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PROCESS SAFETY PROGRESS

ORIGINAL ARTICLE

The effectiveness of behavior-based safety observation program (BSOP) in the chemical manufacturing industry

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Abstract

In 2022, there were 4514 reported cases of occupational accidents in Malaysian manufacturing industry, which is the highest among the sectors. Although governmental regulations mandate the use of personal protective equipment and safe working procedures, workers still take risks while completing their job. Behavioral-based safety (BBS) approach has become a reliable way for correcting workers' behavior and improving their safety performance. This article presents findings from the BBS safety intervention program and reports its effectiveness in increasing the number of workers performing safe acts. The developed program, namely BSOP (behavior-based safety observation program), use four basic principles: (i) goal-setting, (ii) behavioral observation, (iii) constructive feedback, and (iv) reward and celebration. During execution, behavioral observation was conducted daily by appointed observers for 4 months. Results showed that the program reduced at-risk behavior (measured by the percent increase of safe acts) from 61% during baseline to 73% and 82% during the first and second behavioral observation cycles toward 14 identified targeted behavior. This study presents a comprehensive and structured process of developing safety interventions. It contributes to our understanding of the significant effects of changes in targeted behavior due to the success of the safety intervention program.

KEYWORDS

behavior-based safety, constructive feedback, goal setting, rewards, safe behavior, safety performance

1 | INTRODUCTION

Safety theory by Heinrich[1] provides a valuable account of how unsafe behaviors are the direct cause of accidents in workplace environments. According to this theory, 88% of accidents are caused by unsafe acts, 10% by unsafe conditions, and 2% are unavoidable. Furthermore, the discovery of safety-related theoretical models such as accident causation (e.g., Swiss Cheese Model) explain the significant relationship between the crucial elements of human interaction with accident causation. Recent research has also established that the human factor is an essential concept in the exploration of accident analysis in chemical process industries,[2] confined space operations,[3] maritime activities,[4] and petrochemical industries. Indeed, fighting with human nature, where safety measures always make people feel uncomfortable and inconvenienced and the mindset that accidents happen only to other people, makes this field challenging to explore and discover.[5]

Workers' safety-related behavior and attitude are significant concerns in managing safety and health at the workplace,[6,7] as they may represent an organization's current safety climate and culture. To ensure that safety performance has not been affected by these factors, behavior-based safety (BBS) has become well known as a proactive safety intervention approach to reduce injuries and incidents at the workplace.[8] Research has also proven that BBS process outcomes are an important indicator of the overall organizational safety performance and have become an essential part of the safety management system. Over the last decades, implementing the BBS intervention program at the workplace has become widespread in the industry with varying degrees of success. Applications of the BBS approach engage employee participation in injury prevention and are practiced in many industries worldwide, resulting in reduced injury rates.[9]

Generally, BBS is a systematic application of psychological research to change human behavior to safety problems using a proactive approach.[10,11] Historically, BBS started when research by Du Pont in 1929 reported that 96% of incidents are a result of unsafe acts rather than unsafe conditions. The company uses layered safety audits that focused on behavioral and specific feedback technique elements for their safety management. Du Pont's findings supported Heinrich's work, which suggests that 88% of all injuries are a result of unsafe acts by employees rather than unsafe conditions.[12] The first researchers who applied behavioral principles in safety intervention programs were Komaki, Barwick, and Scott[13] in the food manufacturing industry. Employees received safety information and reinforcement to follow the desired behavior during the briefing. In their research, the authors developed a behavioral checklist during their observation, where the results of the behavioral analysis were displayed and frequent feedback to workers was given weekly. Their results showed 26% increase in safe behaviors within 25 weeks of the intervention period. However, safety performance returned to baseline once they stopped the observation program.

The revolutionary study of Komaki and colleagues affirmed that applied behavioral techniques could lead to better safety-related behavioral improvements and has become the most referred work among researchers on BBS. The application of behavioral methods is increasingly recognized as one of the best solutions to the problem concerning human barriers to safety and best practice to adopt for workplace safety and health improvement.[12,14,15] Besides that, it can also be used as an excellent tool for behavioral modification toward a culture change and proactive safety performance measurement indicator.[16–18]

According to Geller,[5] a positive and good safety culture can be developed by understanding the interaction between three crucial domains: personal factors (such as attitudes and beliefs), environmental factors (such as tools, procedures, and temperature), and behavioral factors (such as safe acts and at-risk work practices), as shown in Figure 1. It is also known as the total safety culture (TSC), requiring the continuous attention of the three domains due to their dynamic and interactive dependence on one another. Changes in one factor may affect the other two. In TSC, people in the organization will actively care for each other through involvement and engagement. Thus, it can become the ultimate vision of safety improvement for the organization. This paper aims to report and discuss the findings from the BBS intervention program conducted at a chemical manufacturing industry.

