowledge on occupational health and safety than those who did not attend the safety presentation. The chi-square=3.45, p-value=0.06>0.05 do not show a significant association between the attendance of the safety presentation and respondents' knowledge level. In the first survey, there was a strong association between attendance of the safety presentation and knowledge.

Table 3.2.5.17: Cross-tabulation between attendance of safety presentation and attitude.

	Did you attend the Safety-Presentation?		
	No	Yes	Total

Attitude Score	Low	30	24	54
	High	13	14	27
Total		43	38	81

81 responded to the attitude and attendance-related questions. For Table 3.2.5.17, the chi-square=0.39 and p value=0.53>0.05 indicate that there is no association between attendance in safety presentation and attitude towards safety. In the first survey, there was also no association between attendance and attitude. We can, therefore, conclude that there is no significant association between attendance of the safety presentation and respondents' attitude towards occupational safety.

Table 3.2.5.18: Cross-tabulation between attendance of the safety presentation and behavior.

		Did you attend the Safety-Presentation?		Total
		No	Yes	
Behavior Score	Low	32	21	53
	High	3	15	18
Total		35	36	71

71 participants answered the behavior and attendance-related questions. For Table 3.2.5.18, the chi-square=10.27 and p value=0.001<0.05 indicate that there is a strong

association between attendance of safety presentation and behavior related to occupational safety. In the first survey, there was also a strong association between attendance of the safety presentation and behavior related to occupational safety.

Table 3.2.5.19: Cross-tabulation between employment status and knowledge.

		Faculty	Staff /administrator	Researcher/ graduate student	
Knowledge Score	Low	6	4	17	27
	High	15	26	17	58
Total		21	30	34	85

85 participants answered the knowledge base questions and the question on employment status. The chi-square=10.02 and p value=0.007<0.05 indicate that there is an association between employment status and knowledge related to health and safety. In the first survey, there was also an association between employment status and knowledge related to health and safety.

Table 3.2.5.20: Cross-tabulation between employment status and attitude.

	Employment Status:			Total
	Faculty	Staff / administ	Researcher/ graduate	

			rator	student	
Attitude Score	Low	14	26	24	64
	High	10	9	13	32
Total		24	35	37	96

196 participants answered attitude-related questions and the question on employment status. In Table 3.2.5.20, we can observe that the attitude level of the participants decreased. The chi-square=1.72, p-value=0.42>0.05 indicate that there is no association between attitude and employment status. In the first survey, there was an association between employment status and attitude towards safety.

Table 3.2.5.21: Cross-tabulation between employment status and behavior.

		Employment Status:			Total
		Faculty	Staff /administrator	Researcher/ graduate student	
Behavior Score	Low	17	22	26	65
	High	4	9	7	20
Total		21	31	33	85

Among 103 participants, 85 answered the questions on safety behavior and employment status. In Table 3.2.5.21, we can observe that the safety-related behavior of the respondents has decreased. The chi-square=0.85 and p value=0.65>0.05 do not indicate any association between behavior and employment status. In the first survey, there was an association between employment status and behavior related to safety. This indicates that in the first survey, employment status had more of an effect on participants' knowledge, attitude, and behavior than in the second survey.

Table 3.2.5.22: Cross-tabulation between gender and knowledge base.

		Gender		Total
		Male	Female	
Knowledge Score	Low	14	13	27
	High	32	26	58
Total		46	39	85

85 participants answered the questions on gender and knowledge. For Table 3.2.5.22, the chi-square=0.08, p value=0.78>0.05 do not indicate an association between gender and knowledge. In the first survey, there was also no association between gender and knowledge.

Table 3.2.5.23: Cross-tabulation between gender and attitude.

	Gender	Total

		Male	Female	
Attitude Score	Low	32	32	64
	High	19	13	32
Total		51	45	96

96 participants answered the questions on gender and attitude. The chi-square=0.75 and p value=0.39>0.05 do not support an association between gender and attitude towards safety. In the first survey, there was also no association between gender and attitude.

Table 3.2.5.24: Cross-tabulation between gender and behavior.

		Gender		Total
		Male	Female	
Behavior Score	Low	33	32	65
	High	14	6	20
Total		47	38	85

85 participants answered gender and behavior-related questions. The chi-square=2.29 and p value=0.13 >0.05 do not indicate any association between gender and behavior related to safety. In the first survey, there was also no association between gender and behavior. We can, therefore, conclude that gender has no effect on participants' knowledge, attitude, and behavior related to occupational health and safety.

Table 3.2.5.25: Cross-tabulation between age group and knowledge base.

		In which age group do you fall?		Total
		Below 40 years	40 years or more	
Knowledge Score	Low	18	8	26
	High	22	35	57
Total		40	43	83

83 people responded to the questions related to age group and knowledge. In Table 3.2.5.25, we have combined the last few age groups as they have lower frequencies. Table 3.2.5.25 indicates that the senior employees possess more knowledge and perception related to occupational health and safety than the junior employees. The chi-square=6.71 and p value=0.01<0.05 support the association between age and knowledge. In the first survey, there was also an association between age and knowledge related to health and safety.

Table 3.2.5.26: Cross-tabulation between age group and attitude.

		In which age group do you fall?		Total
		Below 40 years	40 years or more	
Attitude Score	Low	32	31	63
	High	13	18	31
Total		45	49	94

Among the participants, 94 responded to the age group and attitude-related questions. Table 3.2.5.26 indicates that the participants had low/negative attitude towards safety. The chi-square=0.65 and p value=0.42>0.05 do not indicate a relationship between age and attitude towards occupational health and safety. In the first survey, there was an association between age group and attitude towards safety.

Table 3.2.5.27: Cross-tabulation between age group and behavior.

		In which age group do you fall?		Total
		Below 40 years	40 years or more	
Behavior Score	Low	30	33	63
	High	9	11	20
Total		39	44	83

83 people responded to the age group and behavior-related questions. Table 3.2.5.27 indicates that the respondents expressed low or minimum concern about safety at their everyday work. The chi-square=0.04 and p value=0.84>0.05 do not indicate an association between behavior and age group. In the first survey, there was also no association between age group and behavior related to health and safety.

From the two surveys, we observe that age had an effect on the participants' knowledge about occupational health and safety. Age did not have much of an effect on participants' attitude and behavior related to safety.

Table 3.2.5.28: Cross-tabulation between duration of employment and knowledge base of faculty and staff.

		How long have you been on the Campus as an employee?		
		Below 4 years	4 years or more	Total
Knowledge Score	Low	7	3	10
	High	11	28	39
Total		18	31	49

As faculty and staff work longer periods than graduate students/researchers, in this table, we have excluded graduate students/researchers to learn about the safety-related knowledge of the faculty and staff. Among 84 participants, 49 were faculty and staff. For Table 3.2.5.28, the chi-square=5.98 and p value= 0.01<0.05 indicate that there is an association between duration of employment and knowledge of faculty and staff. In the first survey, there was no association between duration of employment and safety knowledge of the faculty and staff.

Table 3.2.5.29: Cross-tabulation between duration of employment and attitude of faculty and staff.

	How long have you been on the Campus as an employee?	Total

		Below 4 years	4 years or more	
Attitude Score	Low	13	26	39
	High	8	10	18
Total		21	36	57

57 faculty and staff responded to the questions. The chi-square=0.65 and p value=0.42>0.05 indicate that there is no association between duration of employment and attitude of faculty and staff. In the first survey, there was also no association between knowledge and duration of employment of the faculty and staff.

84 participants answered the questions related to duration of employment and behavior. As some categories have a very low frequency, we have to combine all the categories into one; therefore, we could not determine the association between the safety-related behavior of the employees and the duration of employment.

As the knowledge group had more questions than the attitude and behavior groups, in the above tables, the number of respondents answering knowledge-related questions is less compared to the number of respondents answering attitude and behavior-related questions.

3.2.6 Interactions among Knowledge, Attitude and Behavior.

In this section, cross-tabulation analysis has been done among the three groups (knowledge, attitude, and behavior) to observe the interrelation between them. The cross-tabulation tables are presented below:

Survey 1

Table 3.2.6.1: Cross-tabulation between knowledge and attitude.

		Attitude		Total
		Low	High	
Knowledge	Low	21	13	34
	High	49	29	78
Total		70	42	112

Among 148 participants, 112 responded to the questions related to attitude and knowledge base. For Table 3.2.6.1, the chi-square=0.01 and p value=0.92>0.05 indicate that there is no association between the knowledge and attitude of the participants regarding occupational health and safety.

Table 3.2.6.2: Cross-tabulation between knowledge and behavior.

		Behavior		Total
		Low	High	
Knowledge	Low	33	2	35
	High	46	33	79
Total		79	35	114

114 people responded to the questions related to behavior and knowledge base. Table 3.2.6.2 shows that the level of concern for job safety has increased greatly with the increase in knowledge about health and safety. The chi-square=14.82 and p value= 0.000<0.05 also support the association between the knowledge and behavior of the employees related to workplace health and safety.

Table 3.2.6.3: Cross-tabulation between attitude and behavior.

		Behavior		Total
		Low	High	
Attitude	Low	60	19	79
	High	27	18	45
Total		87	37	124

124 participants answered the questions related to behavior and attitude towards safety. Table 3.2.6.3 shows that the participants' concerns related to health and safety in everyday work have not increased with the increase in the beliefs and attitude of the participants towards health and safety. The chi-square=3.48 and p value=0.06>0.05 also indicate that there is no significant association between the attitude and behavior of the participants regarding workplace health and safety.

Survey 2

To observe the interrelations of the three groups, we have presented the cross-tabulation tables of the three groups of the second survey below:

Table 3.2.6.4: Cross-tabulation between knowledge and attitude.

		Attitude		Total
		Low	High	
Knowledge	Low	18	7	25
	High	35	22	57
Total		53	29	82

Among 103 participants, 82 responded to the questions related to knowledge and attitude towards safety. For Table 3.2.6.4, the chi-square=0.85 and p value=0.36>0.05 do not

indicate an association between knowledge and attitude. In the first survey, there was also no association between attitude and knowledge.

Table 3.2.6.5: Cross-tabulation between knowledge and behavior.

		Behavior		Total
		Low	High	
Knowledge	Low	21	2	23
	High	39	16	55
Total		60	18	78

78 people responded to the questions related to behavior and knowledge about occupational health and safety. In Table 3.2.6.5, the level of concern/practice related to job safety has increased with the increase in knowledge about health and safety. The chi-square=3.80 and p value=0.051>0.05 do not indicate much of an association between participants' knowledge and behavior related to safety. In the first survey, we observed some association between knowledge and behavior.

Table 3.2.6.6: Cross-tabulation between attitude and behavior.

		Behavior		Total
		Low	High	
Attitude	Low	43	9	52
	High	19	11	30

Total	62	20	82

Among the participants, 82 responded to the questions related to behavior and attitude towards safety. Table 3.2.6.6 shows that the participants' concerns related to health and safety at the workplace increased with the increase in the positive attitude of the participants towards health and safety. The chi-square=3.86 and p value=0.049<0.05 indicate that there is some association between the attitude and behavior of the participants regarding occupational health and safety. In the first survey, there was no significant association between attitude and behavior.

From the two surveys, we can conclude that only the knowledge and behavior of the participants were associated with each other. Therefore, the knowledge of the participants about health and safety has an effect on their everyday work practices.

3.2.7: On-campus health and safety and lab safety

The participants were asked to rate different areas on the campus in terms of health and safety. In the tables, we have divided the respondents into two groups. The faculty, staff, and administrators are in one group and the graduate students and researchers are in the other group in order to observe their opinions separately. We have assessed the responses of the participants regarding the most important areas on the campus. The tables below show the normalized results after removing the "N/A" column. In the tables, we have

presented the frequencies of the responses in numbers (count) and also in percentages (100%).

