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ERGONOMICS FOR NON-TRADITIONAL WORKFORCE IN BEMBOY FIBERGLASS

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ABSTRACT

Ergonomics is one of the most common workplace safety concerns since a non-ergonomic workforce can generate a variety of health problems for employees. Work-related Musculoskeletal Disorders (WMSDs) can occur as a result of insufficient or non-existent workplace ergonomic processes, which can occur in a number of workplaces, particularly in non-traditional workforces where ergonomic policies and procedures are not effectively applied. Therefore, the aim of this study was to evaluate ergonomics risk factors in the workplace among service repair workers. A study was done among 17 Bemboy Fiberglass personnel in Calero, Liloan, Cebu, using a pre-made questionnaire. The collected data were analyzed using mean, likert scale and percentage frequency distribution. The study's findings revealed that workers are exposed to the key ergonomic risk factors that produce WMSDs, such as awkward posture, excessive loads or high exertion, and a high or long frequency. As a result, there is a need to improve the workplace policies and procedures, establish an effective health and safety management system and have a committee in charge for health in order to attain an ergonomic workplace.

Keywords: Risk Factors, Musculoskeletal Disorders, Service Repair Workers, Hazards, Workplace Policies And Procedure.

I. INTRODUCTION

Ergonomics is a scientific field that investigates how people interact with their workplace, particularly with the equipment and other system components they utilize while at work. It applies various principles, data, and methods to improve people's performance and overall system production (Bentley et al., 2021). Thus, knowing the importance of ergonomics and its application in the workplace is integral, as it will significantly impact productivity and human safety (Battini et al., 2016).

Poor ergonomics in a workplace, such as awkward postures, high temperatures, or repetitive actions while performing tasks, may affect the worker's musculoskeletal system. It may result in pain, weariness, and discomfort, which might be the initial symptoms of a musculoskeletal disorder (MSD) known for occupational injuries (Choobineh et al., 2016). Musculoskeletal System Disorders (MSDs) are pains and injuries of the muscles, nerves, tendons, joints, cartilage, and spinal discs brought on by the workplace, excessive biomechanical exposure, or psychosocial or psychological factors associated with the job (Vega-Fernandez, 2021). It is one of the most significant public health issues since it impacts employees' health and the health system and causes financial and social consequences.

Globally, MSDs account for more than 33% of all newly reported occupational diseases, making them the leading cause of work-related sickness (Etana et al., 2021). A 2018 Philippine Statistics Authority (PSA) analysis found that Work-related Musculoskeletal Disorders (WMSDs) increased significantly between 2013 and 2015, reaching 58.5%. Lower back discomfort, carpal tunnel syndrome, De Quervain's tenosynovitis, trigger finger, and many other conditions are typical WMSDs (Roxas et al., 2021). Similarly, when certain joints and muscle groups are utilized quickly over extended period, repeated actions can be dangerous to employees. The inability of the worker to recover due to the little pause between motions makes repeated motion tasks exhausting. These injuries often occur at companies lacking an ergonomics process (McGowan, 2019).

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The understanding of ergonomics significantly influences the system as a whole, the business, the organization, the management, and the people. It significantly contributes to human well-being and safety due to a comfortable work environment, ergonomically developed tools, man-machine interface design, and suitable human work methods. Furthermore, ergonomics awareness and implementation of ergonomic processes improve worker health by eliminating potential hazards for a safe and effective workplace, lowering the risk of developing MSDs. Higher stability and injury-free employee performance may also occur, improving the work culture and the company image with prospective skilled workers (Caputolan et al., 2022).

The study aimed to identify the risk factors for service repair workers of Bemboy Fiberglass and Repair Service, a small business of boat builders that focuses on repairing and crafting boats, speed boats, and yachts. It may serve as a guide for the non-traditional workforce to become aware of the ergonomic risk factors for a safer and better work environment. It will also prompt the management to implement effective policies and procedures to avoid or lessen the possible hazards, which could improve their well-being and performance.

II. METHODOLOGY

This part introduces the research process flow, research environment, research respondents, research instruments, procedures of data gathering, treatment of data, scoring procedure, and definition of terms. This study used Quantitative research design. The primary tool in data gathering was survey and questionnaire administered to the service repair workers.