The number of occupational accidents in Malaysia's manufacturing sector has remained high compared to other industries. Improvement in terms of developing a sustainable solution seems necessary at this level. The existing efforts supporting this improvement often overemphasize the results rather than the process, especially in building a good relationship between employees and managers. In a result-oriented organization, the culture of fault-finding or blaming others tends to occur as the desired outcome is not achieved. Addressing the process and behavioral issues requires a systematic approach since human factors influence any organization's health and safety standards, which has been proven in many studies.[7,19]

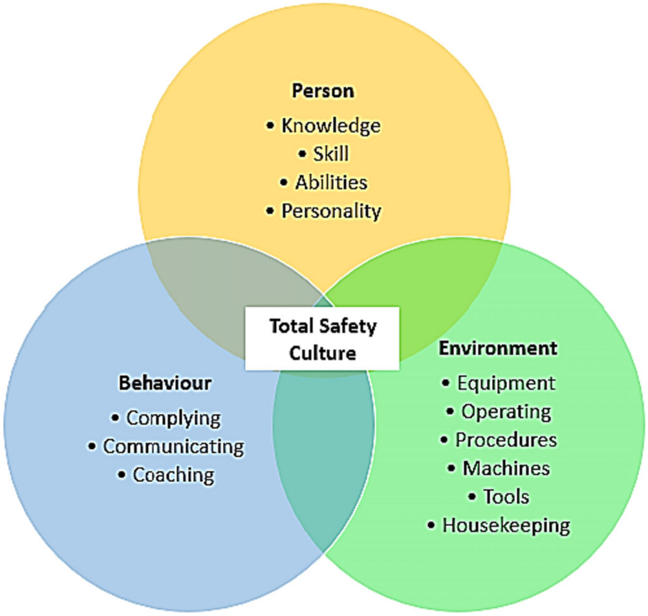

FIGURE 1 Safety culture model.[26]

1.1 | Behavior-based safety observation program structure

Fourteen elements have been identified regarding the structure of the BBS program called behavior-based safety observation program. These elements are mainly based on previous studies and reference books. Table 1 displays the elements embedded in the current BBS program, justification, and references used. The first and second elements are the mission statement and objective of the program, which serve as a common purpose and key initiator for a group of people becoming a team. The mission statement agreed upon was "Safety is a value: towards a positive safety culture," and the objective of the program is to increase safe behaviors and reduce at-risk behaviors.

The third and fourth elements are the Steering Committee (SC) and the Appointed Observers. These two groups of people play a critical role in implementing the program. The SC is responsible for the analysis and problem-solving for safety data, communicating with workers all relevant safety information, addressing their concerns, and coordinating the recognition programs at the end of the month.

TABLE 1 Based safety observation program elements.

Elements		Justification	References
1.	Mission statement	• Set as a concept for all workers to embrace the values of a safety culture that cannot be compromised and reordered • Use as a basis for educating workers on how to interact with others in the context of the behavioral-based safety process	8,22
2.	Objective	• Key to the successful implementation of the behavioral-based safety process and should be specific, measurable, attainable, and timely	8,10
3.	Steering committee	• Having the right teams together to plan the implementation process and create positive engagement	8,25
4.	Appointed observer	• Player or a sampler with high credibility with peers, knowledgeable about the work to be observed, and have good interpersonal skills	10,23
5.	BBS training	• Proper training that convinces participants that the process is working and that they can implement it • Significant for knowledge improvement and self-efficiency	27
6.	Tools	• Used to observe and record the identified critical behaviors • Maximizing the effectiveness of the safety observation program	28
7.	Behavioral observation	• To collect data on how frequently workers behave safely • The "define and observe" stage in behavioral-based safety process • Workers who conduct the observation learn to work more safely and learn to identify hazards in their work areas	28
8.	Baseline data	• Set a benchmark representing the current behavioral patterns of workers • Collected daily for a month using the developed behavioral checklist	26–28
9.	Program launching	• To inform all workers in the plant that there will be a safety intervention program to be launched starting at a certain date • Participation and engagement	22
10.	Goal-setting	• Set up goals together with all workers to improve the percentage of safe behaviors • The behavior of a person is controlled by goals and motivational progression rather than environmental factors	8–10,20,26,29
11.	Feedback	• Reinforcement for improvement and goal attainment • Actively caring concept where workers act to optimize the safety of others • Creating an environment where everyone actively takes care of his or her fellow employees or associates	8,18,30
12.	Reward	• Positive consequences that motivate behaviors	20,24
13.	Result Sharing	• Reinforcement for improvement and goal attainment • Actively caring workers acting to optimize the safety of others • Creating an environment where everyone actively takes care of his or her fellow employees or associates	20,27
14.	Corrective action	• Intentionally break safety rules • Workers should understand that breaking the rules will result in disciplinary action	12

Abbreviation: BBS, behavioral-based safety.