Survey 1

Table 3.2.7.1: Group-wise health and safety ratings of different on-campus areas (count and %)

		Safe	Neutral	Unsafe	Total
Parking Lots	Faculty/staff/ administrator	53 (55%)	30 (31%)	12 (13%)	95 (100%)
	Graduate student/researcher	24 (51%)	20 (42%)	3 (6%)	47 (100%)
Elevators	Faculty/staff/ administrator	59 (63%)	28 (30%)	6 (6%)	93 (100%)
	Graduate student/researcher	26 (56%)	11 (24%)	9 (19%)	46 (100%)
Library	Faculty/staff/ administrator	63 (78%)	13 (16%)	5 (6%)	81 (100%)
	Graduate student/resear	41 (87%)	3 (6%)	3 (6%)	47 (100%)

	cher				
Classrooms	Faculty/staff/ administrator	66 (77%)	18 (20%)	2 (2%)	86 (100%)
	Graduate student/researcher	41 (85%)	7 (14%)	0 (0%)	48 (100%)
Laboratories	Faculty/staff/ administrator	36 (59%)	23 (37%)	2 (3%)	61 (100%)
	Graduate student/researcher	21 (50%)	17 (40%)	4 (9%)	42 (100%)
Restrooms	Faculty/staff/ administrator	65 (69%)	22 (23%)	7 (7%)	94 (100%)
	Graduate student/researcher	29 (63%)	17 (37%)	0 (0%)	46 (100%)
Gym	Faculty/staff/ administrator	50 (78%)	14 (22%)	0 (0%)	64 (100%)
	Graduate student/ researcher	36 (82%)	8 (18%)	0 (0%)	44 (100%)
Student	Faculty/staff/	52 (75%)	15 (22%)	2 (3%)	69 (100%)

Union Building	administrator				
	Graduate student/researcher	34 (79%)	9 (21%)	0 (0%)	43 (100%)
Dormitories	Faculty/staff/ administrator	21 (63%)	10 (30%)	2 (6%)	33 (100%)
	Graduate student/researcher	17 (55%)	13 (42%)	1 (3%)	31 (100%)

Among 148 participants, 145 responded to this question. Among them, 96 are faculty/staff/administrators and 49 are researchers/graduate students. In the above table, we can observe that the faculty/staff/administrators identified parking lots (13%) as the least safe place, which was much more than the graduate students/researchers (6%). On the other hand, the graduate students/researchers identified the elevators (19%) as the least safe place, which was much more than the faculty/staff/administrators (6%). Regarding the rest of the campus areas, all the respondents expressed an almost equal level of safety.

Table 3.2.7.2: Lab safety-related responses from different groups (count and %)

		Agree	Neutral	Disagree	Total
I feel safe in	Faculty/sta	30 (70%)	12 (28%)	1 (2%)	43 (100%)

campus labs	ff/administrator				
	Graduate student/ researcher	17 (51%)	14 (42%)	2 (6%)	33 (100%)
PPE is available in the labs	Faculty/staff/administrator	25 (62%)	13 (32%)	2 (5%)	40 (100%)
	Graduate student/ researcher	19 (63%)	10 (33%)	1 (3%)	30 (100%)
Lab safety is properly explained	Faculty/staff/administrator	25 (66%)	10 (26%)	3 (8%)	38 (100%)
	Graduate student/ researcher	17 (58%)	10 (34%)	2 (7%)	29 (100%)
I received training on appropriate use of eye wash station	Faculty/staff/administrator	19 (57%)	9 (27%)	5 (15%)	33 (100%)
	Graduate student/	16 (53%)	9 (30%)	5 (17%)	30 (100%)

	researcher				
I know the location of nearest safety shower	Faculty/staff/administrator	24 (63%)	9 (24%)	5 (13%)	38 (100%)
	Graduate student/ researcher	17 (58%)	9 (31%)	3 (10%)	29 (100%)

Among 148 participants, 145 answered these questions. Among them, 96 are faculty/staff/administrators and 49 are graduate students/researchers. Overall, there is no major safety issue for any particular area in the campus labs. In Table 3.2.7.2, we can observe that the faculty/staff/administrators are in a better situation regarding awareness and training on laboratory safety than the graduate students/researchers.

In the survey, we asked the employees about the number of hazards they have identified in their workplaces in the last year. Most of the participants (53.3%) reported not identifying any hazards in their workplaces, 13.1% reported identifying 1 hazard, 9.5% identified 2 hazards, 6.6% identified 3 hazards, and 17.5% identified 4 or more hazards in their workplaces last year. A follow-up question was on how many of these hazards have been corrected in a timely manner. Over 50% of the respondents mentioned that none of the hazards were corrected in a timely manner, which clearly shows a lack of initiative from the responsible personnel regarding safety-related issues.

The participants were also asked to give their opinion on precautionary steps which individuals can take to enhance their safety on campus and also on additional steps the university can take to improve campus safety. As a precautionary step to improve safety, among the three choices, most respondents supported taking a safety training class (36.5%), followed by carrying a cellular phone (32.8%) and informing others about their location (30.7%). A few respondents suggested different options such as enhancing situational awareness (i.e., always being aware of your surroundings), keeping an emergency phone number handy, adhering to emergency procedures to be safe, having a co-worker in the lab, or walking in a group. Most respondents felt that there is a need to improve safety escort services (28.9%) followed by having more emergency call boxes (23.4%), more security guards (18.8%), additional lighting (16.4%), self-defense classes (7%) and more safety presentations (5.5%).

Survey 2

Table 3.2.7.3: Group-wise health and safety ratings of different on-campus areas (count and %)

		Safe	Neutral	Unsafe	Total
Parking Lots	Faculty/staff/administrator	35(62%)	18 (32%)	3 (5%)	56 (100%)
	Graduate student/researcher	22 (55%)	16 (40%)	2 (5%)	40 (100%)

Elevators	Faculty/staff/administrator	33 (60%)	19 (34%)	3 (5%)	55 (100%)
	Graduate student/researcher	17 (40%)	18 (43%)	7 (17%)	42 (100%)
Library	Faculty/staff/administrator	40 (89%)	5 (11%)	0 (0%)	45 (100%)
	Graduate student/researcher	34 (81%)	8 (19%)	0 (0%)	42 (100%)
Classrooms	Faculty/staff/administrator	37 (84%)	6 (13%)	1 (2%)	44 (100%)
	Graduate student/researcher	29 (69%)	11 (26%)	2 (5%)	42 (100%)
Laboratories	Faculty/staff/administrator	19 (63%)	11 (37%)	0 (0%)	30 (100%)
	Graduate student/researcher	16 (44%)	14 (39%)	6 (17%)	36 (100%)
Restrooms	Faculty/staff/administrator	38 (68%)	17 (30%)	1 (2%)	56 (100%)
	Graduate student/researcher	19 (49%)	17 (43%)	3 (8%)	39 (100%)
Gym	Faculty/staff/administrator	31 (86%)	5 (14%)	0 (0%)	36 (100%)

	Graduate student/researcher	23 (64%)	12 (33%)	1 (3%)	36 (100%)
Student Union Building	Faculty/staff/administrator	36 (85%)	6 (14%)	0 (0%)	42 (100%)
	Graduate student/researcher	23 (60%)	15 (39%)	0 (0%)	38 (100%)
Dormitories	Faculty/staff/administrator	11(73%)	4 (26%)	0 (0%)	15 (100%)
	Graduate student/researcher	14 (50%)	11(39%)	3 (11%)	28 (100%)

Among 103 participants, 101 answered this question. Among them, 59 are the faculty/staff/administrators and 42 are the graduate students/researchers. In Table 3.2.7.3, we can observe that all of the respondents selected the gymnasium, library, classrooms and student union building as some of the safest places in the university. On the other hand, over 10% of the graduate students/researchers felt unsafe in the laboratories (17%), elevators (17%) and dormitories (11%), which were higher than for the faculty/staff/administrators. Compared to the first survey, the safety issue of laboratory safety has increased in the second survey. It can, therefore, be stated that the university laboratories have become a growing safety issue for the graduate students/researchers.

Table 3.2.7.4: Lab safety-related responses from different groups (count and %)

		Agree	Neutral	Disagree	Total
I feel safe in campus labs	Faculty/staff/ administrator	19 (82%)	14 (17%)	0 (0%)	23 (100%)
	Graduate student/ researcher	11 (36%)	16 (53%)	3 (10%)	30 (100%)
Personal protective equipment is available in the labs	Faculty/staff/ administrator	18 (78%)	5 (21%)	0 (0%)	23 (100%)
	Graduate student/ researcher	14 (46%)	14 (46%)	2 (6%)	30 (100%)
Lab safety is properly explained	Faculty/staff/ administrator	15 (65%)	8 (35%)	0 (0%)	23 (100%)
	Graduate student/ researcher	12 (38%)	16 (51%)	3 (9.7%)	31 (100%)
I received training on appropriate use of eye wash station	Faculty/staff/ administrator	15 (62%)	7 (29%)	2 (8%)	24 (100%)
	Graduate student/ researcher	14 (45%)	12 (38%)	5 (16%)	31 (100%)

I know the location of the nearest safety shower	Faculty/staff/ administrator	19 (76%)	4 (16%)	2 (8%)	25 (100%)
	Graduate student/ researcher	16 (50%)	12 (37%)	4 (12%)	32 (100%)

Among the respondents, 59 were faculty/staff/administrators and 42 were graduate students/researchers. In both of the surveys, the graduate students/researchers felt unsafe in the campus labs and thought that there was inadequate training on laboratory safety. Compared to the first survey, the difference in knowledge regarding lab safety between faculty/staff/administrators and graduate students/researchers increased in the second survey. It can, therefore, be stated that the graduate students/researchers need more awareness sessions and training on laboratory safety.

In response to the question on the number of hazards in the last year, most of the participants (62.2%) reported not identifying any of the hazards in their workplace, 11.2% reported identifying 1 hazard, 6.1% identified 2 hazards, 2% identified 3 hazards, and 18.4% identified 4 or more hazards in their workplaces last year. For the follow-up question on how many of these hazards have been corrected in a timely manner, 68.1% of the respondents answered that none of the hazards were corrected in a timely manner. Both of the surveys clearly indicate a lack of initiative from the responsible personnel regarding workplace health and safety.

Among the three choices for a precautionary step to improve safety, most respondents supported taking a safety training class (36.3%), followed by carrying a cellular phone (35.3%) and informing others about their location (28.4%). A few respondents suggested different options such as using the MUN Alert App and using appropriate personal protective equipment. Most of the respondents selected the option to improve the safety escort service (31.8%), followed by more emergency call boxes (25.9%), additional lighting (18.8%), more security guards (8.2%), more safety presentations (8.2%) and more self- defense classes (7.1). In surveys 1 and 2, most of the respondents felt that there is a need to improve the safety escort service.

3.2.8: Participants' suggestions to improve Health and Safety at MUN.

Survey 1

In the survey questionnaire, there were some open-ended questions to get the participants' opinions about improving health and safety at MUN. The participants gave some comments and suggestions to improve the overall health and safety of the campus. The responses can be broadly divided into (i) policy improvements: Some participants suggested improving the implementation of the policies; improve communication by contacting every student/staff/faculty/stakeholder on campus at once to introduce safety policies; have at least two persons working when buildings are open to the public; provide more auditing of safety policies by EHS to ensure compliance; give CEP greater authority, as they respond first on campus; enforce smoke-free and scent-free environments; put more of a focus on asbestos and air quality and improve environmental

safety such as addressing allergens and chemicals. (ii) Logistics: A few participants suggested providing more security cameras and security personnel; installing more flammable gas detectors and eyewash stations in the labs; improving the splash-proof safety goggles; installing a campus-wide intercom system for emergency announcements; improving the alarms to work in the event of a real code red; repairing walkways and parking lots; and having indicators in each corridor to show different exit routes. (iii) Training: Some participants suggested to provide better training for classroom and laboratory emergencies and to provide health and safety orientation for new employees.

