THE EFFECT OF THE SAFE-SPOT PROGRAM ON THE LEVEL OF SAFETY AWARENESS AMONG FACTORY WORKERS AT PT X SEMARANG

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ABSTRACT

Indonesia's increasing rate of workplace accidents suggests that the country's occupational health and safety (OHS) system is still in need of improvement. Workers at PT X, a manufacturer of botanical extracts, must have a high level of safety awareness due to the complicated and dangerous environment they work in. However, factory workers were found to have poor levels of safety knowledge. SAFE-SPOT is a proactive instructional program that can be used to increase safety awareness. This study aims to analyze the influence of the SAFE-SPOT program on the level of safety awareness among factory workers at PT X Semarang. This study employed a quasi-experimental design with a pre-test post-test control group. The study population comprised 92 production workers at factory PT X Semarang. A sample of 58 workers was selected through purposive sampling and randomly allocated into two groups of 29 workers each. Data analysis utilized the Mann-Whitney U Test to determine the influence of the SAFE-SPOT program on safety awareness levels post-intervention in the experimental group compared to the non-intervened control group. The results demonstrate that the SAFE-SPOT program significantly improves safety awareness levels among factory workers at PT X Semarang.

Keywords: Safety Awareness, OHS Program, Perception, Occupational Safety

INTRODUCTION

The manufacturing industry represents one of the industries with a strategic role in Indonesia's national economic growth (Harahap et al., 2023). However, occupational health and safety (OHS) aspects remain a challenge, with an increase of 91,494 workplace accident cases in 2024 compared to 2023. This data indicates that the OHS system has not been operating optimally across various industrial sectors in Indonesia (Kementrian Ketenagakerjaan Republik Indonesia, 2025).

Every production process within the manufacturing industry carries inherent risks to OHS, whether physical, chemical, or mechanical in (Lim and Abu al-Rejal, 2017). Therefore, companies need to ensure that workers not only know these risks but also understand and possess active awareness in implementing OHS practices (Darwis et al., 2020). Through active worker participation in existing OHS programs, safety awareness will emerge within workers (Afiyah, 2023). Safety awareness is defined as an individual's ability to recognize and assess hazards present in their work activities (Chen et al., 2019). Safety awareness is formed through safety education and training, which subsequently develops into a habit of caring for safety (Song et al., 2019).

PT X Semarang is a manufacturing company engaged in botanical extraction, producing herbal extracts, essential oils, cosmetic extracts, and vanilla extracts. The company has complex production processes that create potential hazards such as noise hazards, pressure and heat temperature hazards, corrosive chemical hazards, biological hazards, and ergonomic hazards. Recapitulation results from the SHE Department indicate low safety awareness among workers, evidenced by low completion rates of first aid kit checklists by workers, suboptimal participation in OHS training, and insufficient accident initiative reporting. This is attributed to one factor: the low level of worker safety awareness regarding safety culture concerns during work. This also impacts the SHE department's

documentation results, which still identifies unsafe actions in the field. Initial survey data conducted among factory workers revealed that 60% of workers were in the poor category, 30% in the adequate category, and 10% had high levels, with an overall average score of 52% and the lowest safety awareness stage in projection at <50%. The lack of safety awareness among workers causes insufficient understanding of the hazards and risks present in their work (Saputra et al., 2022). To improve worker safety awareness levels, educational and proactive OHS promotion programs can be implemented (Afiyah, 2023; Yogama et al., 2022). Previous research conducted by Konijn et al., (2018) demonstrated that providing educational and proactive safety awareness programs had a significant positive impact on improving safety awareness among workers in Ontario and British Columbia, Canada. The SAFE-SPOT (Safety Awareness For Employee- Safety Program Observational Tools) program is a program containing proactive educational promotion through educational booklet provision on OHS hazards and risks, as well as providing proactive hazard reporting program facilities. Through this program, workers will learn safety learning and good safety practices by engaging with educational booklets and identifying and reporting workplace hazards (Wilson et al., 2020) By reducing worker ignorance, understanding and safety actions can be fostered (El-Sallamy et al., 2018).