The Appointed Observers are responsible for the daily observation and are selected based on good individual reputation and safety compliance. The fifth and sixth elements are BBS training and tools used to conduct the observation process. Both elements were developed, validated, and delivered to participants.

The seventh and eighth elements were behavioral observation and baseline data; and the ninth and tenth elements were program launching and goal-setting. The eleventh element is feedback to workers, which is used to correct the unsafe behavior of workers. The last two elements were result-sharing and punishment. Findings from the observation cycle are presented and displayed. For punishment, soft intervention is used to identify workers with the lowest score of safe behavior, who will be made to attend awareness training.

2 | METHODOLOGY

The BBS program in this study utilizes four basic principles. Table 2 explains the principle of behavior change technique, including goal-setting, behavioral observation, constructive feedback, and reward and celebration, and how it applies to safety. These basic principles were chosen for the current development program. Table 3 presents

TABLE 2 The principle of behavior change technique used in the behavioral-based safety program.

Behavior change technique principle	How does it apply to safety?
1. Behavior can be observed and measured (behavioral observation)	• Use daily observation to the set of a specific target behavior determined by past incidents, risk assessment, and expert judgment. • That targeted behavior was correctly defined on what is safe and at-risk and transformed into a CBC (critical behavior checklist). • Trained observers are recruited to perform the observation using the list of safe and at-risk behaviors. • A scoring formula is used to calculate the percentage of safe acts from the total observed behaviors.
2. Behavior is a function of consequences (reward and celebration)	• Why people behave unsafely rely on the consequences after the behavior occurs; for example, not wearing PPE is more comfortable and convenient. • The power of consequences will determine the behavior more or less likely to occur. It refers to the type, whether positive or negative, to the person feeling, timing, whether it is immediate or future, and lastly, probability, whether it is certain or uncertain. • When safe acts are showing improvement, positive feedback is maintained, and monthly celebrations are held, employee motivation will increase to perform the safe act.
3. Behavior can be changed by providing feedback that is specific, regular, and constructive (constructive feedback)	• Observers provide weekly/monthly verbal feedback during morning meetings and graphically display a graph of the frequency of observed safe and at-risk acts.
4. Setting up goal	• Baseline data is set up before the actual observation to look for their actual daily routine while performing the task. Workers are not informed.
5. daily behavioral observation	• They were conducted after the baseline data is established. Inform workers during a formal meeting that appointed observers will observe them under the BBS program. • The behavioral checklist will be publicly displayed on the Health and Safety Notice Board.
6. Goal-setting for safety performance	• Once baseline data safe and at-risk behavior are established, groups of workers are asked to set their own goals for safety improvement.

Abbreviation: BBS, behavioral-based safety.

the timeline for intervention in each phase, and Figure 2 shows an overview of the process flow of activities during program execution.

2.1 | Subjects and setting

The study location was a chemical manufacturing plant located in the east coast of Malaysia. A meeting with the top management was held to discuss details about the program. The company agreed to conduct a comprehensive BBS program at one of their selected plants consisting of 43 workers. This plant produces expended polyethylene used in car parts and packaging, and was established in 1996.

2.2 | Appointment of steering committee members and observers

The SC was established to ensure that the right teams were brought together to plan the program implementation. They were representatives from the production plant (Plant Manager, Plant Safety Officer) and safety personnel from the Safety and Health Department (Safety and Health Officer and Safety and Health Executive). Two observers were appointed from among operators to conduct behavioral observation. They were chosen based on specific criteria, including their capability to become a key influencer and a behavioral change agent at their organization. In this study, the SC members and the appointed observers received education and practical training regarding the principle of the BBS program given by the researcher. Table 4 summarizes their working experience.

2.3 | Identification of critical target behavior

An identified target behavioral checklist was developed following the procedure adapted from Geller[5] and McSween.[12] The approach is qualitative and based on discussion. It can be summarized as follows:

1. An analysis of injury, accident, and near-miss report was conducted with the SC members. A list of possible critical behavior to be included in the checklist was developed.
2. Two criteria were agreed upon during the discussion on what behavior to include in the checklist. The first was, what led to injuries or near-hits in the past. The second was, what could potentially contribute to a large number of injuries or near-hits because of the behavior of many people previously that could lead to serious injury.
3. It was decided to develop the observation checklist as generic since most of the identified behavior contributing to the incidents was not specific to one job. They also agreed to make the inventory generic for future use in other plants.

TABLE 3 Intervention applied in each phase.