Survey 2

The suggestions from the participants to improve the overall safety on the campus have been broadly divided into (i) Policy Improvements: Some participants have suggested to improve communication on existing resources/information, to become more proactive in enforcing safety policies, the poor advertising of preventive measures and emergency tools should be addressed, a safe environment should not be dependent on budget, improve safety protocols in case of emergency evacuation, increase lab space, improve the standard of Toolbox Talks, and there should be more concern about hazardous materials in the air as some buildings are falling apart. (ii) Logistics: Some participants have suggested putting more cameras in the parking lots; removing thick layers of ice from the parking lots to prevent slips and falls; putting indications for pedestrians to use the other sidewalks because of heavy snowfall in winter; repairing the elevators as they are often out of order; there must be clearly visible stations for AED; improving the MUN

Safe App design and usage; improving the structural safety of the buildings; and preventing potential hazards in the buildings such as leaks in the walls/ceilings, metal siding coming off, etc. (iii) Training: A few participants suggested providing a safety introduction to students and providing training on driving university vehicles to university employees and students.

3.3 Key Informant Interview Analysis

To address the objective of conducting a Key Informant Survey of concerned officials to address the issues raised in the surveys, we have conducted key informant interviews (KII) with eight officials who have been responsible for the development and implementation of health and safety programs at MUN. Among them, five officials were from the Environmental Health and Safety (EHS) unit, two officials were from the Workplace Health and Safety Committee (WHSC) and one official was from Facilities Management (FM). Upon receiving the participants' written consent, interviews were arranged at their workplaces at an agreed-upon time during working hours. The interviews were recorded in writing. A thematic content analysis approach was used for data analysis. Each transcript was reviewed and coded to identify key emerging themes. We then compared the coding of the transcripts. The first question of the interview is about the initiatives taken by the EHS unit to raise awareness about health and safety among MUN employees after 2013. For further analysis, we divided the rest of the questions into three groups. The first group is about knowledge and awareness of safety policies. Questions 2, 3, 4, 5, 6, 12 are included in this group. Questions 7, 8, 9, 10 are in

the group on laboratory safety and workplace hazards. Questions 11, 13, 14, and 15 are on the group of MUN facilities and services (please refer to the questionnaire in Appendix D). We have described the analysis of the first question below:

3.3.1: Recent Initiatives Taken by the EHS Unit

The participants were asked about the recent initiatives undertaken by the EHS unit to raise awareness about health and safety among MUN employees. We have divided the participants' responses into three sections. The first section presents the answers provided by the participants from the EHS unit. The second section presents the answers of the members of the WHS committees. The third section presents the answers of the participant from Facilities Management (FM).

The participants from the EHS unit highlighted several initiatives undertaken by their unit since the 2013 Gap Analysis results were released. They are listed below.

(i) Five to seven safety campus-wide presentations were organized, some of which were geared towards senior management and WHS Committee members;

(ii) The EHS unit has been restructured with more efficient staff;

(iii) WHS committees were restructured by bringing a few buildings under each of the 27 WHS committees;

(iv) Auditing and guiding the WHS Committee members since 2015;

(v) An electronic safety reporting system (e-alert) was implemented in 2014;

(vi) The MUN Safe App was introduced in 2016;

(vii) Conducting annual inspections of all university building offices and 350 laboratories;

(viii) The new undergraduate student orientation package includes a description of general safety rules on campus since September 2016;

(ix) The Health and Safety Management System has been revamped;

(x) The concept of designated authority has been made clear;

(xi) New online training modules such as contractor safety, the transportation of dangerous goods and other online courses have been developed;

(xii) A new employee orientation handbook with signup sheets has been developed and disseminated;

(xiii) A chemical management system for labs has been implemented;

(xiv) An annual water sampling procedure has been implemented for drinking water safety;

(xv) Fire drill programs have been revamped; a video on how to deal with an active intruder situation has been developed.

The participants from WHS committees also mentioned some initiatives under-taken by the EHS unit to create safety awareness such as:

(i) There has been an uptake in the participation of the representatives from the EHS Unit to sit on the WHS Committee meeting;

(ii) Now there are more frequent laboratory inspections;

(iii) Fire warden training has been developed;

(iv) They also pointed out a few initiatives highlighted by EHS participants.

The participant from FM mentioned some initiatives such as:

(i) Maintaining a good database to track the expiry date of the employee training to ensure people are re-trained before the expiry date;

(ii) Engaging a dedicated person to organize the time for the safety courses e.g., recently, there has been more engagement in the weekly Toolbox Talk to discuss the potential hazard assessment.

The FM participant also mentioned several initiatives already pointed out by EHS and WHS participants.

3.3.2: Knowledge and awareness of safety policies.

As mentioned earlier, questions 2, 3, 4, 5, 6, and 12 are about knowledge and awareness of safety policies (please refer to the questionnaire in Appendix D).

When asked about the low level of attendance of the employees and students in the safety presentations, most of the KII participants were of the view that attending the safety presentations should be mandatory and should be included in the new employee and student orientation packages. Some KII participants have suggested that some members of the EHS committee can attend the faculty or departmental meetings and encourage the faculty, staff, graduate students and researchers to attend the safety presentations.

When asked about the improvement in the knowledge level of graduate students/researchers about workplace health and safety policies and programs (in the

survey analysis, the safety knowledge level of the graduate students and researchers was lower than the faculty and staff), most of the participants indicated that the supervisors and the department head are the primarily persons responsible for looking at this specific issue. The EHS unit works with faculties and departments to develop safety orientation for the supervisors so the supervisors can transfer the safety information to their graduate students. One participant from the EHS unit has mentioned that there are not enough incident reports from graduate students and researchers to support the concern.

In response to the question regarding whom to call first if someone gets injured at work, most of the participants mentioned that the MUN online accident/incident reporting system, the MUN Safe App, is an effective mechanism for communication. Some participants mentioned the supervisors' responsibility to provide information to the employees and researchers. The participants mentioned some options for disseminating the information such as posting the information on the notice board near the first aid kit, near the phone booth, in the library and near some other important places where people frequently visit. A manual emergency booklet is available near the library and in some other important places. Emergency contact numbers are listed in the booklet.

When asked about any improvements in the communication, implementation, and auditing of safety policies, the key informants stated that since 2014 they have been continuously auditing and improving the safety policies and procedures and providing training and retraining to committee members. The EHS participants elaborated on the Health and Safety Management System (HSMS) and said that the system has eight core

elements: "1) Education and training, 2) Communication, 3) Inspections, 4) Incident management, 5) Document and record management, 6) Competency-based training and awareness, 7) Hazard identification and risk management, 8) Assurance". These elements are under a developmental process. A participant from the WHS Committee mentioned a new safety policy for the laboratory and public spaces upcoming in the engineering faculty. The participant from FM said, "We have guidelines for standard operating procedures, all potential hazards are outlined by controlled measures". A few participants candidly mentioned that there should be more effort made to review and audit the safety policies on an ongoing basis.

When asked about the level of participation in the Tool Box Talks, the KII participants mentioned that, recently in facilities management, laboratory safety management, the diving sector and technical service sector, the number of Tool Box Talks has increased.

In response to the question on the low level of awareness on MUN's working alone procedure among employees and graduate students, several KII participants indicated that the supervisors and building safety committees are responsible for raising awareness on the working alone procedure. They also mentioned that the working alone policy is included in the orientation for laboratory safety. Some participants described a very effective feature of the MUN Safe App called 'Friend Walk', in which one can request a friend to follow him/her with their GPS over the phone. A participant from the EHS unit mentioned that they were waiting for approval for funding to set up the 'working alone' feature in the MUN Safe App.

3.3.3: Laboratory Safety and Workplace Hazards.

Questions 7, 8, 9, and 10 are in the group of laboratory safety and workplace hazards (please refer to the questionnaire in Appendix D).

In response to the question regarding training on the eyewash station and safety shower for the graduate students/researchers, the KII participants mentioned that the PIs, supervisors and the technical staff should be instructed to provide training on using the eyewash station and safety shower to the graduate students/researchers as sometimes the lab users run to the washroom in case of an emergency instead of going to the eyewash station. The participant from Facilities Management said that the employees in the labs are required to know how to test the eyewash station and safety shower first. The participants have referred to the safety course 1000, which includes all the information regarding the eyewash station and safety shower. One participant commented that, "The biggest issue is facilities. We need to have aa modernized and updated eyewash station and safety shower." Some participants candidly admitted that there should be weekly instead of yearly inspections, and more demonstrations on how to use the eyewash station and safety shower will be provided for the lab users if the PIs and supervisors recommend it.

When asked about the shortage of lab safety equipment such as PPE (personal protective equipment), splash-proof safety goggles, and flammable gas detectors, the participants said that these are the responsibilities of the PIs and supervisors. They should ensure that there are enough PPE and safety goggles for their lab researchers. The department may

have to pay for the PPE and safety goggles using the grad research money. The lab researchers are required to maintain their own PPE and safety goggles. Regarding the flammable gas detectors, most of the key informants did not feel that it is a big concern and thought that there are adequate gas detectors, as all the labs have minimal use of gas detectors. However, a few KII participants felt that the university laboratories need more gas detectors.

Regarding the shortage of lab space, most of the key informants mentioned that the labs in new the Science Building (under construction) will be equipped with all the facilities. They also mentioned that the new building for the medicine faculty provides adequate space for research and there is enough space inside the lab to do testing and research and that they are well equipped with safety measures. A participant commented, "Space is not an issue, but the content is the issue."

In response to the question about addressing the issues related to the hazards in the workplace, the participants from the EHS unit and from the Workplace Health and Safety Committee (WHSC) mentioned that they usually receive hazard reports through an online reporting system (MIMS or MUN Safe App) and they immediately transfer the requests to Facilities Management (FM). A participant from WHSC has emphasized the supervisors' responsibility in bringing up the issue at departmental meetings. In FM, hazards get prioritized according to risk assessment. The participant from FM described that hazards will be prioritized as low, medium and high. In a critical situation like 'IDLH' (Immediately Dangerous for Life and Health) the EHS unit shuts down the area

immediately and puts the hazard on high priority. The KII participants identified financial aspects and manpower as bottlenecks in addressing the hazards in a timely manner. They said, “There are so many requests and very few people are engaged to correct the hazards. The staff in FM are overtasked, so sometimes low prioritized hazards get delayed attention in the process”.

3.3.4: MUN Facilities and Services.

Questions 11, 13, 14, and 15 are in this group (see the questionnaire in Appendix D). In response to the question about the general awareness about the AED (Automated External Defibrillator), the participants mentioned that the 27 Workplace Health and Safety Committee members receive AED training from the EHS unit. It is, therefore, the committee members’ responsibility to arrange the demonstration/training for the employees and students. The participants also mentioned that the AED video demonstration is on the university website. A participant from the EHS unit said, “The AED is capable of being operated by anybody”. Another participant from the EHS Unit answered, “In the CPR training, the AED is included. Red Cross or other outside sources provide the CPR training and the supervisor will allocate the funding”. The participant also mentioned that there are AEDs in every building and the EHS unit is planning to place an AED on every floor. The participant from FM noted that all the employees in FM are required to do the first aid training and the AED is included in the training. He suggested, “It would be a good idea to include the AED training in the new students’ orientation package”.

When asked about the repair of walkways and parking lots and the removal of ice from parking lots to prevent slips and falls, the EHS participants' response was that this issue comes under the purview of Facilities Management. The EHS unit receives the incident reports from the employees and students through the online reporting system and if it is a big concern, the report is sent to FM for corrective actions. The EHS unit provides statistics for slips and falls to FM to classify and prioritize jobs for action. Sometimes the employees directly contact FM. The participant from FM mentioned that snow cleaning is a high priority and the FM staff are continuously working on that. In addition to online reporting, employees and students can also report incidents to the CEP (Campus Enforcement Patrol). The CEP will call the FM work control number, which is available 7 days a week. The participant from FM said, "The university residents need to give the crews a chance to do proper snow cleaning, as sometimes people get into the campus before the snow cleaning is done".