Research Process Flow

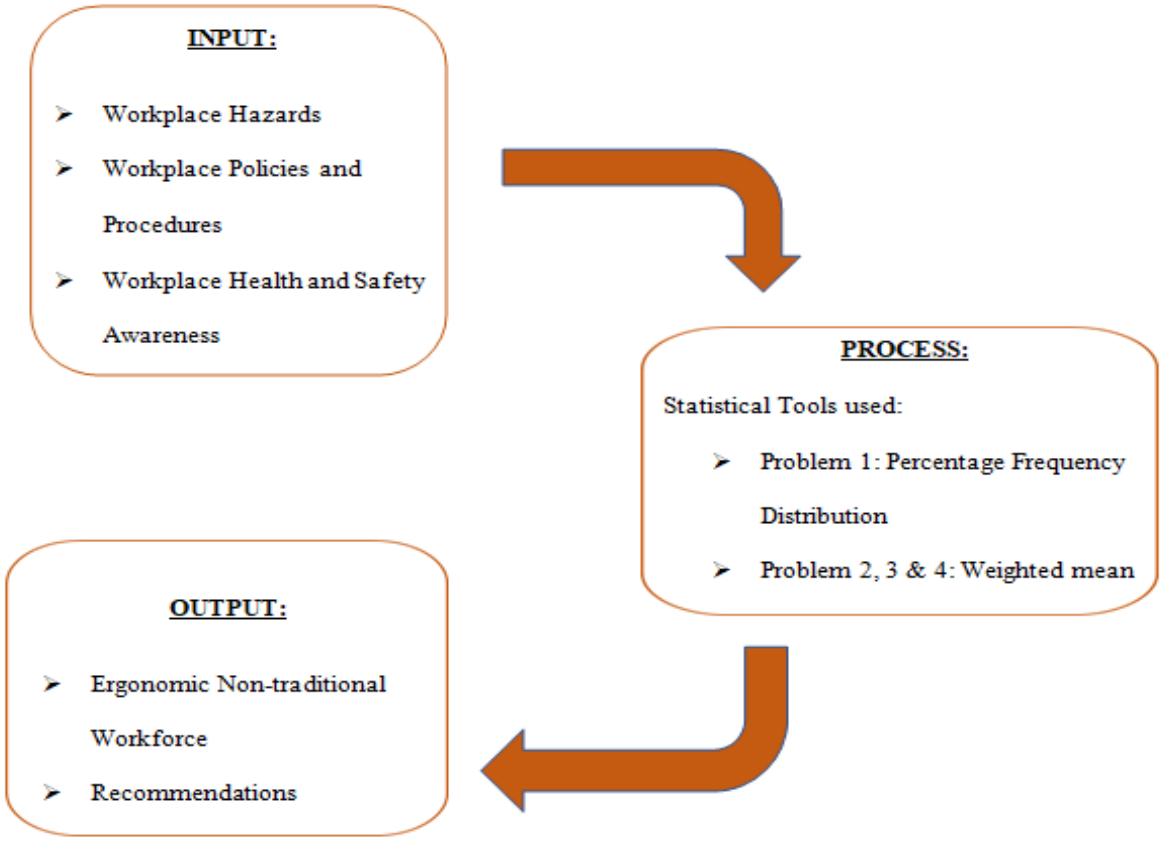

Figure No. 1: Research Process Flow

The diagram in Figure 1 shows the process flow of the study, which has been divided into three parts: input, process, and output. Input entails gathering information on how frequently employees are exposed to workplace hazards, determining the policies and systems at work, and evaluating the employees' level of awareness about occupational health and safety. Moreover, the researchers analyze the data using statistical tools such as the Percentage Frequency of Distribution and Weighted Mean to interpret the assessed ergonomic risk factors and develop an ergonomic non-traditional workplace.

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Research Environment

The study was conducted in the Northern part of Cebu, specifically in Bemboy Fiberglass inside the Porters Marina in Calero, Liloan, Cebu.