Phase	Week	Intervention applied
Baseline observation	1–8	Nil
Program launching	9	1. Workers were informed about the BBS program during the monthly assembly. 2. Safety and Health Supervisor explained and shared the behavioral checklist and the workers were told to follow all instructions and obey the safe behavior listed in the checklist.
Observation cycle 1	9–12	1. Daily behavioral observation. 2. Constructive feedback during weekly assembly. 3. Displaying graph.
Monthly celebration	13	1. Setting up a goal for the percentage of the safe act for the next cycle. 2. Reward for the highest percentage of safe acts and best observers.
Observation cycle 2	13–16	1. Daily behavioral observation. 2. Constructive feedback during weekly assembly. 3. Displaying graph.
Monthly celebration	16	1. Setting up a goal for the percentage of the safe act for the next cycle. 2. Reward for the highest percentage of safe acts and best observers.

4. The number of identified behavior was initially 21. After a week of observation, during baseline, a meeting was conducted to discuss some irrelevant identified behavior and to combine specific behaviors to become more general. For example, pushing, pulling, and lifting goods had been classified under repetitive movement when the workers performed the job more than 10 times in 10 min.
5. After the interactive discussion, the checklist was revised and validated by the SC members into 14 target behaviors. Figure 3 displays the critical behavior checklist in Bahasa Malaysia. (The checklist was written in Bahasa Malaysia to ensure understanding, since the first language among Malaysians is Bahasa Malaysia.)

2.4 | Goal-setting, constructive feedback, rewards and celebrations

Setting up goals for the percentage of safe acts was discussed among workers and displayed on the notice board. The discussion was conducted during the monthly assembly after revealing the baseline results. This activity involved all workers, from managers to operators. The weekly graph was posted on the department bulletin board. Findings from behavioral observations were presented graphically through the use of charts. Each week, a short session was held explaining the performance and encouraging improvements delivered by the observers to employees in the preceding week. The effectiveness of the BBS program was calculated using a formula for safe acts performed by employees during the 3-month intervention period. A celebration was organized during the monthly assembly to reinforce safe behavior by honoring individuals with the best safe behavior and the best observer. All winners are given a voucher, an umbrella, and a coffee mug with the safety message "Safety is a Value."

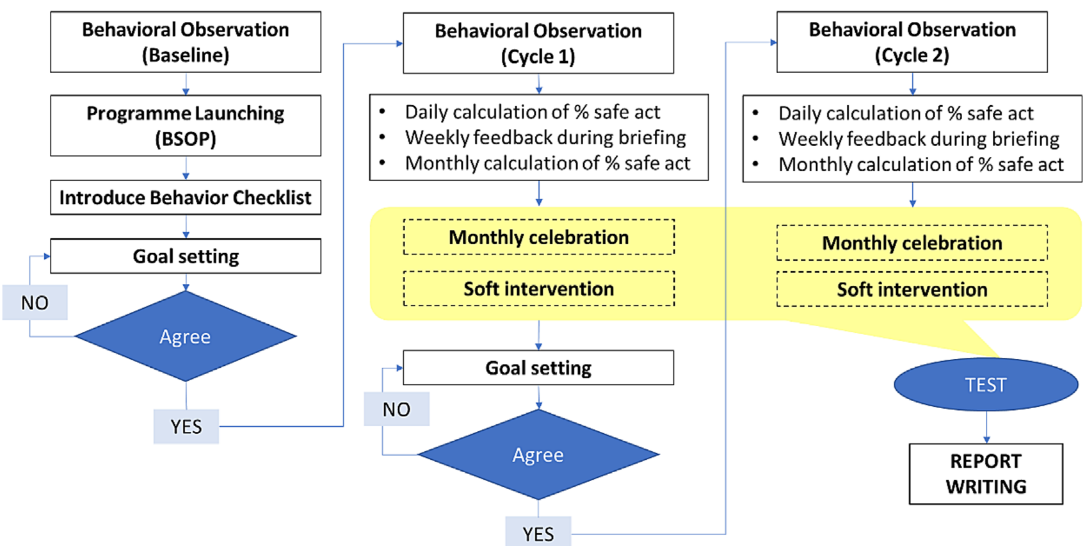

FIGURE 2 Process flow of activity during behavior-based safety observation program (BSOP) execution.

2.5 | Calculation of safe behavior

Baseline data were collected and recorded for 2 months based on the identified target behavior. Observations were conducted with a minimum of one per day. The daily behavioral observation was carried out following the program's launch and revealed the baseline result.

The percentage of a daily safe act was calculated based on the following formula:

$$\text{Percentage of safe acts} = \frac{\text{Number of safe acts}}{\text{Total number of safe acts} + \text{total number of at} - \text{risk acts}} \times 100.$$

TABLE 4 Profile of the steering committee members and observers.