Based on the background of existing problems, the researcher is interested in conducting research by implementing the SAFE-SPOT program, SAFE-SPOT (Safety Awareness for Employees—Safety Program Observational Tools) is an intervention tool to increase worker safety awareness. One way to increase safety awareness is by implementing a hazard reporting system, which allows workers to identify and report hazards and risks in the workplace. which aims to analyze the influence of the SAFE-SPOT program on safety awareness levels among factory workers at PT X Semarang.

METHOD

Study Design and Participants

This study employed a quasi-experimental method using a pre-test and post-test non-equivalent control group design (Sugiyono, 2020). The research was conducted at PT X, a manufacturing company located in Semarang Regency, Central Java, from March to July 2025. The study was ethically approved by the Health Research Ethics Committee (HREC) of Dr. Moewardi Hospital (Approval No. 1.390/VI/HREC/2025).

The study population consisted of all factory production workers at PT X Semarang, totaling 92 individuals. The sample was selected using a purposive sampling technique based on the following inclusion criteria: willingness to participate, availability during the study period, and being part of lower management (including supervisors and operators). This resulted in a sample of 58 respondents.

Sample Criteria and Variable

The determination of sample size for each group was determined using Federer's formula, namely (t-1) (r-1) ≥ 15, where n is the sample size and r is the treatment group (Eppang, 2020). The criteria for respondents included in the experimental group were production workers with morning and afternoon work shifts, while the control group consisted of production workers with night shifts. The reason researchers focused on morning and afternoon shift workers was because they were not permitted to collect research data during the night shift. The independent variable in this study was the SAFE-SPOT program, while the dependent variable was level safety awareness.

Prosedure and Scoring

The research procedure began with the distribution of informed consent and research explanation to selected respondents, followed by the distribution of pre-test safety awareness questionnaires to all respondents. The questionnaire contained 18 statements that had been tested for validity and reliability with valid and reliable results (Cronbach's Alpha>0,80) (Budiastuti and Bandur, 2018). The questionnaire used positive and negative statements

on a Likert scale (1-4): 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree.

After the pre-test questionnaire was administered, respondents in the experimental group received treatment through the SAFE-SPOT program for 2 weeks. The intervention in the first week was a booklet as a visual medium used to educate workers, containing material related to the dissemination of occupational health and safety policies and company regulations, an introduction to hazards and risks, an introduction to the types and sources of hazards in the workplace, guidelines for identifying hazards and risks, and guidelines for the hazard reporting system.

The intervention in the second week was the implementation of a hazard reporting system, which is used as a means of reporting when behavioral nonconformities and conditions that could potentially cause hazards and risks in the workplace are found in the field. This system will work through Quick Response (QR) codes, which is a technique for storing written data in two-dimensional codes, where QR codes are a further development of bar codes. Post-intervention on the 15th day, a post-test was conducted for both groups using the same questionnaire as the pre-test.

The questionnaire results are calculated based on the total score using the following equation (Hasmudin et al., 2021; Naif et al., 2019).

$$\%\ safety\ awareness\ = (Answer\ Score)/(maximum\ number\ of\ score\ )\ x100\%$$

From the comes about of calculation will be seen the category of *safety awareness* level.

Table 3 Categories of Level Safety Awareness

Safety awareness Level	Scale Value
High safety awareness	>80%
Moderate safety awareness	60%-79%
Low safety awareness	<60%

RESULTS AND DISCUSSION

1. Characteristics Respondens

Table 2, illustrates the frequency distribution of respondent characteristics, highlighting key demographic patterns across both the experiment and control groups. The difference between the control group and the intervention group is the division of groups based on work shifts. The control group consists of respondents who work the night shift, while the intervention group consists of respondents who work the morning and afternoon shifts.Table 4 Frequency Distribution of Respondent Characteristics

Characteristics Responden	Control Group		Experiment Group	
	Frequency (f)	percentage (%)	Frequency (f)	percentage (%)
Age				
<30 Years	15	51.7	13	44.8
≥30 Years	14	48.3	16	55.2
Total	29	100	29	100
Level of Education				
Junior High School	0	0	0	0
Senior High School	28	96.5	27	93.1
Associate Degree	1	3.5	2	6.9
Total	29	100	29	100
Years of Service				
<6 Years	15	51.7	16	55.2
6-10 Years	10	34.5	10	34.5
>10 Years	4	13.8	3	10.3
Total	29	100	29	100