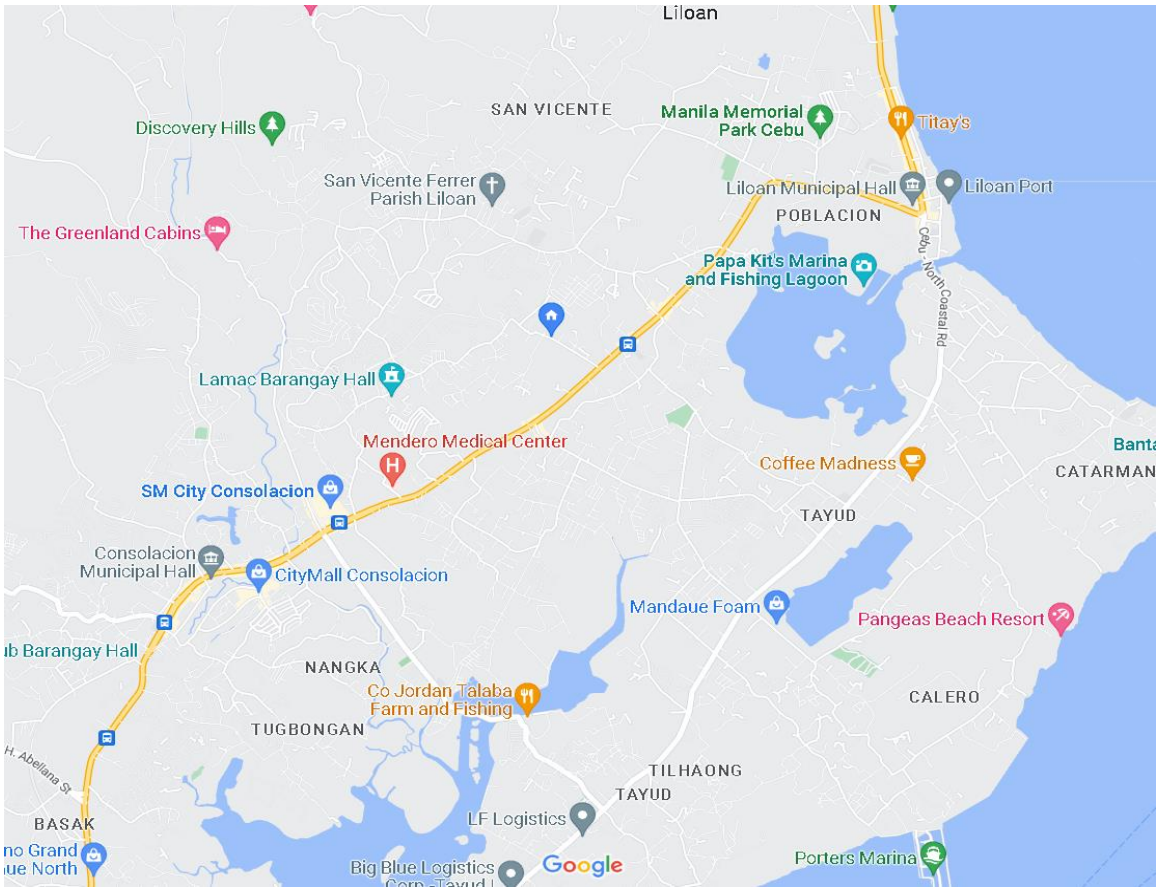

Figure No. 2: Map of Porters Marina, Calero, Liloan, Cebu

Research Respondents

The respondents of this study were all the service repair workers of Bemboy Fiberglass. There were 17 workers, 15 males and 2 females aged from 24 to 59, who were surveyed for this study.

Research Instruments

The researchers used a ready-made questionnaire from the Institute for Work and Health's OHS vulnerability measure (IWH) to collect the necessary data. The questionnaire used in the study obtained the Ergonomics of a Non-Traditional Workforce divided into four sections. Part I of the research instrument consists of items that collect respondents' profile information such as name, sex, age, and gender. Part II contains an answer sheet about the frequency workers have been exposed to workplace hazards. Part III consists of questions about the workplace policies and procedures that have been implemented. Part IV also includes a section to assess workers' awareness of workplace health and safety. This questionnaire will be the primary tool used in this study to obtain positive and negative responses to specific questions and will be distributed to respondents.

Procedures for Data Gathering

The figure below shows the process made during the data gathering. First, the researchers asked for the signature of Engr. Delfa G. Castilla, M. Ed. as the researchers' research mentor, together with the approval of Engr. Donald R. Lalican, M. Eng'g.IE, Chairman of BSIE; Engr. Jayson G. Bayogo, M.Eng'g.CE, Dean of College of Engineering; and Mr. Romeo Tundag, the owner of Bemboy Fiberglass and Repair Services. Second, the researchers gathered the respondents. Then a ready-made questionnaire was used in conducting a survey.