In response to the question regarding the improvement of the design and usage of the MUN Safe App, the participants stated that they are not aware of any concerns about the MUN Safe App as it is very user-friendly and gives detailed information in the case of emergency. They mentioned the possibility that some people may not know how to communicate through it. The participants referred to the instruction manual for the MUN Safe App on the university website. One participant from the WHS Committee mentioned that, "Any app needs to be improved on a regular basis."

Regarding the improvement of the on-campus safety escort service, most of the KII participants mentioned that the CEP (Campus Enforcement Patrol) can provide the safe escort service. Some participants referred to the blue phones, which are available near the library, student union building, parking lots and some other important places on campus. The blue phone can connect directly to the CEP. Some other participants suggested that one can use the ‘friend walk’ feature in the MUN Safe App as a substitute for the safety escort service.

CHAPTER 4

Discussion

Our current research has fulfilled all the study objectives. We have summarized the study results according to the research questions below.

Question: Is the EHS unit at Memorial University offering sufficient safety programs and safety services compared to other Canadian universities?

To provide adequate safety services and to meet the legislated requirements of the OHS Act and Regulations, MUN has established 27 Workplace Health and Safety Committees (WHSCs) on campus. Each of the 27 WHSCs covers a few buildings on campus. Similar to other major universities in Canada, the EHS unit and the WHSCs of MUN follow CCOHS regulations. In August 1996, OSHA published a Program Evaluation Profile (PEP). The PEP along with "Form OSHA-195" remains a widely-used instrument for evaluating occupational health and safety programs. The PEP has been used in this study to review and compare the safety programs of Memorial University with the safety programs of other Canadian universities**.** From the comparison of safety programs of ten Canadian universities, we can conclude that, overall, there is not much difference in the health and safety programs of the ten Canadian universities. Memorial University is providing adequate safety-related services to university employees and students. Compared to the other universities, Memorial University offers either equal or even more health and safety policies to the campus community. Regarding safety training, a few other universities offer more types of safety training than MUN, such as office

ergonomics, field activities plans/programs, graduate student safety certificates, a program to help individuals at risk, violence prevention, the safe use of biological safety cabinets, training on evacuation procedures, traffic safety, practical loss control leadership, supervisory development training, communication campaigns, and environmental training. There is room for improvement in the area of safety training and improvements to health and safety programs are currently being made at MUN.

Question: What are the levels of knowledge, attitude, and practices of the faculty members, staff, graduate students and researchers regarding workplace health and safety programs offered at Memorial University and do they differ with respect to demographic variables?

From the statistical analysis, we observed some significant associations between the participants' knowledge, attitude, behavior and different demographic information, such as an association between attendance of the safety presentation and participants' health and safety-related knowledge and behavior, an association between employment status and participants' knowledge on health and safety, an association between participants' age and safety knowledge, and an association between length of service and participants' knowledge of health and safety. In the data analysis, we did not observe any association between the demographics and attitude towards health and safety. Gender has no effect on the participants' knowledge, attitude, and behavior related to health and safety. It can therefore be stated that the safety-related knowledge, attitude and practices of MUN employees may differ with respect to demographic variables.

Question: Has there been any significant improvement on the perception of the workplace health and safety of MUN employees since the results of the survey on the gap analysis of safety culture were released?

The results of the cross-sectional surveys (our two surveys and the gap analysis survey) indicate that overall there is consistency in the three surveys' results. As presented in Chapter 3, in Table 3.2.1 (page 61) and in Table 3.2.2 (page 63), the respondents demonstrated an increase in the level of their knowledge/awareness such as awareness about the EHS unit and their newsletters, brochures, and bulletins as well as knowledge and awareness about MUN's health and safety policies and online reporting system. The survey respondents also improved their communication with the Health and Safety Committee over time. On the other hand, we have observed some issues that need to be addressed such as a lower level of knowledge about MUN's working alone procedures and AED locations. It should be noted that AEDs were installed in different buildings at MUN around the same time as when the first survey was conducted. This decrease in the level of knowledge over time is due to a lack of retention of information on AEDs. Also, less familiarity with the Occupational Health and Safety Act has been noticed. The dissemination of information on the Health and Safety Act needs improvement, as this is the root of all health and safety-related regulations, responsibilities, and rights.

Question: Is there any significant difference in the perception of safety practices between those who attended safety presentations facilitated by the EHS unit at MUN and those who did not attend these presentations?

In both of our surveys, we observed that those who attended safety presentations have a better level of safety practices than those who did not attend the safety presentations (please refer to Chapter 3, Table 3.2.5.3 on page 76 and Table 3.2.5.18 on page 86). The workplace safety practices of the employees and graduate students will improve with an increase in their awareness about health and safety. It is clear from the results that there should be more emphasis on dissemination of the activities of the EHS unit to a larger number of MUN employees and students.

Question: Have the knowledge, attitude and behavior of the employees about safety changed over the 6-month period?

Overall, there is no significant difference in the knowledge, attitude, and behavior of the employees and graduate students between the two surveys. The tables showing the knowledge, attitude, and behavior of the two surveys are presented below.

Table 4.1: Comparison between Survey 1 and Survey 2 in Knowledge.

	Survey 1	Survey 2	Total
Knowledge Score Low	37	27	64
Knowledge Score High	81	58	139
Total	118	85	203

In Table 4.1, in both of the surveys, the knowledge level of the respondents is high. In the first survey, the knowledge level was a little higher than in the second survey. The

chi-square= 0.004 and p value= 0.95>0.05 indicate that there is no association between the time of the surveys and the knowledge level of employees and graduate students. (Please refer to the chi-square test results in Appendix C).

Table 4.2: Comparison between Survey 1 and Survey 2 in Attitude.

	Survey 1	Survey 2	Total
Attitude Score Low	87	64	151
Attitude Score High	47	32	79
Total	134	96	230

In Table 4.2, in both of the surveys, the attitude level of the participants is low. In the first survey, the attitude level is a little lower than in the second survey. The chi-square= 0.07 and p value= 0.78>0.05 indicate that there is no difference between the levels of the scores in Survey 1 and Survey 2 regarding the employees' and graduate students' attitudes.

Table 4.3: Comparison between Survey 1 and Survey 2 in behavior.

	Survey 1	Survey 2	Total
Behavior Score Low	94	65	159
Behavior Score High	37	20	57
Total	131	85	216

In Table 4.3, in both of the surveys, the respondents' level of behavior or safety practice is low. In the first survey, the behavior is lower than in the second survey. The chi-square= 0.59 and p value= 0.44>0.05 indicate that the difference in the level of behavior in Survey 1 and Survey 2 is not statistically significant.

In the above tables, the chi-square test results indicate that there is no effect of the time of the two surveys with reference to the levels of knowledge, attitude and behavior of the employees and graduate students. There is very little change in the knowledge, attitude and behavior of the university employees and graduate students in the second survey as compared to the first. This indicates that the employees' perceptions on workplace health and safety have not changed much over the period of six months. The only significant change we observed is a decrease in the knowledge of graduate students and researchers regarding laboratory safety in the second survey (please refer to Chapter 3, Table 3.2.7.2 on page 102 and Table 3.2.7.4 on page 108).

Question: What are the responses of the officials to the issues raised in the surveys? From the analysis of the key informant interviews (KII), we can observe that some initiatives have been introduced recently to raise awareness about health and safety at MUN. However, the level of uptake is still low. The most beneficent initiatives are the arrangement of five to seven safety presentations campus-wide, restructuring of the WHS and EHS committees, the implementation of an electronic safety reporting system and the MUN Safe App, annual inspections for all university building offices and 350 laboratories, new orientation for undergraduate students where general safety rules are

described, and development of the Health and Safety Management System. The KII participants pointed out that the MUN Safe App is very useful as it has various features related to health and safety. Most of the KII participants mentioned that the supervisors of graduate students are responsible for providing information to the students on (i) laboratory safety rules (ii) working alone procedures, and (iii) whom to call first in the event of an incident/accident. They placed the responsibility for providing laboratory safety equipment to the students and researchers on the department heads. The participants emphasized budget and manpower as the main bottlenecks for addressing the hazards in offices and in laboratories in a timely manner. There are some suggestions from the KII participants to improve health and safety at MUN such as making attending safety presentations mandatory and included as part of the new employee and student orientation packages, demonstrating the AED in every building in a booth to raise awareness among the students and employees, encouraging all university residents to install the MUN Safe App on their phones, and any app needs to be improved on a regular basis. Overall, the analysis indicates that the EHS Unit, WHS committees and FM are working together to improve the health and safety at Memorial University.

The goal of our study is to evaluate the effectiveness of safety programs at MUN. In 2015, the EHS unit of the Office of the Chief Risk Officer of Memorial University conducted several safety presentations to address the identified gaps in health and safety programs. The safety presentations included videos, lectures, pamphlets, and feedback from the participants. MUN also provides hands-on training for some safety-specific areas; for example, WHMIS, laboratory safety, respiratory protection, the transportation

of dangerous goods, etc. In previous studies, several researchers had examined the effectiveness of various methods of safety training. For example, Burke et al. (2006) examined the relative effectiveness of three different methods of worker health and safety training. The least engaging were videos, lectures and the distribution of pamphlets. Programmed instructions and feedback interventions were included in the moderately engaging method. The most engaging were hands-on training and training on behavioral modeling. The results indicated that the most engaging training method was more effective in improving workers' safety knowledge and performance than other methods of training. MUN is using all three types of mechanisms for safety training. It is obviously recommended to have more hands-on training.

Many researchers have used employees' perceptions to evaluate the effectiveness of safety programs. For example, O'Toole, M. (2002) used an employees' perception survey as a predictive tool for assessing the effectiveness of a safety program. The study also examined the relationship between management's approach to safety and employees' perceptions of how essential safety is to the company. For this purpose, an employee safety perception survey was conducted at eight manufacturing sites in the southwest region of the United States. This survey was conducted in industrial settings. Our surveys have been conducted in university settings, as it is equally important for universities to implement health and safety programs to reduce accidents in the workplace.

Some studies had been done on university settings to assess the safety perceptions of employees. For example, in 2011, Kristine Witt conducted an online survey of faculty,

staff and students to assess their perceptions on Montana Tech Campus's safety and security. The study findings concluded that Montana Tech is overall a safe campus during different times of the day and according to Annual Security Reports, very few crimes actually happened on the campus. Bryden and Fletcher (2007) also examined the safety concerns of faculty members and staff on a small university campus in Alabama. They distributed a survey questionnaire to faculty members and staff asking about daily campus activities, personal safety protection taken while on campus, attitudes about safety on campus and reported cases of victimization on campus. Their study results indicated that female employees took more personal safety precautions and reported more about violent acts than male employees.

Our study results have not found any effect of gender on employees' perceptions regarding workplace health and safety. Only age, attendance at safety presentations, employment status and employment duration have effects on the knowledge of the employees and graduate students in relation to health and safety.