Source: Primary Data 2025In the experiment group, the predominant age range was ≥ 30 years, encompassing 16 workers (55.2%). Conversely, the control group primarily consisted of workers aged < 30 years, with 15 workers (51.7%) falling into this category. Regarding educational

attainment, a substantial majority in both groups reported a Senior High School education: 27 workers (93.1%) in the experiment group and 28 workers (96.5%) in the control group. Finally, concerning years of service, both groups were largely characterized by individuals with less than 6 years of service. Specifically, 16 workers (55.2%) in the experiment group and 15 workers (51.7%) in the control group belonged to this category.

Table 3. Correlation Characteristics Respondent With Safety Awarness

No	Correlation	*Spearman's Test Sig. (2 tailed)*	
		r	***p-value***
1	Age	0.158	0.235
2	Level Education	0.371	0.004
3	Working Period	0.484	<0.001

Source: Primary Data 2025

Based on the analysis results, a p-value of 0.235 (p>0.05) for the age characteristic and a positive coefficient of 0.158 indicate that there is no significant relationship between safety awareness and workplace use. The education level characteristic was then determined by a p-value of approximately 0.004 (p<0.05) and a coefficient of 0.371. This indicates that educational level characteristics have a significant relationship with safety awareness levels. Furthermore, working age group characteristics related to safety awareness levels produced a p-value of less than 0.001 (p<0.05) with a positive coefficient of 0.484. This indicates that working age group characteristics have a relationship with safety awareness levels.

2. Differences in Safety Awareness Between the Control Group and the Experiment Group.

Based on Table 4, the normality test of the data shows that the safety awareness level variable in both the control and intervention groups is not normal, as indicated by a p-value < 0.05. The analysis of the difference in safety awareness between the two groups for the non-normal data distribution uses the Wilcoxon Signed-

Rank test so that the difference in the level of safety awareness before and after the intervention in the experimental group and the control group can be seen.

Table 4. Results of Normality Test of Safety Awareness Levels in the Experimental and Control Groups

Level of Safety Awareness	**Control Group**		**Experiment Group**	
	Shapiro-Wilk			
	p-value	**Keterangan**	**p-value**	**Keterangan**
Pre-test	0.006	Abnormal	0.012	Abnormal
Post-test	<0.001	Abnormal	0.343	Normal

Source: Primary Data 2025Table 5. Wilcoxon Test Results for Safety Awareness Levels in the Experimental and Control Groups

Level of Safety Awareness	**N**	**Z**	**Sig. (2 tailed) p-value**
Control Group	29	-1.652	0.099
Experiment Group	29	-4.709	<0.001

Source: Primary Data 2025

As shown in Table 4, the Z-value for the control group was -1.652, and the p-value was 0.099 (p > 0.05), indicating no statistically significant difference between the pre-test and post-test scores. For the experimental group, the Z-value was -4.709, and the p-value was 0.001 (p < 0.05), indicating a statistically significant difference between the pre-test and post-test scores.

3. The Effect of The SAFE-SPOT Program On The Level Of Safety Awareness.

Table 6. *The Level of Safety Awareness on Experiment Group and Control Group*

Level of Safety Awareness	**Pre-test**		**Post-test**		**p-value**
	f	**%**	**f**	**%**	
Control Groups					<0.001
Low	22	75.9	19	65.5	
Middle	6	20.7	9	31.0	
High	1	3.40	1	3.40	
Total	29	100	29	100	
Experiment Groups					
Low	22	75.9	0	0	
Middle	6	20.7	18	62.1	

Level of Safety Awareness	Pre-test		Post-test		p-value
	f	%	f	%	
High	1	3.40	11	37.9	
Total	29	100	29	100	

Source: Primary Data 2025

Based on Table 6, there was a significant improvement in the level of safety awareness in the experimental group following the intervention. In the pre-test, most respondents exhibited a low level of safety awareness, with 22 workers (75.9%) in the low category, 6 workers (20.7%) in the moderate category, and only 1 worker (3.4%) in the high category. Following the post-test, no respondents remained in the low category (0%); the number of workers at the moderate level increased to 18 (62.1%), while those at the high level increased substantially to 11 workers (37.9%).