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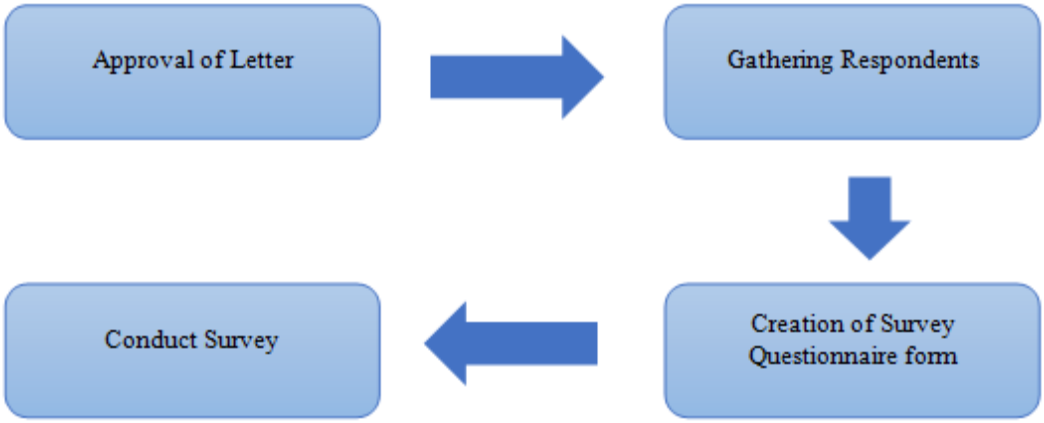

Figure No. 3: Process of Data Gathering

Treatment of Data

The collected data was analyzed and evaluated using quantitative tools in this study. These are the Percentage Frequency Distribution and Weighted Mean. The Percentage Frequency Distribution expresses the profiling of respondents, and the weighted mean interprets their perceptions.

Scoring Procedures

A scoring procedure appraises the study's methodological quality and serves as a foundation for data analysis and interpretation. The aggregated weighted mean determines the level of concern among respondents.

Table No. 1: Scoring Procedure for Workplace Hazard

Scale	Weighted Mean	Category	Description
5	4.21 – 5.00	Every hour	The respondent affirmed that they are exposed to hazardous work every hour.
4	3.41 – 4.20	Every 2 hours	The respondent affirmed that they are exposed to hazardous work every 2 hours.
3	2.61 – 3.40	Every 4 hours	The respondent affirmed that they are exposed to hazardous work every 4 hours.
2	1.81 – 2.60	Every 8 hours	The respondent affirmed that they are exposed to hazardous work every 8 hours.
1	1.00 – 1.80	Never	The respondent affirmed that they have never been exposed to hazardous work.

Table No. 2: Scoring Procedure for Workplace Policies and Procedures

Scale	Weighted Mean	Category	Description
5	4.21 – 5.00	Strongly Agree	The respondent affirmed that they strongly agree with the workplace policies and procedures.
4	3.41 – 4.20	Agree	The respondent affirmed that they agree with the workplace policies and procedures.
			The respondent affirmed that they are

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3	2.61 – 3.40	Neutral	neutral with the workplace policies and procedures.
2	1.81 – 2.60	Disagree	The respondent affirmed that they disagree with the workplace policies and procedures.
1	1.00 – 1.80	Strongly Disagree	The respondent affirmed that they strongly disagree with the workplace policies and procedures.

Table No. 3: Scoring Procedure for Workplace Health and Safety Awareness

Scale	Weighted Mean	Category	Description
5	4.21 – 5.00	Extremely Aware	The respondent affirmed that they are extremely aware of the workplace health and safety.
4	3.41 – 4.20	Very much Aware	The respondent affirmed that they are very much aware of the workplace health and safety.
3	2.61 – 3.40	Moderately Aware	The respondent affirmed that they are moderately aware of the workplace health and safety.
2	1.81 – 2.60	Slightly Aware	The respondent affirmed that they are slightly aware of the workplace health and safety.
1	1.00 – 1.80	Not Aware	The respondent affirmed that they are unaware of the workplace health and safety.

