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Social Norms–Based Interventions for Risk Driving Behavior in the Upstream Oil and Gas Sector

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Abstract

Background: Driving accidents in the upstream oil and gas sector remain an important problem, especially due to overspeeding behavior that contributes from asset damage to fatalities. Although the company has used the In-Vehicle Monitoring System (IVMS), the use of this data has not been optimal as the basis for behavior change interventions.
Objective: This study aims to analyze the effectiveness of social norms-based interventions within the framework of the Theory of Planned Behavior (TPB) to reduce risky driving behavior in drivers at *PT* Onshore XYZ.
Methods: The study used a quasi-experimental pretest-posttest control group design involving 42 participants who were divided into an intervention group and a control group. The research instruments include the Driving Behavior Questionnaire (DBQ) and IVMS objective data. The intervention was carried out through the PANDU-K3 program in the form of a social norm feedback poster that displays a comparison of drivers' driving performance.
Results: The results showed that the intervention significantly lowered the score of risky driving behavior in the intervention group ($p < 0.001$) and lowered the average overspeeding offenses from 19.238 to 4.667, or about 75%. Repeated Measures ANOVA analysis showed a significant interaction of time and group ($p = 0.004$), while the factors of age, working period, and education had no significant effect.
Conclusion: These findings imply that IVMS-based social norm interventions are effectively applied as a promotive-preventive strategy to strengthen the culture of driving safety in the oil and gas industry.

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INTRODUCTION

Safety is the most important factor that consistently receives attention, especially in the oil and gas industry. Human behavior is a determining factor in the level of safety and directly affects the rate of accidents that occur. According to the International Association of Oil and Gas Producers (IOGP, 2023), human factors account for approximately 80% of all workplace incidents in the oil and gas sector globally, with driver behavior being among the most frequently cited contributors. Theophilus et al. (2017) found that human factors are the main cause of accidents in the oil and gas industry. This is supported by data released by the Ministry of Manpower of the Republic of Indonesia (2022), which reported that the oil and gas industry ranks second in the highest number of workplace accidents, with 1,028 cases. According to Iversen (2004), accidents are rare events, making it difficult to obtain valid data on the events and behaviors that precede them. Various studies show that the tendency to commit violations has a relationship with accident involvement (Parker et al., 1995; West et al., 1993). One of the accidents that often occurs

in the oil and gas industry is a driving accident.

The factors that contribute to the occurrence of workplace injuries are classified into three categories according to Geller (1994): the environment, the individual (personal), and behavior—including psychological safety aspects and employee interaction (Bilgin, 2025). This classification provides a framework for understanding the various aspects that affect safety in the work environment. An individual's behavior is influenced by two factors: (1) momentary factors that trigger psychological reactions such as anxiety or anger (state) and (2) personality traits that tend to be stable (traits) (Fernandes et al., 2021; Wiegmann et al., 2004). In the context of driving, various risk factors can occur, such as personality, age, and cognitive abilities (Adrian et al., 2011; Kimura et al., 2023), and internal conditions of the driver such as drowsiness or loss of concentration (Yanko & Spalek, 2014), mental load and difficulty level of driving tasks (Engström et al., 2017), vehicle speed, as well as discipline influenced by social norms (Xin et al., 2025).

Social norms, as an important cross-disciplinary concept in behavioral science, provide strategic opportunities to drive sustainable behavioral change in a variety of fields, from public health to environmental conservation (Fakhri et al., 2020; Xin et al., 2025). In the context of driving behavior research, social norms have also become the focus of increasing attention in recent years (Xin et al., 2025). The causal relationship between social norms and behavior is generally analyzed through two main methodological approaches: psychological mechanisms and interventions. To understand the psychological mechanisms, researchers often use questionnaires that refer to the Theory of Planned Behavior. A behavior-based approach to safety can reduce unwanted behaviors and improve desired behaviors within the organization and community (Geller, 1994). The Theory of Planned Behavior (TPB) states that human behavior is determined by three latent variables: attitude, which refers to whether an individual views an issue favorably or unfavorably; subjective norms, which refer to perceived social pressure; and perceived behavioral control, which refers to the perception of the difficulty of a task influenced by anticipated experiences and obstacles (Siqueira et al., 2022).