Steering committee members	Years of experience
1. Safety and Health Officer	>10
2. Plant Manager	>10
3. Safety and Health Executive	<10
4. Plant Safety Officer	<10
Observers	
1. Operator 1	>10
2. Operators 2	<10

3 | RESULTS AND DISCUSSION

A positive increase was recorded in the number of workers performing safe acts. Fourteen target behaviors were identified based on the incident report and discussions with the plant safety manager and

BEHAVIOR OBSERVATION CHECKLIST

DATE: **NAME**

TIME **AM** **PM**

DAY: **HOUR:** **UNTIL**

AREA: **WORK AREA:**

INSTRUCTIONS: For all behavioral practices observed, mark (√) in the appropriate box.

		Is Safe	Poses a Risk	Not Applicable	Comment
1.	Tidying up the work environment according to 5S principles (sort, set in order, shine, standardised and sustain)				
2.	Hold handrails when climbing stairs				
3.	The PPE used is complete to carry out the work process				
4.	The correct PPE is used				
5.	The PPE used is in good condition				
6.	The jacket is worn correctly				
7.	Hand tools are used safely				
8.	The hand tools used are correct for the work process				
9.	The hand tools used are in good condition				
10.	Repetitive movement				
11.	Body position / awkward posture				
12.	Focus is fully on the work at hand				
13.	Workers are in a safe area away from the risk of falling objects				
14.	Equipment is used in a safe manner				

OBSERVATION OF UNSAFE CONDITIONS

1. Did you find any unsafe conditions while conducting observations? Yes No
If Yes, specify: ______________________________

2. Is the unsafe condition near the worker being observed? Yes No

3. Calculate the number of safe observations

$$\frac{\text{Number of safe acts}}{\text{Total number of safe acts } + \text{ total number of at risk}} \times 100 \quad =$$

FIGURE 3 Critical behavior checklist during behavioral observation.

safety officer. The daily observation was carried out by two trained appointed observers. The behavioral observation was conducted in the work area where mini pallet and beads were produced. There are three essential processes in this area: extrusion, palletizing, packaging and storage. Figures 4 and 5 show the palletizing machine in which the materials are cut to specific pallet sizes and the warehouse, respectively. Workers in this area must follow all the standard operating procedures (SOPs), including wearing proper personal protective equipment (PPE), using the right tools and equipment, and using the handrail while climbing the stairs.

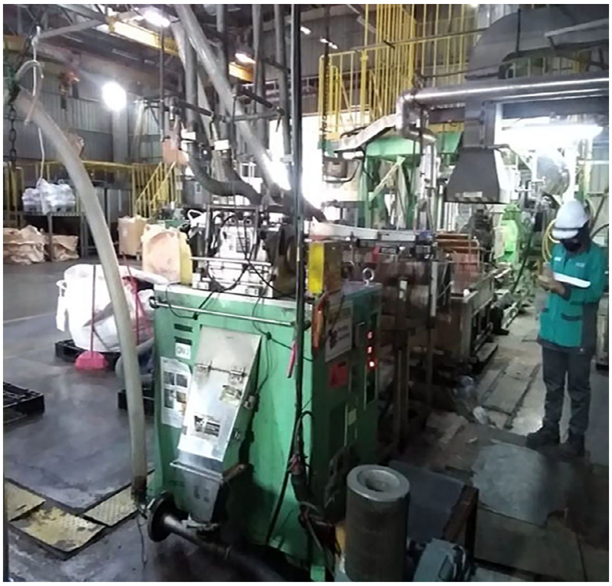

FIGURE 4 Work area where behavioral observation was conducted.

FIGURE 5 Work area where behavioral observation was conducted.

As shown in Table 5, 30 observations were conducted during the 8-week baseline measurement phase. The safe acts performed by workers at baseline is 61%. The lowest safe target behavior is a jacket inappropriately worn, followed by not holding handrails when climbing stairs and repetitive movements. Workers tend to fold their jacket sleeves and not properly button up, thus getting stuck in the equipment while doing the job. There was a recorded incident that was associated with this behavior. Holding handrails is compulsory, and it is considered a risk when workers do not adhere to it. At-risk repetitive movements were recorded frequently at the bagging section where workers had to manually push a jumbo bag. After the baseline measurement, intervention techniques were applied, including goal-setting, feedback, and a reward system. A total of 47 observations (cycles 1 and 2) for the same target behavior during baseline were conducted during the period, as shown in Table 6.

Figure 6 shows the percentage of safe behavior workers performed during cycle 1 and 2 observations. What stands out in this figure is the increasing percentage of safe acts from baseline to the observation cycle 2. From baseline, the percentage increased 12% during cycle 1 and further another 9% during observation cycle 2. Figure 7 compares the results obtained from the behavioral observation cycle specific to the identified target behavior. From the chart, it can be seen that most of the target behaviors improved compared to baseline during the first observation cycle, except for the following four: (i) jacket worn appropriately; (ii) PPE worn correctly; (iii) awkward posture; and (iv) focus while performing the task. This finding was unexpected and suggested that the four target behaviors needed further explanation and refinement.