III. RESULTS AND DISCUSSION

Profile of the Respondents

Table No. 4: Age Profile of the Respondents

AGE	N	%
21-30	6	35.30%
31-40	6	35.30%
41-50	4	23.50%
51-59	1	5.90%
TOTAL	17	100%

Table No. 4 shows the age profile of respondents with four ranges set by the researchers. The age ranges 21-30 and 31-40 years old had an equal number of respondents following age ranges 41-50 years old and 51-59 years old as the last age range. On this result, with the highest percentage of 35.30 percent, the age 21-30 and 31-40 years old was meant to have the highest number of respondents where most of them are mature enough to work on a difficult task in Bemboy Fiberglass.

According to Strasser (2018), muscle strength eventually declines after reaching the peak performance range for men and women in their 20s to 30s. With physical work playing a lesser part in the industry now than in the past when the human body's physical power was vitally important, this issue is less of a problem.

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Table No. 5: Gender Profile of the Respondents

GENDER	N	%
Male	15	88.20%
Female	2	11.80%
TOTAL	17	100%

Table 5 shows the gender profile of respondents where researchers had shown that among two gender types, the male got the highest value of 88.20 percent, meaning that most of the workers in Bemboy Fiberglass were male, who are most likely to do complex tasks such as assembling the parts and molding the structure of the yachts, boats or speed boats.

Women may be at higher risk than men for developing chronic musculoskeletal problems. Compared to 7.5 million males, approximately 10.7 million women reported limits in everyday activities brought on by musculoskeletal problems in 2012 (Brismée et al., 2016). Based on epidemiological research, they will identify with being more susceptible to developing neck shoulder musculoskeletal disorders when performing low-force, repetitive work tasks. The outcome implies that the ability of men and women to carry out the repeating task with low to moderate force may not be different. Nevertheless, while performing repetitive tasks for an extended time in the workplace, differences in the motor control strategies used in task performance may account for gender disparities in susceptibility to developing musculoskeletal problems. (Srinivasan et al., 2016).

Table No. 6: Height Profile of the Respondents

HEIGHT (in cm)	N	%
150 – 159	5	29.40%
160 – 169	9	52.90%
170 – 179	2	11.80%
180 – 189	1	5.90%
TOTAL	17	100%

Table No. 6 shows the height profile of the respondents. Researchers had set the responders' height. First, the height ranges from 150 to 159 centimeters received five responses or 29.40 percent, then the height range from 160 to 169 centimeters obtained 52.90 percent or nine responses. The height ranges from 170 to 179 centimeters received two responses or 11.80 percent; finally, the height range from 180 to 189 centimeters received only 5.90 percent or one response. Based on the data acquired, Bemboy Fiberglass employed personnel who were of average height.

Table No. 7: Weight Profile of the Respondents

WEIGHT (in kg)	N	%
51 – 60	7	41.20%
61 – 70	6	35.30%
71 – 80	4	23.50%
TOTAL	17	100%

Table No. 7 shows the weight profile of the respondents, and the researchers had set the respondents' weight. The weight ranges from 51 – 60 kilograms would attain 41.20 percent or seven respondents, the weight range from 61 – 70 kilograms would attain 35.30 percent or six respondents, and 71 – 80 kilograms attained the lowest weight range of 23.50 percent or four respondents. The table above shows that most Bemboy Fiberglass employees achieved an average weight result.

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Workplace Hazards

Table No. 8: Weighted Mean Distribution and Verbal Interpretation of Workplace Hazards

QUESTIONS	WEIGHTED MEAN	DESCRIPTION
Manually lift, carry or push items heavier than 20 kg at least 10 times during the day.	3.20	The respondent affirmed that they are exposed to hazardous work every 4 hours.
Do repetitive movements with your hands or wrists (packing, sorting, assembling, cleaning, pulling, pushing, typing) for at least 3 hours during the day.	4.60	The respondent affirmed that they are exposed to hazardous work every hour.
Perform work tasks, or use work methods, that you are not familiar with.	3.60	The respondent affirmed that they are exposed to hazardous work every 2 hours.
Interact with hazardous substances such as chemicals, flammable liquids and gases	4.00	The respondent affirmed that they are exposed to hazardous work every 2 hours.
Work in a bent, twisted or awkward work posture.	4.90	The respondent affirmed that they are exposed to hazardous work every hour.
Work at a height that is 2 meters or more above the ground or floor.	4.10	The respondent affirmed that they are exposed to hazardous work every 2 hours.
Work in noise levels that are so high that you have to raise your voice when talking to people less than one meter away.	3.80	The respondent affirmed that they are exposed to hazardous work every 2 hours.
Stand for more than 2 hours in a row.	4.90	The respondent affirmed that they are exposed to hazardous work every hour.