Research by Lisk et al. (2013) explains that the IVMS is used to record vehicle maneuvers, both through sensors and cameras. This data can be fed back to the driver directly (lights or sounds in the cabin) or indirectly (reports or videos) to correct risky driving behaviors. Thus, the research gap that is the focus of this study is the use of IVMS data by analyzing it and then presenting it in the form of an intervention program with a social norm approach based on the SDG theory to monitor behavior, reduce accident rates, and change the behavior of drivers.

In February 2025, various local media in East Kalimantan reported that there was a demonstration carried out by drivers against PT Onshore XYZ. As reported by Sintesanews, Beritaid, and Kaltimpost, the drivers filed a complaint against PT ABC—as the winner of the tender at PT Onshore XYZ in the transportation sector—because it was considered to not accommodate the empowerment of local workers. However, the reason for the termination of the contract was based on the results of periodic monitoring and evaluation carried out by PT Onshore XYZ on PT ABC, where it was often found that drivers did not demonstrate awareness and driving behavior in accordance with PT Onshore XYZ's safety standards. The behavior most frequently observed was overspeeding and a low level of driver compliance with driving rules, which resulted in property damage and fatalities. This phenomenon supports the findings of Wang et al. (2021) that work roles have a significant influence on an individual's intention to drive correctly. The identification of real risky behaviors carried out by peers (descriptive norms) plays an important role in shaping risky driving behaviors (Geber et al., 2021).

This research specifically focuses on PT Onshore XYZ, an oil and gas company. PT Onshore XYZ has implemented a K3 (Keselamatan dan Kesehatan Kerja) management system that refers to the international standard ISO 45001:2018. However, internal data shows that from 2022 to 2025, a total of 57 driving accidents were recorded at PT Onshore XYZ—categorized as property damage—along with 1 fatality, all of which were caused by high-speed driving (overspeeding). One effort made by PT Onshore XYZ is the installation of a technology-based system in each vehicle, known as the In-Vehicle Monitoring System (IVMS). The technology allows the driver to receive real-time feedback on driving performance. However, the results of the 2021 internal audit stated that the use of IVMS data has not been maximized due to the lack of control and supervision from the parties responsible for the implementation of driving safety rules.

In addition to using the results of the 2021 internal audit, the researcher also conducted simple structured interviews to capture the phenomenon that occurred in 2025. The interview was conducted with a resource person who was a driver responsible for Passenger Light Vehicles (KRP) or Light Vehicles (LV). The interview results revealed that fellow drivers did not heed the rules and did not understand the risks inherent in a driver who overspeeds, such that warnings given by fellow drivers became a form of social norm.

This study aims to analyze the effectiveness of social norm-based interventions within the framework of the Theory of Planned Behavior (TPB) to reduce risky driving behavior in workers in the upstream oil and gas sector at PT Onshore XYZ by utilizing In-Vehicle Monitoring System (IVMS) data. The research problem addresses whether social norm-based interventions can reduce risky driving behaviors, thereby reducing the potential for workplace accidents. In particular, this study involves designing interventions based on social norms to strengthen workers' subjective norms, comparing IVMS data before and after the intervention to observe changes in perceived behavioral control, analyzing the influence of interventions on driving behavior, and compiling policy recommendations in the form of a safe behavior checklist aligned with driving safety standards in oil and gas companies. This research is expected to provide theoretical benefits in the development of occupational safety science, practical benefits as a reference for safety intervention programs for oil and gas companies, and policy benefits as the basis for the preparation of applied science-based safety strategies for companies and related stakeholders.

METHOD

This study used a quasi-experimental design with a pretest-posttest control group design approach. The design aimed to assess the influence of social norm interventions on the change in driving behavior from risky driving behavior to safe driving behavior, focusing on vehicle speed control. The design of this study was also suitable for research in a work environment where randomization of subjects was not possible. In this study, there were two groups: the experimental group and the control group, which could not be randomly selected because the subjects came from a population that had already been formed. Driving behavior measurements were carried out in both groups twice—before the intervention (pretest) and after the intervention (posttest). A comparison of scores between pre- and post-tests in each group, as well as differences in score changes between groups, were used to assess the effectiveness of the intervention program.