Chapter 5

Conclusion

The main purpose of our study is to evaluate the effectiveness of MUN's safety programs and safety presentations through well-designed surveys and to compare the safety programs of Memorial University with the safety programs of other Canadian universities**.**

The survey results indicate that there is an association between knowledge and the practice of safety protocols in the workplace. Therefore, the workplace safety practices of the employees and graduate students will improve with an increase in their knowledge about health and safety and to increase their knowledge, attending safety presentations is necessary. The survey analysis also indicates that employees who attended safety presentations demonstrated a higher level of knowledge on workplace health and safety and put safety regulations into practice in their daily activities more than those who did not attend the safety presentations. The analysis indicates some association between knowledge and age, knowledge and employment status, and knowledge and length of service. Age, gender, employment status, and employment duration do not have much of an effect on participants' attitude and safety practices in jobs. The survey results indicate that the knowledge, attitude, and behavior of the employees regarding safety have not changed much over the period of 6 months. The only change is in the perception of the graduate students/researchers about laboratory safety. Regarding laboratory safety, most of the KII participants referred to the supervisors' responsibility to provide laboratory

safety rules and laboratory safety equipment to the students and researchers. The KII participants emphasized that the budget and workforce the main bottlenecks for addressing hazards in offices and laboratories in time. The KII participants provided some suggestions for improving health and safety at MUN such as making attendance of the safety presentations mandatory and including them in the new employee and student orientation package, MUN employees and students should install the MUN Safe App on their phones, and any app needs to be improved on a regular basis. The findings of the cross-sectional surveys indicate that there is an improvement in respondents' knowledge about MUN's health and safety policies and online reporting system. The survey respondents also improved their communication with the Health and Safety Committee.

Compared with the health and safety programs of other universities, Memorial University is providing more safety policies and programs for the university community; for example, MUN has additional training on boating and diving safety, Health and Safety Management System Software (HSMS), and working with dust-emitting products. Memorial University also provides more safety training such as training on the operation of mobile equipment and power line hazards training.

The gap in knowledge, attitude and behavior of the employees about health and safety was identified through surveys and responses were sought through key informant interview as a result of which improvement in the health and safety programs are planned and promised by some officials. This is the contribution of my thesis not only to literature but also to practice.

The study has some limitations; for example, we could not find any detailed information from the university websites to compare the health and safety programs of the ten Canadian universities; the sample sizes of the surveys were small, as the participation was voluntary, and there was no incentive for participating in the surveys; the survey participants were not equally distributed, as the numbers of the respondents of some faculties were much higher than the numbers of the respondents of other faculties; the survey data were anonymous so that we could not observe the changes in the perceptions of the health and safety of a particular respondent over a six-month period of time; and there were very few qualitative questions on the survey questionnaire to elicit respondents' comments.

In future surveys, undergraduate students should be included, as they are also a significant portion of the MUN community with health and security needs. There is also scope for making more broad-scale comparisons through surveys and direct contact for collecting information on the health and safety programs of Canadian universities.

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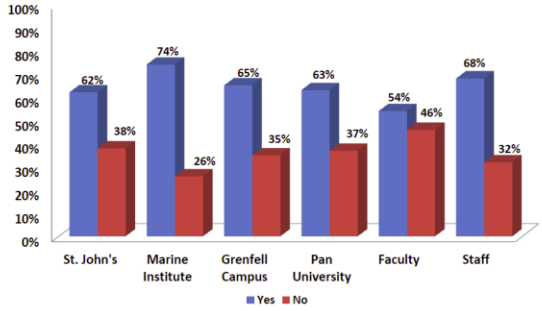
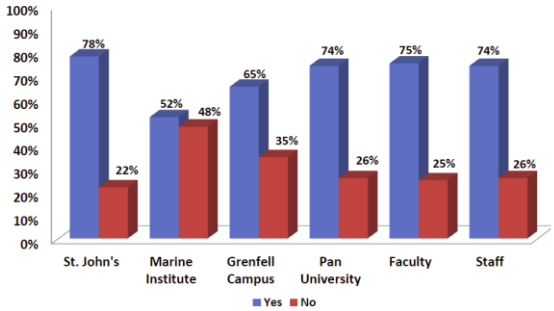
APPENDIX A

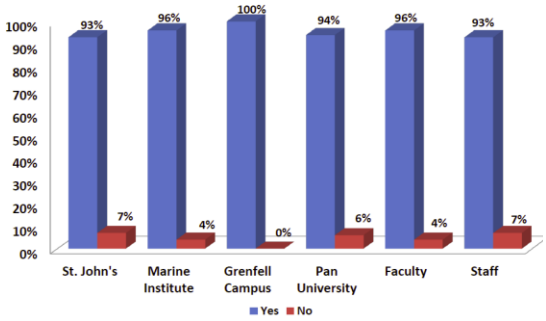
Q1. Do you fully understand your responsibilities for he and safety?



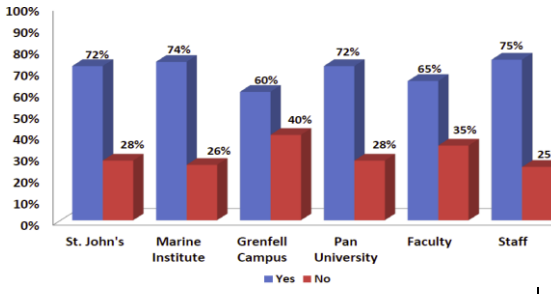
Q3. Safety is discussed in my workplace?



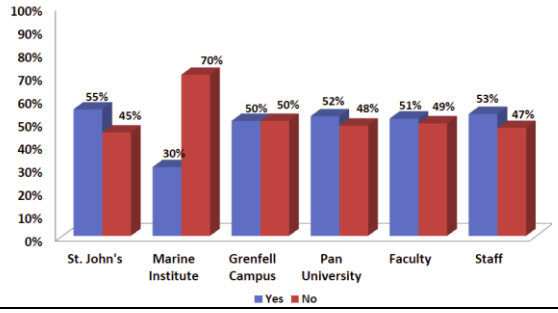
Q5. I report unsafe acts/conditions if I see them?



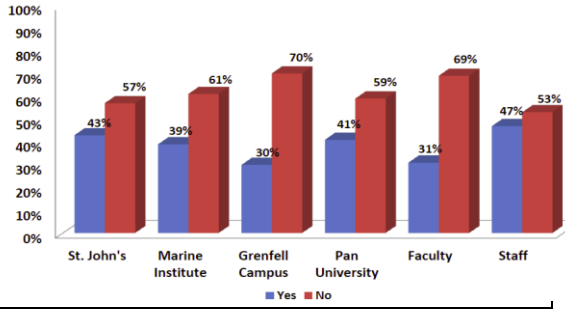
Q7. Safety is a priority within the University?



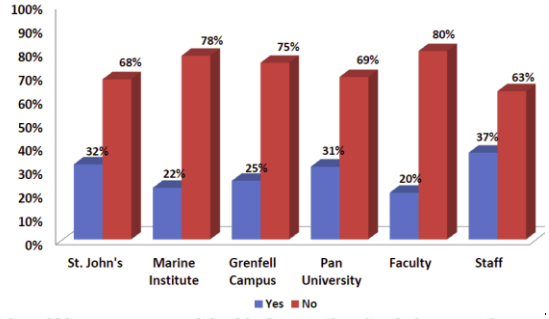
Q10. Do you receive newsletters, brochures, bulletins, e Relating to health and safety?



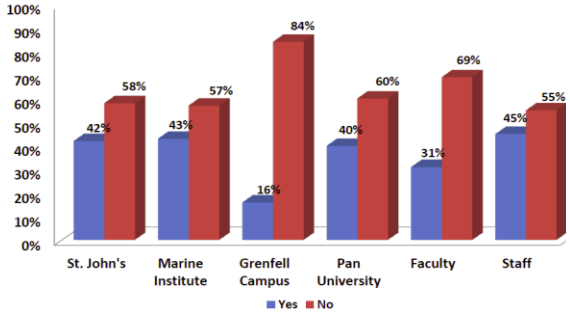
Q16. Have you reviewed MUN's health and safety polic and procedures?



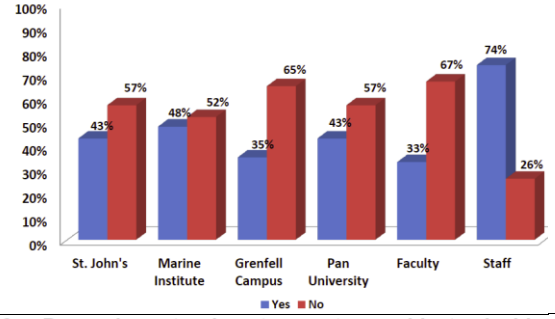
Q18. Were you informed about your rights under the Occupational Health and Safety Act (Right to Kno Right to Participate, Right to Refuse)?



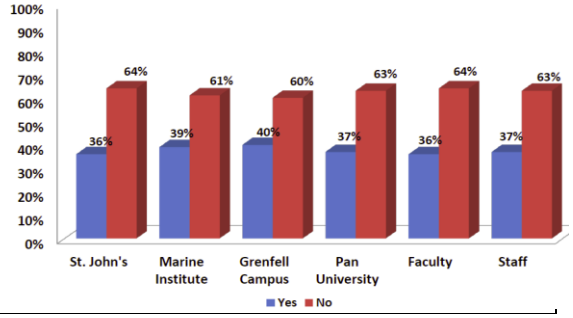
Q19. Were you informed about the hazardous material that are present in your workplace?



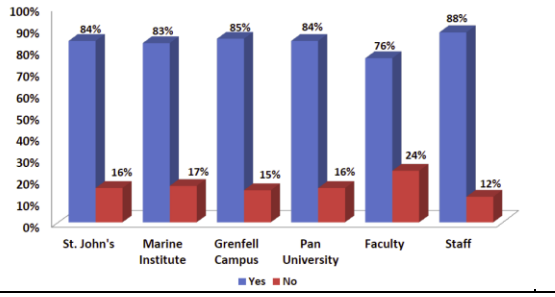
Q21. Were you provided information/training on the sa use and maintenance of tools and equipment necessary for your job?



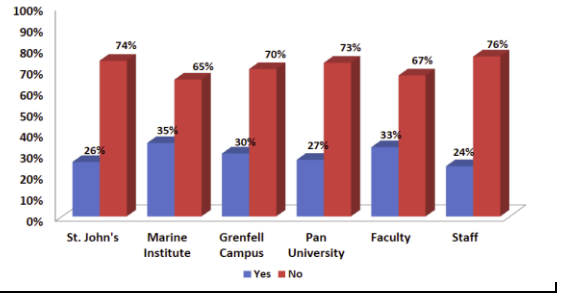
Q25. Does the OHS Committee communicate with you'



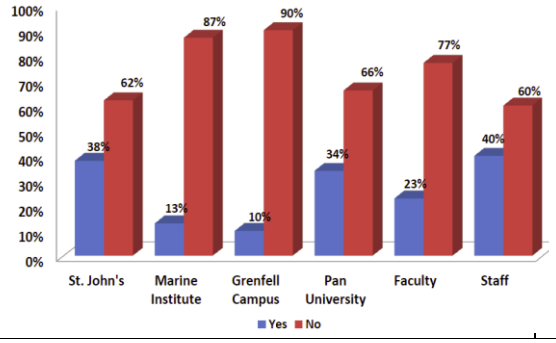
Q29. Do you know to whom to report an accident or incider



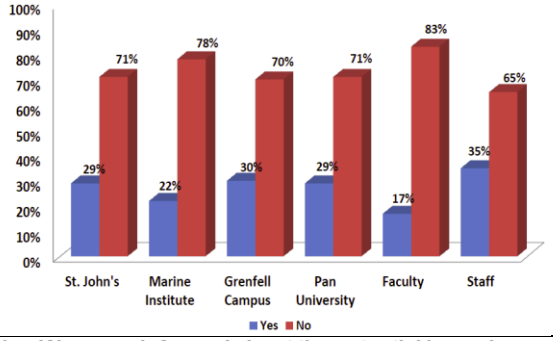
Q31. Employees are given feedback on accidents that occur in your workplace?



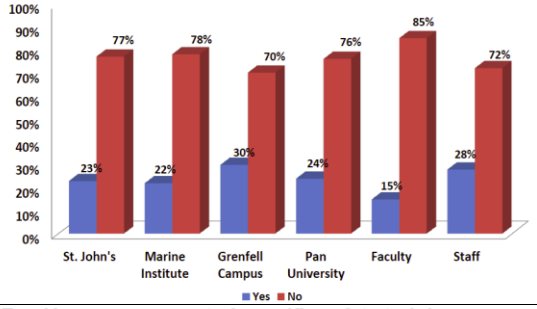
Q34. Are you aware of MUN's online reporting system f health and safety issues/concerns?