Table No. 8 shows the weighted mean distribution and verbal interpretation of workplace hazards. The respondents affirmed that they are frequently exposed to workplace hazards, with a weighted mean range of 3.2-4.9. Among the hazards, the workers are most frequently exposed to risks include standing for more than two hours straight, working in a bent, twisted or awkward work posture, which has a weighted mean of 4.9, and doing repetitive actions with their hands or wrists every hour, which has a weighted mean of 4.6.

According to Greater Chesapeake (2018), hands and wrists have a great range of motion and are susceptible to repetitive motion disorders when used for an extended period of time while repetitive motions in awkward postures, such as bending and kneeling, have all been found to contribute to the developing MSDs (Benos et al., 2020). Working in a bent or twisted body positions for more than two hours per day, according to Roman-Liu (2020), is a significant risk factor for Musculoskeletal disorders. Workers may be exposed to high risk and vulnerability to work-related musculoskeletal disorders because they have confirmed that they are frequently exposed to working in awkward postures for every hour.

On the other hand, working in a standing position can be a problem if it is not possible to alternate the standing posture with other postures and if the duration on a daily basis is too long, as it can cause fatigue, leg fatigue cramps, and backache. In the long run, this may cause ankle, knee, and hip joint damage and muscle pain (Langen et al., 2020). According to Iowa Health Center (2021), prolonged standing is standing for more than an hour without leaving one's workstation and standing for more than two hours per day. Workers who stand for

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more than 2 hours are at a high risk of developing musculoskeletal disorders. Because the respondents stated that they stand for more than two hours, on average, they are highly vulnerable to MSD.

The employees confirmed that, on average, 4.6 times per hour, they are required to do repetitive movements with their hands or wrists. No standards for occupational health and safety have been created to classify movements as having a high or low repetition, according to Canadian Centre (2017). Work requiring repetitive movement is exhausting because the worker cannot fully recuperate in the brief times between actions, hence performing motions repeatedly regardless of the time period entails an ergonomic risk.

Moreover, the workers affirmed that they work at a height 2 meters above the ground floor every 2 hours, with a weighted mean of 4.1, and work at noise levels that are so high, with a weighted mean of 3.8. Accordingly, with a weighted mean of 3.6, the respondents affirmed that they perform unfamiliar work tasks at least every 2 hours and manually lift, carry, or push objects weighing more than 20 kg at least ten times per day, most frequently every 4 hours with a weighted mean of 3.2.

According to Safety Culture (2022), workplace hazards are the causes of possible injury or damage to someone or something in any workplace. It includes various risks that may result in MSDs, including repetitive movements and awkward posture. Thus, it is necessary to get rid of or reduce workplace dangers in order to prevent accidents and lessen work-related bodily injuries.

Workplace Policies and Procedures

Table No. 9: Weighted Mean Distribution and Verbal Interpretation of Workplace Policies and Procedures

QUESTIONS	WEIGHTED MEAN	DESCRIPTION
Everyone receives the necessary workplace health and safety training when starting a job, changing jobs or using new techniques	4.40	The respondent affirmed that they are strongly agree with the workplace policies and procedures.
There is regular communication between employees and management about safety issues	5.00	The respondent affirmed that they are strongly agree with the workplace policies and procedures.
Systems are in place to identify, prevent and deal with hazards at work	3.20	The respondent affirmed that they are neutral with the workplace policies and procedures.
Workplace health and safety is considered extremely important	5.00	The respondent affirmed that they are strongly agree with the workplace policies and procedures.
There is an active and effective health and safety committee	1.00	The respondent affirmed that they are strongly disagree with the workplace policies and procedures.
Incidents and accidents are investigated quickly in order to improve workplace health and safety	4.20	The respondent affirmed that they agree with the workplace policies and procedures.
Health and Safety Procedures are clearly communicated	4.00	The respondent affirmed that they agree with the workplace policies and procedures.