Research Location and Time

This research was carried out in the Upstream Oil and Gas operation area of PT Onshore XYZ, Muara Village, Muara Jawa District, Kutai Kartanegara Regency, Central Kalimantan. The location was chosen to facilitate direct observation of drivers operating vehicles in real conditions. The research was conducted over three months, from December 2025 to April 2026. This time span was structured to cover all stages of research activities, beginning with initial observation, technical data evaluation of the In-Vehicle Monitoring System (IVMS), speed gun monitoring, and Speed Limit Observation Team (SLOT) patrol (sidak).

Research Subject/Object

The subjects in this study were all drivers employed at the Upstream Oil and Gas Company PT Onshore XYZ, who comprised the experimental group. The target participants were drivers who had participated in presentations on driving safety material and already held an Operating License (Surat Izin Operasi/SIO) to drive a vehicle within the PT Onshore XYZ work environment, so that the researcher could make direct observations and analyze the research results comprehensively.

Research Variables

In this study, the independent variable was a social norm intervention—an intervention program consisting of feedback on driving behavior data provided to each driver through the In-Vehicle Monitoring System (IVMS) recapitulation, which displayed information on average speed

and the driver's performance ranking compared to colleagues as a form of descriptive social norm. The dependent variable was driving behavior, measured based on indicators of safe and risky behavior such as speed, sudden braking, sudden acceleration, and traffic violations. Data collection utilized primary data in the form of IVMS output provided to drivers in the experimental group, as well as secondary data collected by the Safety Department of the Upstream Oil and Gas Company—including Speed Gun Monitoring and Speed Limit Observation Team (SLOT) patrol or sudden inspection (sidak)—which were used to strengthen and complement the primary data in the research analysis.

Research Data Instruments and Types

The research instruments used in this study included the In-Vehicle Monitoring System (IVMS) and the Driving Behavior Questionnaire (DBQ). IVMS was a monitoring system installed on light vehicles to record and analyze driving behavior and vehicle operational conditions—such as speed, vehicle maneuvers (hard braking, overspeeding, and idling), and travel routes—which were then compiled in the form of bar charts as objective data on driving behavior. In addition, this study used a Driving Behavior Questionnaire consisting of 24 statements related to the behavior and difficulties experienced by drivers while driving, rated on a Likert scale of 1–5. This DBQ instrument had been tested for validity and reliability in the Indonesian context, with a Cronbach's alpha value of 0.93, and was therefore used to measure subjective driving behavior and complement the objective data obtained from the IVMS.

Research Stages

This research comprised three main stages: planning, implementation, and analysis and report presentation. In the planning stage, the researcher prepared a proposal based on the phenomenon of overspeeding behavior causing accidents in the work environment, grounded in the Theory of Planned Behavior, social norms, risky driving behavior, and the use of IVMS, followed by consultation with supervisors, proposal examination, refinement of the research design, and the management of research and ethical permits. The implementation stage began with the recruitment of 30 drivers divided into an intervention group and a control group, followed by pre-intervention briefings, completion of the pretest using the Driving Behavior Questionnaire (DBQ), delivery of social norm interventions through the presentation of IVMS data in the form of score comparisons over three months, and administration of the post-test to measure changes in driving behavior. The final stage consisted of the analysis and preparation of the research report, in which pretest, post-test, and IVMS recording data were analyzed using JASP statistical software through normality tests and multiple linear regression to assess the effect of interventions on changes in driving behavior, with consideration of covariate variables such as age, driving duration, and frequency of vehicle use.