In contrast, the control group exhibited only minor changes. The pre-test distribution was identical to that of the experimental group: 22 workers (75.9%) at a low level, 6 workers (20.7%) at a moderate level, and 1 worker (3.4%) at a high level. After the post-test, the number of workers in the low category decreased slightly to 19 (65.5%), the moderate category increased to 9 workers (31.0%), and the high category remained unchanged at 1 worker (3.4%).

The results of the Mann–Whitney test for the post-test scores yielded a p-value of < 0.001 ($p < 0.05$), indicating that the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted. This finding suggests that the SAFE-SPOT program had a statistically significant effect on workers' safety awareness.

DISCUSSION

1. Characteristics Respondens

Based on age, respondents were divided into two categories: < 30 years and ≥ 30 years. This classification follows the approach used by Islam et al., (2025). who found that workers under the age of 30 are more prone to underestimating risks, acting carelessly and hastily, and failing to comply with safety protocols. In the experimental group, 16 workers (55.2%) were aged ≥ 30 years, whereas in the control group,

the majority of workers (15 individuals, 51.7%) were aged < 30 years.

Older respondents are generally more capable of absorbing information effectively (Nidin et al., 2022). Furthermore, increasing age has been shown to influence cognitive processing and decision-making, particularly in determining safety-related behaviors and actions that contribute to safety awareness (Susiana, 2023).

In terms of educational level, the classification used in this study follows the Indonesian national education system (Kemendikbud, 2003). In both research groups, the majority of respondents had a high school, vocational school, or equivalent level of education. Specifically, 27 workers (93.1%) in the experimental group and 28 workers (96.5%) in the control group fell into this category. Educational level influences an individual's ability to understand and comply with safety regulations (Ruwanto et al., 2023). Higher educational attainment contributes to enhanced knowledge and cognitive development, thereby fostering greater safety awareness (Putra et al., 2023).

Based on the grouping used in this study, length of service was categorized into three groups: < 6 years, 6–10 years, and > 10 years (Robbins and Judge, 2018). The experimental group was predominantly composed of workers with less than six years of service, totaling 16 individuals (55.2%), while the control group included 15 workers (51.7%) in the same category. As work experience increases, workers become more familiar with their work environment, thereby enhancing their safety awareness (Febrianti and Salena, 2020). Over time, longer work experience contributes to greater awareness of potential occupational hazards (Irawanti et al., 2021).

2. Differences in Safety Awareness Between the Control Group and the Experimental Group.

Based on the Wilcoxon test results presented in Table 4, the significance value was p = 0.099 (p > 0.05), indicating no statistically significant difference between the pre-test and post-test safety awareness levels in the

control group. As shown in Figure 1, although the mean value increased from 39.41 to 40.17, no intervention was applied to the control group. This slight increase may be attributed to uncontrolled variables during the study, such as external factors like the company's occupational safety and health (OSH) culture, internal OSH training, leadership, and workplace communication that occurred concurrently. The researchers conducted an intervention using the Safe SPOT Program to raise safety awareness. To do this, they controlled the delivery of the intervention in different areas so that the communication and training aspects of the Safe SPOT Program were not provided to the control group. The intervention focused on the morning and afternoon shifts, where the respondents did not work together with the respondents on the night shift.

A similar finding was reported by Syamsiah et al., (2021), who observed a non-significant increase in OSH knowledge in a control group without intervention ($p = 0.2921$). The primary factor contributing to the limited increase in the current study was the absence of active intervention in the control group, unlike the experimental group, where targeted efforts produced more substantial effects on safety awareness (Hammer et al., 2016). The control group, which did not receive information about the sources of danger, potential hazards, and OSH risk control, showed a lack of safety awareness. This was due to low cognitive assessment and low participation in safety-related activities in the work environment.