There are several explanations for why the jacket is not worn appropriately while working. First, the poor enforcement of safety rules and procedures can be the cause for these practices, and to change this is a challenge. Besides, it may be due to common practices that have existed in the organization, such as rolling up the jacket sleeves. This scenario can also be referred to as habituation, that is, workers become habituated to this behavior without realizing it is risky and has the potential to cause incidents. Improper wearing of a jacket can cause entanglement hazards that can result in workplace incidents and accidents. The machinery used in this plant has the potential for this hazard to occur; thus, correcting workers' behavior to wear the jacket correctly is highly advised and mandatory for all workers. In a study conducted by Lee and Kim[9] measuring the effect of safety-reminding interventions against risky habituation, they found that behavioral feedback is more efficient than fixed repetitive alarms against risk habituation. In this study, the second observation cycle showed an increase in the percentage of safe acts for a jacket worn appropriately due to the given constructive behavioral feedback and appreciation to the employees who managed to obtain the highest percentage of safe work practices.

The other three targeted behaviors that did not show improvement in the first observation cycle reflect the safety culture or the way we do things in the organization. However, it is possible that these results may not be generalizable to a broader range of safety culture elements in this organization. Nevertheless, the company

TABLE 5 Behavioral observation: Result for baseline data.

Target behavior	Total obs.	Safe act	At-risk	% safe act
1. The jacket is worn properly	30	9	21	30
2. Hold handrails when climbing stairs	7	5	2	28
3. Repetitive movement	18	7	11	38
4. PPE used is completely in performing the work process	40	16	24	40
5. Adequate tidying of the work area	86	50	36	42
6. Correct PPE is worn	38	17	21	44
7. PPE worn in an accurate manner	29	14	15	48
8. Hand tools are used safely	16	11	5	68
9. Awkward posture	31	22	9	71
10. Equipment is used in a safe manner	23	17	6	74
11. Focus is given entirely on the work being done	29	26	3	89
12. Workers are in a safe area from the risk of falling objects	23	22	1	89
13. Hand tools used are in good condition	15	14	1	93
14. Hand tools used are correct for the work process	16	15	1	93
Number of targets behaviors observed				14
The total number of observations conducted				30
The total number of behaviors observed				420
Total number of safe acts				245
Total number of at-risk behaviors				156
Total safe acts				61%

Abbreviation: PPE, personal protective equipment.

TABLE 6 Behavioral observation: Results for cycles 1 and 2.

	Observation cycle	
	1	2
Total number of safe acts	154	269
Total number of at-risk behaviors	59	57
Total safe acts (%)	73	82

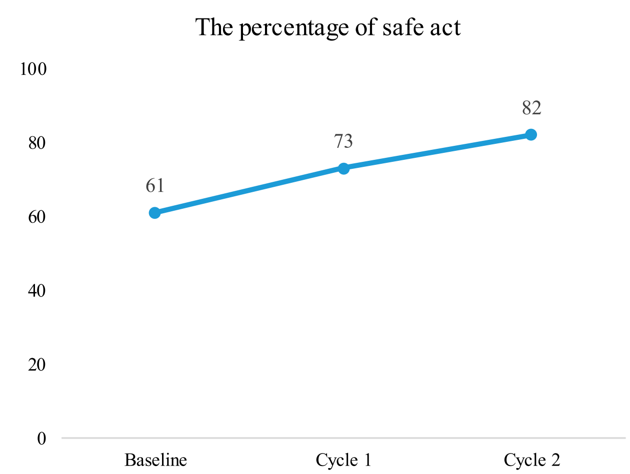

FIGURE 6 Increment in the number of safe acts performed by workers during baseline and observation cycles 1 and 2.

could use these remarkable findings as basic indicators of its safety culture to improve the overall safety performance to the next level. The approaches embedded in the current intervention have been widely accepted and proven reliable in improving an organization's safety culture. These findings support the work of other studies in this area linking positive intervention approaches with workers′ safety behavior. A recent study evaluating workers' internal factors with reduction in unsafe behavior revealed that safety knowledge, attitudes, and perceptions contribute to the persistent positive effect on their safe behavior.[20]

A positive increment was recorded in the number of safe acts performed by workers. In addition, worker engagement was also observed during the observation cycle, as they noticed a program for safety improvement. The following discusses how the intervention utilized and embedded in the program affects its effectiveness.