Table No. 9 demonstrates that workplace health and safety is prioritized, that current health and safety policies are communicated, that workers receive adequate training before beginning their jobs, and that incidents are swiftly investigated. All of these factors have weighted means above 4.0. However, the respondents state that they strongly disagree that they have an active health and safety committee, as shown by the weighted mean of 1.0 for active health and safety committee. According to Silva et al. (2019), the health and safety committee assists in addressing employee work health and safety concerns, such as implementing new inspection

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processes or reviewing training needs. Safety and health committees are very effective at lowering the number of occupational diseases and injuries and workers' compensation claims while increasing adherence to local or national occupational safety and health regulations (Burdick, 2020).

Additionally, the systems in place to recognize, avoid, and deal with workplace risks have a weighted mean of 3.2, which indicates that respondents have confirmed they feel neutral about such ergonomic policies and procedures. OSHA (2017) defines a safety and health management system as a proactive, cooperative approach to identifying and addressing workplace hazards before workers are hurt or ill. By implementing safety and health management systems, businesses can better protect employees from occupational diseases and injuries, increase compliance with laws and regulations, lower costs—including significantly lower premiums for workers' compensation—engage staff members, support their social responsibility objectives, boost productivity, and improve all aspects of their operations. A good health and safety management system comprise comprehensive policies, strategies, and procedures that consider how businesses operate and serve as the foundation for a system that lowers risk and protects people (Bambury et al., 2021).

In addition, the systems in place to recognize, avoid, and deal with workplace risks have a weighted mean of 3.2, which indicates that respondents have confirmed they feel neutral about such ergonomic policies and procedures. OSHA (2017) defines a safety and health management system as a proactive, cooperative approach to identifying and addressing workplace hazards before workers are hurt or ill. By implementing safety and health management systems, businesses can better protect employees from occupational diseases and injuries, increase compliance with laws and regulations, lower costs—including significantly lower premiums for workers' compensation—engage staff members, support their social responsibility objectives, boost productivity, and improve all aspects of their operations. A good health and safety management system comprise comprehensive policies, strategies, and procedures that consider how businesses operate and serve as the foundation for a system that lowers risk and protects people (Bambury et al., 2021).

Workplace Health and Safety Awareness

Table No. 10: Weighted Mean Distribution and Verbal Interpretation of Workplace Health and Safety Awareness

QUESTIONS	WEIGHTED MEAN	DESCRIPTION
I am clear about health and safety regulations at work	3.90	The respondent affirmed that they are very much aware of the workplace health and safety
I know how to perform my job in a safe manner	4.00	The respondent affirmed that they are very much aware of the workplace health and safety
If I became aware of a health or safety hazard at my workplace, I know who (at my workplace) I would report it to	4.00	The respondent affirmed that they are very much aware of the workplace health and safety
I help my teammates understand the importance of health and safety	4.40	The respondent affirmed that they are extremely aware of the workplace health and safety

Table No. 10 shows the weighted mean distribution and verbal interpretation of workplace health and safety awareness. Given the data above, the respondents affirmed that they are very much aware of how to perform their job safely, that they are aware of the health or safety hazards in their workplace, and that they know when they would report it, which has a weighted mean of 4.0. On the other hand, the respondents also affirmed that they are extremely aware that they must help their teammates understand the importance of health and safety. Moreover, the respondents affirmed that they are very much aware of the apparent health and safety regulations at work.

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Health and safety awareness are essential, especially to the workers and the management, as it helps them become more aware of the potential risk factor and mitigate workplace incidents or injuries. According to EconoTimes, (2019), health and safety awareness plays a crucial part in lowering the chance of accident or sickness by assisting staff in identifying any possible dangers and instructing them to raise safety standards. They have also stated that staff members who have received adequate training will know how to respond in an emergency while being aware of their duties and the value of a safe workplace.

IV. CONCLUSION

The researchers concluded that the workers are frequently exposed to ergonomic risk factors such as standing for more than two hours, doing repetitive movements with their hands or wrists, and working in a bent, twisted, or awkward position. Furthermore, it is concluded that there is a need to improve and strengthen the company's policies and procedures, such as forming a safety and health committee and establishing effective safety and health management systems to provide service repair workers with more knowledge to prevent them from being exposed to workplace hazards, ultimately attaining an ergonomic workplace.

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