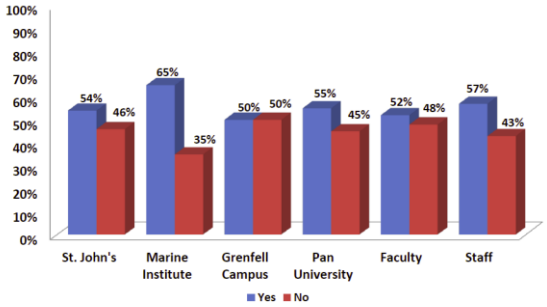
Q41. Have you participated in a toolbox talk/safety meetin



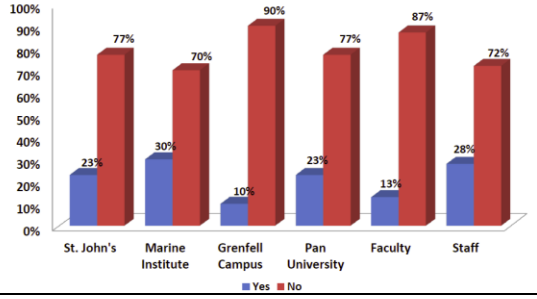
Q43. Are toolbox talks/safety meetings relevant to your tas



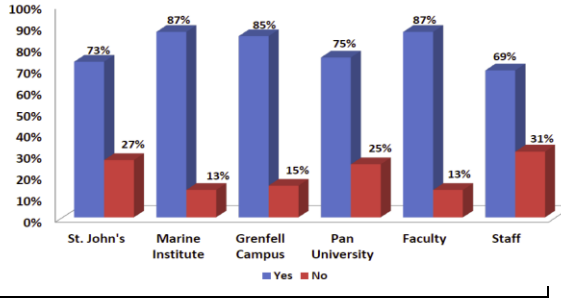
Q44. Were you informed about the potential hazards prese in your workplace?



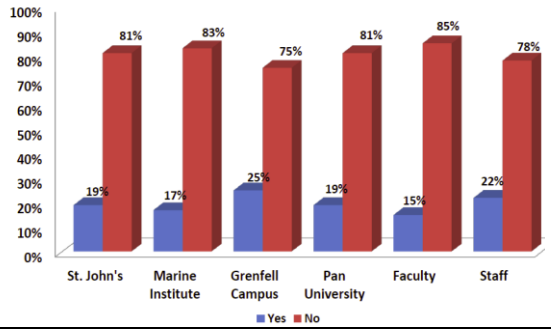
Q47. Have you requested specific safety training appropria to your position?



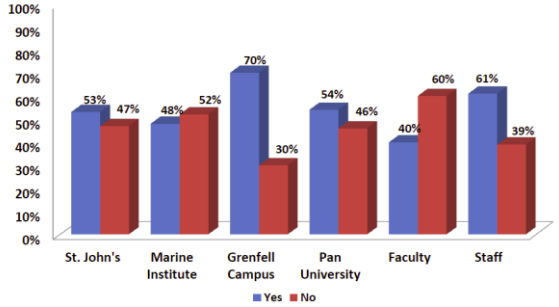
Q49. Are you required to work alone?



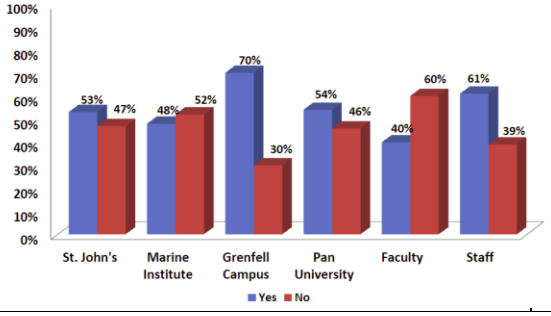
Q50. Are you aware of MUN's working alone policy and procedures?



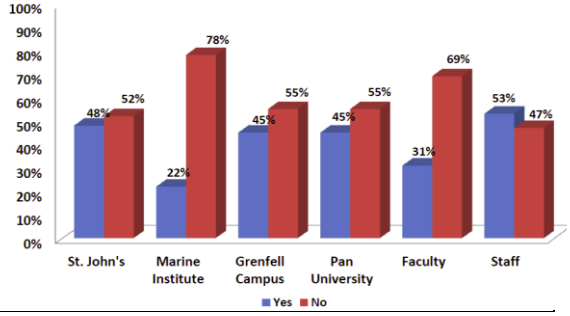
Q53. Do you know your role in the event of an emergency



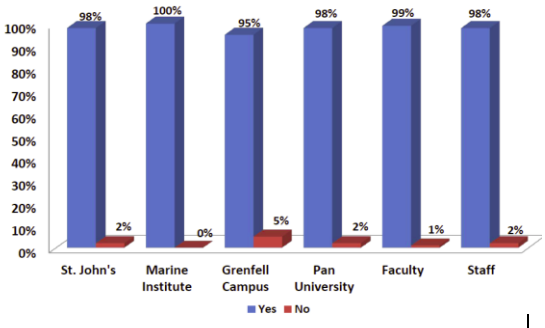
Q53. Do you know your role in the event of an emergenc



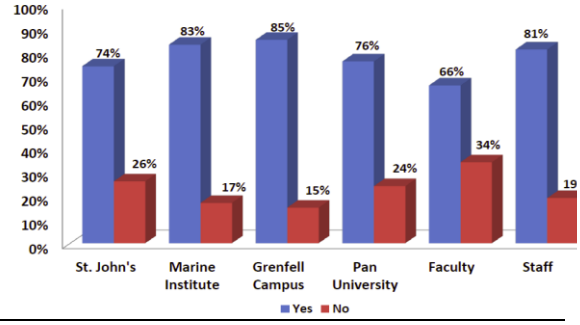
Q54. Do you know the campus emergency telephone number?



Q56. Do you know the shortest exit route from your wor area(s)?



Q59. I know what to do if I get injured at work?



APPENDIX B

Survey E-mail.

Hello, my name is Zakia Hoque. I am a graduate student in the Division of Community Health and Humanities at Memorial University. As a part of my Master's program I am doing research on '**Effectiveness of Workplace Health and Safety Programs in University Settings'.** It is my understanding that some of you in your Department/ Division/Faculty/office attended a Safety-Presentation /Safety-Workshop on Workplace Health and Safety (WHS) provided by Environmental Health and Safety Unit at Memorial University few weeks/months ago. As a part of my thesis work, I am conducting surveys to study about the current awareness and retention of awareness over the next few months of the information on WHS programs at Memorial. Again, my objective is to study the effectiveness of general health and safety programs provided by Environmental Health and Safety Unit at Memorial University over time. I will also review the publicly available information on the workplace health and safety programs in other Canadian Universities and compare them with Memorial's Safety Programs. The outcomes of this study will help inform the Environmental Health and Safety Unit about the general awareness of their programs over time and about similar programs in other university settings. The intent of the study is to help in the improvement of the general health and safety of employees at Memorial in future.

You are invited to participate in this research project now, by completing the anonymous survey which you can access using the link provided below. You will also be invited to complete the same survey anonymously six months later to assess the retention of the information on Workplace Health and Safety Programs. As these two surveys are anonymous, your responses can't be linked. You are invited to participate in this study as a member of the Memorial University employee community. Please participate in the study irrespective of whether or not you attended the Safety-Presentation/Safety-Workshop on Workplace Health and Safety in the past few weeks/months. The survey will take only about 15 minutes of your time. Thanks for your cooperation and participation.

Please access the survey by clicking on the following link.

https://www.surveymonkey.com/r/hru_mun_safety

Memorial University-Workplace Health and Safety Survey.

Before you start answering the questions in the survey, please read and understand the informed consent part carefully. Your consent to participate is implied by your participation in the study.

Informed Consent

Your participation in this study is voluntary. Although no risks or discomforts are foreseen, except for your time in completing the surveys, you may choose not to participate now or four months later. These surveys are anonymous and your responses will be kept confidential. You may decide not to answer some of the questions in the surveys either now or later. All data will be stored in a password protected encrypted computer at Medical School at Memorial University. The consolidated results of the study will be reported through masters' thesis, journal articles and conference presentations. We have no conflict of interest to declare. If you have any questions about taking part in this study, you can contact the researcher ZAKIA HOQUE (znh117@mun.ca).

Thank you very much for your cooperation and participation.

Please begin to participate in the study by selecting the appropriate answer to the following questions.

1. Did you attend the Safety-Presentation provided by Environmental Health and Safety Unit at Memorial University?
[ ]Yes.
[ ] No.
[ ] I don't remember.

2. Employment Status
[ ]Faculty.
[ ]Staff.
[ ]Researcher/Graduate student.
[ ]Administrator.

3. Gender
[ ]Male

[ ]Female.

4. Which faculty/office do you belong to?
[ ] Medicine
[ ]Pharmacy
[ ]Nursing
[ ]Science
[ ]Engineering
[ ]Business
[ ]Education
[ ]Arts
[ ]Administrative office
[ ]Other (Please specify)_____

5. In which age group do you fall?
[ ] Less than 30
[ ] 30-39
[ ] 40-49
[ ] 50-59
[ ] 60 or more

6. How long have you been on the Campus as an employee?
[ ] less than 5 years
[ ] 5-9 years.
[ ] 10 -14 years
[ ] 15-19 years
[ ] 20-24 years
[ ] 25 years or more

7. Are you aware of the presence of the Environmental Health and Safety Unit at Memorial University? (GA Survey, 2013)

[ ] Yes
[ ] No.

8. Are you aware of Workplace Health and Safety Committees (WHSC- formerly known as Occupational Health and Safety Committees) of the building you work in? (GA Survey, 2013)

[ ] Yes
[ ] No.

9. Does the WHSC in your building communicate with you? (GA Survey, 2013)

[ ] Yes
[ ] No.

10. Do you read newsletters, brochures, bulletins, etc. relating to health and safety e-mailed by Environmental Health and Safety Unit? (GA Survey, 2013)

[ ] Yes
[ ] No.
[ ] I don't receive any of them.

11. Were you informed about the Occupational Health and Safety Act? (GA Survey, 2013)

[ ] Yes
[ ] No.

12) Do you know where to report a safety concern, a safety hazard or accident? (GA Survey, 2013)

[ ] Yes
[ ] No.

13) Do you know your role in the event of an emergency? (GA Survey, 2013)

[ ] Yes
[ ] No.

14) Do you know the campus emergency telephone number? (GA Survey, 2013)

[ ] Yes
[ ] No.

15. Do you know the shortest exit route from your work area(s)? (GA Survey, 2013)

[ ] Yes
[ ] No.

16. Do you know whom you call first if you get injured at work? (GA Survey, 2013)

[ ] Yes
[ ] No.

17. Are you aware that there are Automated External Defibrillators (AED) available in campus buildings? (GA Survey, 2013)

[ ] Yes
[ ] No.

18. Do you know where the AEDs are located in the buildings you work? (GA Survey, 2013)

[ ] Yes
[ ] No.

19. If AED training is made available through MUN, would you be interested in participating in the training? (GA Survey, 2013)

[ ] Yes
[ ] No
[ ] I am already trained in using AED.

20. In your experience, do you think that safety is a priority within your department/division/faculty/office? (GA Survey, 2013)

[ ] Yes
[ ] No.

21. Do you understand your responsibilities for your and your colleagues' health and safety? (GA Survey, 2013)

[ ] Yes
[ ] No.

22. Are you familiar with MUN's health and safety policies? (GA Survey, 2013)

[ ] Yes
[ ] No.