The appointed SC members in this BBS program consisted of safety and health officers, safety executives from the Safety and Health Department, safety coordinators, and plant managers. According to McSween,[12] the SC is responsible for analyzing the data obtained from the observations, communicating safety information to workers, addressing concerns by the workers, and coordinating recognition and celebration. In the present study, the discussion between the researcher and SC members was held from time to time to ensure the maintenance and continued refinement of the BBS program. The daily observation checklist submitted by the observers was analyzed, and information about the performance was displayed on the safety

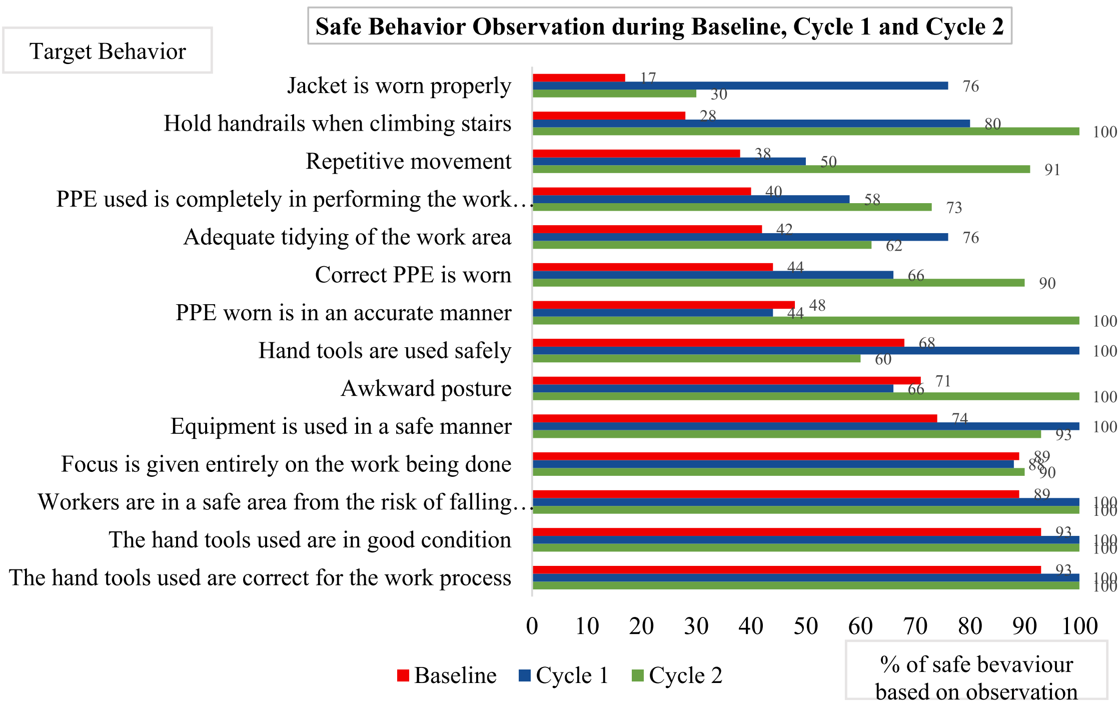

FIGURE 7 Comparison between baseline, observation cycle 1, and observation cycle 2 measurements for the identified target behaviors.

bulletin board located near the pantry. The committee also evaluates and responds to concerns about the program and other safety-related issues. Lastly, the SC in this study was responsible for coordinating monthly celebration plans and nominating individuals for recognition based on the highest percentage of safe acts performed.

In addition, the BBS program's success in this study was also due to all plant members setting realistic and achievable safety goals during the monthly meetings. Following the baseline observation and analysis, the first goal-setting meeting was held. Attainable goals associated with target behaviors were projected, discussed, and agreed upon by the task force and workers. In the present study, all workers agreed to increase the percentage of safe acts from 61% (baseline) to 66% during observation cycle 1. This 5% increase is seen as realistic and achievable, showing an outstanding increment and exceeding the 5% discussed during the program launch. This may be due to the alertness and support from all workers as they know that a behavioral observation program is being carried out daily. Furthermore, all workers, either observers or observees, feel they own the program since they had been appropriately involved and had been given proper explanation regarding the program structure and benefits.

The plant safety officer gave regular briefings twice daily, once in the morning and then about 3 p.m. before the next shift started. Workers were reminded of the observation program that was going on and were asked to follow all safety rules and procedures. Findings from the observations were presented to the workers every week. They were shown the highest percentage of unsafe acts from the checklist and were reminded to prevent at-risk behaviors and increase safe acts while performing their tasks. Weekly constructive feedback was given to all workers during the meeting.

This finding broadly supports the work of other studies in this area linking goal-setting in the BBS program with increase in safe behaviors in various industrial settings, including the oil and gas industry,[21] the construction industry,[20,22–24] and in manufacturing.[25,26] Goal-setting theory suggests that a person's behavior is controlled by goals and motivational progression rather than by environmental factors. On another note, promoting safe behaviors should come first, accompanied by safety goals, before the program itself. From this viewpoint, the process of the BBS program encourages safe conduct and can be represented using the performance cycle known as "the high output loop." According to this cycle, starting goals and self-efficacy yield high results, contributing to incentives, satisfaction, and dedication to future goals.