In contrast, the experimental group showed a statistically significant increase in safety awareness. As shown in Table 4, the Wilcoxon test yielded $p < 0.001$ ($p < 0.05$), confirming a significant difference between pre-test and post-test scores. According to Figure 1, the average score increased significantly from 38.38 to 55.38 after the intervention was implemented. This shows that the integration of proactive occupational safety promotion programs, such as educational brochures and hazard reporting systems, can significantly increase safety awareness levels.These findings

align with research by (Wibawa et al., 2024), which demonstrated that safety guard application interventions effectively enhanced safety awareness in an experimental group. Similarly, Herman et al., (2020) found that delivering information through visual media can stimulate the brain via the visual channel at a rate of 75–87% increasing information retention. Additionally, Douglas et al., (2015) emphasized that the use of accessible hazard reporting systems facilitates hazard observation and contributes to improved hazard-related safety awareness.

3. The Effect Of The SAFE-SPOT Program On The Level Of Safety Awareness.

Based on Table 5, the results of the Mann–Whitney statistical test indicated a significance value of $p < 0.001$ ($p<0.05$), suggesting a statistically significant effect of the SAFE-SPOT program on the level of safety awareness among factory workers at PT X Semarang. These findings are consistent with those of Price et al., (2020) who demonstrated that proactive intervention programs involving education and the demonstration of life-saving applications enhanced safety awareness among dental and pharmacy students in the United States. Similarly, Wibawa et al., (2024) reported that an educational intervention program increased safety awareness among production workers in a manufacturing setting.

In the present study, the SAFE-SPOT program which consisted of educational booklets and a hazard reporting system served as a source of information that stimulated improvements in safety awareness among workers in the experimental group. The use of booklets was deemed effective due to their small size, portability, and ease of use, making them a practical reference for understanding workplace hazards and risks (Nisa and Khaira, 2021) Meanwhile, the hazard reporting system allowed workers to actively participate in the implementation of workplace safety initiatives. Through this system, workers engaged in three stages of safety awareness development: perception,

comprehension, and projection. In the perception stage, workers observed potential hazards using their senses. In the comprehension stage, they analyzed and interpreted the meaning of observed conditions. In the projection stage, workers made informed decisions by taking action based on what they had observed specifically through hazard reporting thereby enhancing their overall safety awareness (Endsley, 2021; Kim et al., 2023).

As shown in Table 6, the experimental group demonstrated a significant improvement in safety awareness levels following the intervention. In the pre-test, the majority of respondents (22 workers; 75.9%) were at a low level of safety awareness. After the intervention, no respondents remained at the low level: 18 workers (62.1%) reached a moderate level, and 11 workers (37.9%) reached a high level. In contrast, the control group showed only minimal changes. After the post-test, 19 workers (65.5%) remained at the low level, 9 workers (31.0%) were at the moderate level, and only 1 worker (3.4%) was at the high level, unchanged from the pre-test.

These results indicate that the SAFE-SPOT program was effective in improving workers' safety awareness, particularly within the experimental group, where there was a clear shift from "low" to "moderate" and "high" levels of awareness. This improvement can be attributed to the participants' ability to engage with the provided media and information, which facilitated their understanding of necessary safety measures (Trisnowati and Aseta, 2020) With adequate knowledge, individuals are better equipped to interpret hazardous situations and determine appropriate actions to take when faced with risks in the workplace (Ruwanto et al., 2023).

CONCLUSION

Based on the results of the previous analysis, it can be concluded that the SAFE-SPOT program had a statistically significant effect on improving the safety awareness levels of factory workers at PT X Semarang. The experimental group that received the SAFE-SPOT intervention showed a

substantial increase in safety awareness compared to the control group, which experienced only minimal changes. These findings suggest that a proactive educational approach using educational booklets and a hazard reporting system can serve as an effective strategy for enhancing workplace safety awareness in the manufacturing sector. The limitation of this study is that it measures changes in safety awareness over a short period of time, so it cannot yet show whether the changes or improvements that have occurred will be sustained in the long term.

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