23. Please rate how safe you feel in the following areas on campus. (Montana Tech Safety Awareness Survey, 2011).

	Safe	Neutral	Unsafe	N/A
Parking Lots				
Elevators				
Gym				
Library				
Student Union Building				
Classrooms				
Laboratories				
Restrooms				
Dormitories				

Please elaborate on any other particular areas you feel unsafe.

_____

_____

24. What precautions do you think you should take to increase your safety on campus? (Check all that apply). (Montana Tech Safety Awareness Survey, 2011).

i) Carry a cellular phone.
ii) Let others know where I will be.
iii)Take safety- training classes.
iv)Other, please specify.

_____

_____

25. Are you aware of Memorial's online reporting system for the health and safety issues/concerns? (GA Survey, 2013)

[ ] Yes
[ ] No.

26. Do you report unsafe acts/conditions if you see them? (GA Survey, 2013)

[ ] Yes
[ ] No.

'Toolbox Talks' is the name of a meeting, which gives opportunity to memorial university workers, supervisors and Department Heads a means of communicating health, safety and environmental initiatives as well as accident/incident 'Lessons learned' and expressing concerns, obtaining information, and resolving issues related to safety in the workplace.

27. Are toolbox talks/safety meetings relevant to your task? (GA Survey, 2013)

[ ] Yes
[ ] No.
[ ] I do not know.

28. Have you participated in a toolbox talk/safety meeting? (GA Survey, 2013)

[ ] Yes
[ ] No
[ ] N/A.

29. Are you aware of MUN's working alone procedures? (GA Survey, 2013)

[ ] Yes
[ ] No.

30. Do you work after hours at least some times? (GA Survey, 2013)

[ ] Yes
[ ] No.

31. Are you aware of MUN's safety escort service? (GA Survey, 2013)

[ ] Yes
[ ] No.

32. Do you work at a lab or visit one frequently?

[ ] Yes
[ ] No.

33. Please rate the following regarding laboratories on campus.

	Agree	Neutral	Disagree	N/A
I feel safe in campus labs (Montana Tech Safety Awareness Survey, 2011)				
PPE is available in the labs. (Montana Tech Safety Awareness Survey, 2011)				
Lab safety is properly explained. (Montana Tech Safety Awareness Survey, 2011)				
I received training on appropriate use of eye wash station				
I Know the location of nearest safety shower				

34. Is safety discussed in your workplace? (GA Survey, 2013)

[ ] Yes
[ ] No.

35. Were you provided information/training on the safe use and maintenance of tools and equipment necessary for your job? (GA Survey, 2013)

[ ] Yes
[ ] No.
[ ] N/A.

36. Have you requested specific safety training appropriate to your position? (GA Survey, 2013)

[ ] Yes
[ ] No
[ ] N/A.

37. Were you informed about the hazardous materials that are present in your workplace? (GA Survey, 2013)

[ ] Yes
[ ] No.
[ ] N/A.

For the purpose of this survey a hazard is defined as: 'Any source of potential damage, harm or adverse health effects on something or someone under certain conditions at work'.

38. How many hazards have you identified in your work place in the last one year.

0 1 2 3 4 or more.

In the above question if your answer is 1 or more than 1 go to question 34 or else go to question 35.

39. How many of them have been corrected in a timely manner?

0 1 2 3 4 or more.

40. Are Employees given feedback on accidents that occur in your workplace? (GA Survey, 2013)

[ ] Yes
[ ] No.

41. Do you have any concerns regarding your safety and /or security in your faculty or department?

[ ] Yes
[ ] No.

If you answered yes please specify.

42. Which of the following do you think MUN should provide to help increase the safety of the campus community? (Check all that apply). (Montana Tech Safety Awareness Survey, 2011)

a) Improve safety escort service.
b) More emergency call boxes.
c) Additional lighting.
d) More security guards.
e) More safety presentations.
f) Self-defense classes.
g) Other, please specify

_____

APPENDIX C

Chi-Square Tables

Chi-Square Tests for table 3.2.5.1

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	14.728[a]	1	.000		
Continuity Correction[b]	13.133	1	.000		
Likelihood Ratio	14.951	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	14.587	1	.000		
N of Valid Cases	105				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 14.02.

Chi-Square Tests for table 3.2.5..2

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.942[a]	1	.332		
Continuity Correction[b]	.607	1	.436		
Likelihood Ratio	.943	1	.331		
Fisher's Exact Test				.345	.218
Linear-by-Linear Association	.934	1	.334		
N of Valid Cases	119				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 20.47.

Chi-Square Tests for table 3.2.5.3

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.757[a]	1	.016		
Continuity Correction[b]	4.799	1	.028		
Likelihood Ratio	5.933	1	.015		
Fisher's Exact Test				.022	.013
Linear-by-Linear Association	5.707	1	.017		
N of Valid Cases	115				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 14.75.

Chi-Square Tests for table 3.2.5.4

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	30.585[a]	2	.000
Likelihood Ratio	31.058	2	.000
Linear-by-Linear Association	14.304	1	.000
N of Valid Cases	115		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.89.

Chi-Square Tests for table 3.2.5.5

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.455[a]	2	.040
Likelihood Ratio	6.440	2	.040
Linear-by-Linear Association	2.187	1	.139

N of Valid Cases	132		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.71.

Chi-Square Tests for table 3.2.5.6

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12.299[a]	2	.002
Likelihood Ratio	12.920	2	.002
Linear-by-Linear Association	1.858	1	.173
N of Valid Cases	128		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.94.

Chi-Square Tests for table 3.2.5.7

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.961[a]	1	.327		
Continuity Correction[b]	.610	1	.435		
Likelihood Ratio	.961	1	.327		
Fisher's Exact Test				.425	.217
Linear-by-Linear Association	.953	1	.329		
N of Valid Cases	116				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 17.54.

Chi-Square Tests for table 3.2.5.8

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.902[a]	1	.342		
Continuity Correction[b]	.590	1	.442		
Likelihood Ratio	.905	1	.341		
Fisher's Exact Test				.369	.221
Linear-by-Linear Association	.896	1	.344		
N of Valid Cases	133				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 22.62.

Chi-Square Tests for table 3.2.5.9

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.290[a]	1	.256		
Continuity Correction[b]	.883	1	.347		
Likelihood Ratio	1.300	1	.254		
Fisher's Exact Test				.327	.174
Linear-by-Linear Association	1.280	1	.258		
N of Valid Cases	130				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 16.89.

Chi-Square Tests for Table 3.2.5.10

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.623[a]	1	.006		
Continuity Correction[b]	6.562	1	.010		
Likelihood Ratio	7.681	1	.006		
Fisher's Exact Test				.009	.005
Linear-by-Linear Association	7.558	1	.006		
N of Valid Cases	117				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 17.08.

Chi-Square Tests for Table 3.2.5.11

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.142[a]	1	.023		
Continuity Correction[b]	4.347	1	.037		
Likelihood Ratio	5.166	1	.023		
Fisher's Exact Test				.029	.018
Linear-by-Linear Association	5.103	1	.024		
N of Valid Cases	133				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 21.79.

Chi-Square Tests for Table 3.2.5.12

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Si side
Pearson Chi-Square	1.057[a]	1	.304		
Continuity Correction[b]	.692	1	.406		
Likelihood Ratio	1.065	1	.302		
Fisher's Exact Test				.332	
Linear-by-Linear Association	1.049	1	.306		
N of Valid Cases	130				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 16.62.

Chi-Square Tests for Table 3.2.5.13

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.108[a]	1	.293		
Continuity Correction[b]	.452	1	.501		
Likelihood Ratio	1.020	1	.313		
Fisher's Exact Test				.282	.242
Linear-by-Linear Association	1.094	1	.296		
N of Valid Cases	78				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.62.

Chi-Square Tests for Table 3.2.5.14

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.592[a]	1	.442		
Continuity Correction[b]	.232	1	.630		
Likelihood Ratio	.619	1	.432		
Fisher's Exact Test				.570	.323
Linear-by-Linear Association	.586	1	.444		
N of Valid Cases	89				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.34.

Chi-Square Tests for Table 3.2.5.15

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.116[a]	1	.733		
Continuity Correction[b]	.004	1	.947		
Likelihood Ratio	.117	1	.732		
Fisher's Exact Test				.791	.479
Linear-by-Linear Association	.115	1	.735		
N of Valid Cases	87				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.62.

Chi-Square Tests for Table 3.2.5.16

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.450[a]	1	.063		

Continuity Correction[b]	2.572	1	.109		
Likelihood Ratio	3.490	1	.062		
Fisher's Exact Test				.079	.054
Linear-by-Linear Association	3.402	1	.065		
N of Valid Cases	71				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.34.

Chi-Square Tests for Table 3.2.5.17

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.397[a]	1	.529		
Continuity Correction[b]	.155	1	.694		
Likelihood Ratio	.396	1	.529		
Fisher's Exact Test				.638	.347
Linear-by-Linear Association	.392	1	.531		
N of Valid Cases	81				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.67.

Chi-Square Tests for Table 3.2.5.18

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	10.271[a]	1	.001		
Continuity Correction[b]	8.597	1	.003		
Likelihood Ratio	11.019	1	.001		
Fisher's Exact Test				.002	.001
Linear-by-Linear Association	10.126	1	.001		
N of Valid Cases	71				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.87.

Chi-Square Tests for Table 3.2.5.19

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.017[a]	2	.007
Likelihood Ratio	10.442	2	.005
Linear-by-Linear Association	4.060	1	.044
N of Valid Cases	85		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.67.

Chi-Square Tests for Table 3.2.5.20

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.718[a]	2	.424
Likelihood Ratio	1.733	2	.420
Linear-by-Linear Association	.134	1	.715
N of Valid Cases	96		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.00.

Chi-Square Tests for Table 3.2.5.21

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.855[a]	2	.652
Likelihood Ratio	.844	2	.656
Linear-by-Linear Association	.003	1	.954
N of Valid Cases	85		

a.1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.94.

Chi-Square Tests for Table 3.2.5.22

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.082[a]	1	.775		
Continuity Correction[b]	.003	1	.958		
Likelihood Ratio	.082	1	.775		
Fisher's Exact Test				.818	.478
Linear-by-Linear Association	.081	1	.776		
N of Valid Cases	85				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.39.

Chi-Square Tests for Table 3.2.5.23

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.753[a]	1	.386		
Continuity Correction[b]	.424	1	.515		
Likelihood Ratio	.756	1	.384		
Fisher's Exact Test				.516	.258
Linear-by-Linear Association	.745	1	.388		
N of Valid Cases	96				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.00.

Chi-Square Tests for Table 3.2.5.24

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.288[a]	1	.130		
Continuity Correction[b]	1.576	1	.209		
Likelihood Ratio	2.352	1	.125		
Fisher's Exact Test				.198	.104
Linear-by-Linear Association	2.261	1	.133		
N of Valid Cases	85				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.94.

Chi-Square Tests for Table 3.2.5.25

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.711[a]	1	.010		
Continuity Correction[b]	5.541	1	.019		
Likelihood Ratio	6.830	1	.009		
Fisher's Exact Test				.017	.009
Linear-by-Linear Association	6.631	1	.010		
N of Valid Cases	83				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.53.

Chi-Square Tests for Table 3.2.5.26

	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.653[a]	1	.419		

Continuity Correction[b]	.347	1	.556		
Likelihood Ratio	.656	1	.418		
Fisher's Exact Test				.512	.278
Linear-by-Linear Association	.646	1	.421		
N of Valid Cases	94				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 14.84.

Chi-Square Tests for table 3.2.5.27

	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.042[a]	1	.838		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.042	1	.838		
Fisher's Exact Test				1.000	.522
Linear-by-Linear Association	.041	1	.839		
N of Valid Cases	83				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.40.