Goal motivation, capability, and feedback had been identified to influence the relationship between safety goal direction, effort, and consistency. It has been identified as the first process to improve safety performance and efficiency. Furthermore, extrinsic rewards (i.e., gift and cash vouchers) result in good safety performance and indirectly motivate intrinsic rewards such as a sense of achievement and happiness. Consequently, workers are more engaged and feel motivated with their job and eventually contribute to a significant dedication to the BBS program.

The BBS program's concepts of rewards and celebration are vital to ensure its success and sustainability. As Geller[26] suggested, the key process in the BBS program for continuous safety is behavior recognition and celebration. In the current study, a monthly celebration plan at the end of the observation cycle was seen as a positive reinforcement technique that motivated workers to practice safe behaviors at both plants. This can be seen from the increment in the percentage of safe acts performed by workers. Besides that, from the researcher's observation and information from the plant safety officer, workers were happy and felt good. They felt appreciated when their organization introduced a reward and celebration system to the safety intervention program for safety improvement. Furthermore, they knew what they did to earn the rewards, eventually motivating them to continue that behavior.

This can be best explained using the theory of positive reinforcement through the power of behavioral consequences. The power of behavioral consequences lies in the reinforcement theory developed by Depasquale and Geller.[27] Suppose a safe or an unsafe performance results in a reinforcing result representing a positive consequence or the avoidance of an aversive one. In that case, the performer will repeatedly follow that behavior. In contrast, if it results in punitive consequences, it will discourage the performer from repeating those kinds of behavior (presentation of an aversive effect or removal of a reinforcing consequence). Furthermore, definite (probable) consequences are more effective at encouraging behavior than uncertain consequences (improbable). Finally, immediate or near-immediate consequences are more effective at encouraging behavior than delayed consequences. Moreover, behavioral safety in safety intervention programs demonstrates how the realm of psychology can effectively manage to help the industry in terms of facing the challenging part of safety management, which is human behavior.

4 | STUDY LIMITATIONS

The current study has several limitations despite careful preparation. First, the involvement and engagement from the top management require total effort from the researcher to ensure the successful journey of the implemented program. This is due to their busy schedule and production demand. Although earlier notifications and reminders had been set up before the discussion, it was usually postponed to another date. This resulted in the researcher dragging the timeframe that had been prepared and affecting the duration of the study.

Further investigation is required to understand the underlying causes of this phenomenon, emphasizing the discrepancies between group-level involvement towards safety and health improvement programs. Also, future work in the field is required to assess the long-term impacts of the intervention program. It is important to ensure the stability of findings at the end of every observation cycle.

5 | CONCLUSION

This paper discussed the findings from an intervention program conducted in one chemical manufacturing industry in Malaysia. The program was conducted to evaluate the effectiveness of its implementation. Goal-setting, feedback, and rewards and celebration were introduced in the program. Results confirmed that the program reduced the at-risk behavior (measured by the increase in percentage of safe acts) and improved participants' understanding of the concept of applied behavior in the BBS program. The successful application of the BBS approach improved workers' occupational safety behavior and overall safety performance in the organization. Furthermore, as "human" plays a core and crucial role in industry 5.0 paradigm, we believe that the implementation of BBS in industrial sectors makes a feasible and effective goals towards industrial sustainability.

AUTHOR CONTRIBUTIONS

Junaidah Zakaria: Conceptualization (lead); data curation (lead); formal analysis (lead); investigation (lead); methodology (lead); project administration (lead); resources (equal); software (equal); validation (equal); visualization (equal); writing – original draft (lead); writing – review and editing (lead). **Che Rosmani Che Hassan:** Conceptualization (supporting); data curation (supporting); formal analysis (supporting); funding acquisition (supporting); investigation (supporting); methodology (supporting); project administration (supporting); resources (equal); software (equal); supervision (lead); validation (lead); visualization (equal); writing – original draft (supporting); writing – review and editing (supporting). **Mahar Diana Hamid:** Conceptualization (supporting); data curation (supporting); formal analysis (supporting); funding acquisition (supporting); investigation (supporting); methodology (supporting); project administration (supporting); resources (equal); software (equal); supervision (supporting); validation (equal); visualization (equal); writing – original draft (supporting); writing – review and editing (supporting). **Ezrin Hani Sukadarin:** Conceptualization (supporting); data curation (supporting); formal analysis (supporting); funding acquisition (supporting); investigation (supporting); methodology (supporting); project administration (supporting); resources (equal); software (equal); supervision (equal); validation (equal); visualization (equal); writing – original draft (supporting); writing – review and editing (supporting).

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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