Chi-Square Tests for table 63.2.5.28

	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.982[a]	1	.014		
Continuity Correction[b]	4.319	1	.038		
Likelihood Ratio	5.820	1	.016		
Fisher's Exact Test				.025	.020

Linear-by-Linear Association	5.860	1	.015		
N of Valid Cases	49				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 3.67.

Chi-Square Tests for Table 3.2.5.29

	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.653[a]	1	.419		
Continuity Correction[b]	.263	1	.608		
Likelihood Ratio	.646	1	.422		
Fisher's Exact Test				.556	.302
Linear-by-Linear Association	.642	1	.423		
N of Valid Cases	57				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.63.

Chi-Square Tests for Table 3.2.6.1

	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.011[a]	1	.915		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.011	1	.916		
Fisher's Exact Test				1.000	.539
Linear-by-Linear Association	.011	1	.916		
N of Valid Cases	112				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.75.

Chi-Square Tests for Table 3.2.6.2

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	14.822[a]	1	.000		
Continuity Correction[b]	13.176	1	.000		
Likelihood Ratio	17.906	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	14.692	1	.000		
N of Valid Cases	114				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.75.

Chi-Square Tests for table 3.2.6.3

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.484[a]	1	.062		
Continuity Correction[b]	2.763	1	.096		
Likelihood Ratio	3.420	1	.064		
Fisher's Exact Test				.070	.049
Linear-by-Linear Association	3.455	1	.063		
N of Valid Cases	124				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13.43.

Chi-Square Tests for Table 3.2.6.4

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.854[a]	1	.356		
Continuity Correction[b]	.453	1	.501		
Likelihood Ratio	.873	1	.350		
Fisher's Exact Test				.454	.253
Linear-by-Linear Association	.843	1	.358		

N of Valid Cases	82				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.84.

Chi-Square Tests for table 3.2.6.5

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.800[a]	1	.051		
Continuity Correction[b]	2.738	1	.098		
Likelihood Ratio	4.356	1	.037		
Fisher's Exact Test				.076	.043
Linear-by-Linear Association	3.752	1	.053		
N of Valid Cases	78				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.31.

Chi-Square Tests for Table 3.2.6.6

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.866[a]	1	.049		
Continuity Correction[b]	2.888	1	.089		
Likelihood Ratio	3.762	1	.052		
Fisher's Exact Test				.064	.046
Linear-by-Linear Association	3.819	1	.051		
N of Valid Cases	82				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.32.

Chi-Square Tests for Table 4.1

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.004[a]	1	.951		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.004	1	.951		
Fisher's Exact Test				1.000	.535
Linear-by-Linear Association	.004	1	.951		
N of Valid Cases	203				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 26.80.

Chi-Square Tests for Table 4.2

Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.075[a]	1	.784		
Continuity Correction[b]	.018	1	.894		
Likelihood Ratio	.075	1	.784		
Fisher's Exact Test				.888	.448
Linear-by-Linear Association	.075	1	.784		
N of Valid Cases	230				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 32.97.

Chi-Square Tests for Table 4.3

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.590[a]	1	.442		
Continuity Correction[b]	.372	1	.542		
Likelihood Ratio	.595	1	.440		
Fisher's Exact Test				.528	.272
Linear-by-Linear Association	.587	1	.443		
N of Valid Cases	216				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 22.43.

APPENDIX D

Key Informant Interview Questions

Q1. After the 2013 Gap Analysis survey on safety culture, can you recall any additional initiatives that EHS Unit has initiated to create awareness on health and safety among MUN employees?

Q2. In the surveys less than 50% respondents (first survey 46.6%, second survey 40.8%) notified that they had participated in the safety presentation/workshop in 2015. Is this level of participation satisfactory? If not what additional steps can be taken to reach out to more people at MUN?

Q3. The survey results indicate that, the graduate students and researchers have low level of knowledge/awareness on occupational health and safety programs compared to the faculty and staff. Knowing that the graduate students and researchers are more exposed group to different safety critical scenarios,

i) Does this appear as a concern?

ii) How do you think the safety awareness of graduate students and researchers can be improved?

Q4. In the surveys less than 65% of the participants know whom to call first if they get injured at work. Is this level of awareness acceptable? What are the current mechanisms

to educate researchers/employees about this information? How do you think this information can be disseminated more effectively?

Q5. The respondents have suggested to improve communication and implementation of the policies and to provide more auditing of safety policies by EHS department to ensure compliance, do you have a similar observation? Is there any continuing effort to improve this concern?

Q6. The surveys indicate that, among the people who said Tool Box Talk is relevant to them, the level of participation in toolbox talk decreased over time. Does your observation support this finding? If so, what can be done to increase the participation?

Q7. The survey analysis indicates that, the graduate students and researchers need more training on eyewash station and safety shower, can you explain the current mechanisms for training graduate students on these basic safety practices? Do you see any way to improve the provision of training and increase the level of participation?

Q8.The respondents suggested to install more flammable gas detectors and improve the splash proof safety goggles. In your opinion are the units/labs equipped with adequate gas detectors and splash proof safety goggles?

Q9. The respondents commented on shortage of lab space and shortage of PPE (Personal Protective Equipment).

i) Is there any continuing effort to create more lab space?

ii) Who is normally responsible to provide the PPE to the researchers/graduate students? How can one address the shortage of PPE in labs at MUN?

Q10. In the surveys over 50% of the respondents mentioned that, none of the hazards at their workplaces had been addressed in a timely manner. (i) What are the current practices for reporting, follow-up and correction of hazards? (ii) Do you see any bottleneck in the addressing the hazards in a timely fashion?

Q11. The survey results show that over 70% of the respondents want to participate in AED training. Is there any continuing effort to provide AED training to the employees and students at MUN?

Q12. The surveys indicate that a significant portion of the employees is not aware of MUN's working alone procedure though most of the employees are working after hours at the office. Is this a concern? If so what can be done to increase awareness on working alone procedure among the employees?

Q13. The participants have suggested repair of walkways and parking lots and removal of thick layer of ice from the parking lots to prevent slips and falls. Does this come under the purview of EHS Unit? If yes how can one address this issue?

Q14. Many respondents showed their concern about the design and usage of MUN Safe App. Is there a continuing effort to improve the App and make it user friendly?

Q15. In the surveys many of the participants have suggested the improvement of the on-campus safety escort service. How is the current safety escort service implemented and what additional steps can be taken to improve it?

APPENDIX E

Informed Consent Form for Qualitative and Community Based Research

Title:

"Effectiveness of Workplace Health and Safety Programs in University Settings."

This form is part of the process of informed consent. It should give you a basic idea of what this project is about and what your participation will involve. In order to decide whether you wish to participate in this research project, you should understand enough about the potential risks and benefits to be able to make an informed decision. This is the informed consent process.

Hello, We are pleased to invite you to participate in a research project entitled "Effectiveness of Workplace Health and Safety Programs in University Settings."

I am Zakia Nahin Hoque. I am a graduate student in the Division of Community Health and Humanities at Memorial University. This study/research is a part of my Masters' program.

Background of the Research

Health and safety in workplace is important to ensure safe working environment for all employees. Accidents or incidents ranges from small injuries from slip on the ground, to death or life threatening injuries caused by fall from high elevation, exposure to hazardous materials, catching fire in laboratories or other places in the workplace. Work-related injuries and deaths continue to occur at an alarming rate. Like industry, safety is a growing concern that needs to be addressed in university campuses. There are no statistics available on workplace fatalities and injuries in Canadian or US universities. However, many studies showed that young and new hires are significantly at higher risk of injury compared to the rest of the population [ENFORM]. In recent years there have been several accidents in prominent universities. In Canada all major universities have an Environment Health and Safety (EHS) Department (or similar) through which occupational health and safety (OH&S) is administered. Some universities also offer certification on OH&S through academic units. Canadian Center for Occupational Health and Safety (CCOHS) has workplace legislation for 10 provincial and 3 territorial jurisdictions. OH&S in industries and in the universities fall under the same workplace legislation [CCOHS, 2016]. Traditionally, health and safety training program is

considered to be the most effective method for managing occupational health and safety. Most organizations including universities spend a significant portion of the occupational health and safety resources to conduct training programs among workers. These safety trainings are sometimes highly structured training courses, other times these are in formal on the job training. Most in-house assessments of training programs measure only immediate reactions of trainees and ignore more important factors. Therefore, it is important to design a systematic method to evaluate the effectiveness of safety programs in university settings.

The objective of my research study is to evaluate the effectiveness of the Health and Safety presentations conducted by MUN Environmental Health and Safety (EHS) Unit. This will be a novel contribution as no such studies have been done in Canadian university context, and only few incomplete studies were done globally. The proposed research will also compare health and safety programs among Canadian universities and establish a benchmark. Memorial University is a small campus and is committed to providing a safe learning and working environment for all of its students and employees. Memorial University is a relatively safe campus, it is still important for the university to examine its safety practices to assure that the campus is safe. The main purpose of Environmental Health and Safety Management System (EHSMS) At MUN is to increase employees' awareness on environmental health and safety, help share the mission to create a safe working environment to prevent accidents and injuries. This research will closely evaluate the health and safety programs at MUN. It will assess the effectiveness of health and safety programs at MUN, and give an insight on the important factors to make the programs more effective.

The objectives of my study are:

1) Review and compare Workplace Health and Safety (WHS) programs in Canadian Universities using the publicly available information.
2) Collect information on safety awareness, perception on safety, and day- to- day practice of safety protocols of the faculties, researchers and staff members of Memorial University.
3) Evaluate the effectiveness of safety training provided by the Environmental Health and Safety (EHS) unit of Memorial University.

In order to achieve the first objective, I reviewed publicly available information about the WHS programs of 10 universities across Canada and performed a comparative study. I used university webpage and other reports that are available in the online domain. For fulfilling the second and third objectives, I conducted two surveys of employees and graduate students of Memorial University around the dissemination of the information on Workplace Health and Safety programs at MUN provided by the EHS Unit through ongoing Safety presentations. Based on the analysis of the survey data, we will be asking you some questions regarding health and safety programs for further clarification

The interview will take approximately 45 minutes.

You can choose not to answer some questions if you think it is inconvenient for you. You are also free to withdraw from the study at any point without any implications. If you withdraw, your data will not be used for the study.

The outcomes of this study will benefit to improve/modify the dissemination of the information on the programs of EHS Unit and contribute to the overall general health and safety of employees at Memorial in future.

There is no possible risk of participating in this study except for your time to complete the interview.

Your privacy and confidentiality will be maintained. Any information pertaining to your identification will not be used in the final analysis, and will not appear in the final report or publications.

The data will be stored in a password protected, encrypted computer at the Medical School at Memorial University. The recorded copies of Key Informant Interviews will be kept under lock. The data will be stored for 5 years. My Supervisor professor Veeresh Gadag will be the custodian of the data. After 5 years, my Supervisor will destroy/delete the data.

The results of the study will be reported through the thesis, journal articles and conference presentation.

The results of the research will be shared with the Environmental Health and Safety Unit of Memorial University .We can provide you a copy of the Executive Summary of the result if you wish.

We have no conflict of interest to declare.

Signature Page

Your signature on this form means that:

- You have read the information about the research.
- You have been able to ask questions about your involvement in this study.
- You are comfortable with the answers to all your questions.
- You understand what the study is about and what you will be doing.
- You understand that you are free to leave the study at any time, without penalty.
- You understand that any data collected from you up to the point of your withdrawal will be *destroyed*.

[ ] I have read what this study is about, understood the risks and benefits, and had enough time to think about taking part. I have had the opportunity to ask questions and my questions have been answered.

[ ] I agree to participate in this research project. I understand the risks and what I would be asked to do. I also know that my participation is voluntary, and that I may stop participating at any time.

_____

Signature of Participant Date (DD-MM-YYYY)

Researcher's Signature:

I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study and that he or she has freely chosen to be in the study.

_____

Signature of Principal Investigator Date (DD-MM-YYYY)