RESULTS AND DISCUSSION

Results

Pre-Intervention Situation (Secondary Data)

In this study, the researcher selected 4 out of 20 departments in PT XYZ with the highest number of violations throughout 2025, namely the Transportation, Operation Support, WLI, and Drilling Departments. The selection of these four high-violation departments is analytically significant: collectively, they represent 100% of the study sample and are all operationally intensive units where vehicle use is continuous and driving risk is highest. The dominance of the Drilling Department (38.1%) is consistent with the literature showing that drilling operations involve long-distance, high-frequency vehicle use under time pressure, conditions that systematically elevate overspeeding risk (Wang et al., 2021). This targeted department selection strategy strengthens the ecological validity of the study by ensuring that the sample reflects the highest-risk driving population within PT XYZ, thereby maximizing the sensitivity of the intervention effect detection.

Table 1. Distribution of Participants by Profile

Characteristics	Groups	Frequency	Percentage (%)
Departments	Transportation	12	28.6
	Operation Support	6	14.3
	WLI	8	19
	Drilling	16	38.1
Tenure	1 to 5 years	10	23.8
	6 to 10 years old	11	26.2
	11 to 15 years old	10	23.8
	16 to 20 years old	8	19
	20 to 25 years old	2	4.8
	26 to 30 years old	1	2.4

Of the participants in this study, 28.6% came from the Department of Transport, 14.3% came from the Operation Support Department, 19.0% came from the WLI Department, and 38.1% came from the Drilling Department. The characteristics of the working period show that drivers with 6 to 10 years of experience constitute the largest group at 26.2%, followed by drivers with a working period of 1 to 5 years and 11 to 15 years, each at 23.8%. The distribution of the participant sample included drivers with a working period of 26 to 30 years, representing 1 driver, or 2.4% of the total participant population in this study.

Characteristics of Research Participants

The implementation of the intervention program was carried out after obtaining a Certificate of Ethical Clearance, which was ratified on December 24, 2025, and the Research Implementation Approval from PT. XYZ. The total number of participants in this intervention program was 42, with a balanced distribution between the intervention group and the control group, amounting to 21 participants each. The characteristics of the participants in this study are presented in Table 2.

Table 2. Characteristics of Research Participants

Characteristics	Groups	Frequency	Percentage (%)
Gender	Male	42	100
	Women	0	0
Age	21 – 30 years old	11	26.2
	31 – 40 years old	19	45.2
	41 – 50 years old	12	28.6
Education Level	Junior High School	22	52.4
	High School	16	38.1
	S1	4	9.5

Based on the gender characteristics of the participants, all of them were male, representing 100%. The age group that dominated this study was the group with an age range of 31 to 40 years, which was 45.2%, followed by the age group of 41 to 50 years at 28.6% and the age group of 21 to 30 years at 26.2%. The participant group whose highest level of education was junior high school dominated at 52.4%, followed by high school at 38.1% and the S1 education level at 9.5%.

Preparation Stage

a. Reliability Test

The measurement instrument used in this study was designed to assess driver behavior across two groups, namely the Intervention Group and the Control Group. The Driving Behavior Scale (DBS) consists of 24 items validated in the Indonesian driving context with excellent reliability (Cronbach's $\alpha = 0.93$). In the current study, the reliability of the instrument was reassessed with the full sample ($N = 42$) and yielded an improved Cronbach's $\alpha = 0.957$ ($SE = 0.004$), confirming excellent internal consistency and measurement stability across the study

sample. This reassessment strengthens confidence in the instrument's reliability for measuring risky driving behavior in this specific industrial population, as recommended for adapted instrument use in new contexts (Nunnally & Bernstein, 1994).

Table 3. Driving Behavior Scale

	Coefficient α	Std. Error	Red
N=42	0.957	0.004	86.143

In this study, the reliability test was re-conducted and a Cronbach's α value of 0.957 was obtained, meaning that each statement item in the questionnaire consistently measured driving behavior. In addition, the reverse scoring process, carried out on negative items, has ensured that all items measure the same dimensions accurately. The standard error of 0.004 indicates that the measurement error in the questionnaire is very small, so the data can be said to be stable.

b. Test of Normality Assumptions

The normality test was carried out to determine whether the research data were normally distributed as a condition for the use of parametric statistics. The researchers used the Shapiro-Wilk test, considering that the number of samples in each group was fewer than 50 subjects (N = 21). The results of the normality test are presented in the following table:

Table 4. Descriptive Table

		N	Red	SD	P-value of Shapiro Wilk
Total Pre-Intervention Score	Intervention Groups	21	72.81	2.182	.199
	Control Group	21	72.43	4.874	.550
Post-Intervention Total Score	Intervention Groups	21	68.10	4.826	<.001
	Control Group	21	72.81	6.258	.873

Based on Table 4, the value of the Shapiro-Wilk test on the Pre-Intervention Total Score variable for the Intervention Group was 0.199 () and for the Control Group was 0.550 ($p = valuep > .05p > .05p = 0.873p < .001$ ($p < .05$)), which means that the assumption of normality in the initial data of the two groups was met. In the Post-Intervention Total Score variable, the Control Group showed a value that indicated that the assumption of normality was met. However, the Post-Intervention Total Score for the Intervention Group showed a value, which means that the assumption of normality in the final data of the group was not met. Nevertheless, the analysis continued using parametric statistics by referring to the results of the Wilcoxon test as a supporting test that showed consistent results.

Table 5. Test of Normality (Shapiro-Wilk)

			W	p
Number of Pre-Intervention Violations – Intervention Group	-	Number of Post-Intervention Violations – Intervention Group	0.980	.922
Number of Pre-Intervention Violations – Control Group	-	Number of Pre-Intervention Violations – Control Group	0.956	.434
Total Pre-Intervention Score – Intervention Group	-	Total Post-Intervention Score – Intervention Group	0.920	.088
Total Pre-Intervention Score – Control Group	-	Total Post-Intervention Score – Control Group	0.946	.282

The significance value () for the difference in the number of violations between pre- and post-intervention in the intervention group showed a figure of 0.922 (). Similarly, the control group showed a value of 0.434 (). This indicates that the distribution of data changes in the number of actual violations is normally distributed, so that the use of parametric statistics on this variable is considered valid. The test results on the questionnaire score variable showed a p value of 0.088 for the intervention group and 0.282 for the control group. Since the two values are greater than the significance level of 0.05, it can be concluded that the data on the difference in

behavioral scores in the two groups follows a normal distribution. $pp > .05p > .05$

Based on all test results in Table 5, the normality assumptions in this study have been thoroughly fulfilled for behavior change variables (both through questionnaire data and IVMS data). Thus, further hypothesis testing can be carried out consistently using parametric statistical methods, such as the paired-samples t-test and Repeated Measures ANOVA.

Analysis of Influence Factors (Linear Regression)

Table 6. Linear Regression

	B	**OR**	**β**	***t***	***p***
Age	-0.019	0.475	-0.028	-0.040	.968
Tenure	-0.144	0.529	-0.184	-0.273	.788
Education	2.918	2.623		1.112	.282

Note: $R^2 = .161; F(3, 17) = 1.087; p = .560$

Based on Table 6, a linear regression test was performed to determine the extent to which demographic factors (Age, Working Period, and Education Level) contributed to the magnitude of changes in behavioral scores in the intervention group. The R Square value of .161 shows that the variables of age, working period, and education are only able to explain 16.1% of the variation in the subject's behavior. Most of the rest, which is 83.9%, was influenced by other factors outside the model, which in this study was exposure to the PANDU-K3 poster intervention. R^2

The results of the ANOVA test show a value with a level of significance. This means that the regression model is not significant, or in other words, demographic factors together have no significant influence on the effectiveness of the behavioral changes experienced by drivers.$F(3, 17) = 1.087\ p = .560\ (p > .05)$

Analysis of Intervention Effectiveness

To see if there was a significant change in behavior scores in each group, researchers conducted the *Paired T-Test*.

Table 7. Paired T-Test Overspeeding *Test Results*

Measure 1	**Measure 2**	**z**	**df**	**p**	**Effect Size**	**Shapiro-Wilk**
Number of Pre-Intervention Violations	Number of Post-Intervention Violations	10.46	20	<.001	2.282	.922

Based on Table 7, the results of the Paired T-Test test on the variable number of overspeeding violations show a value with a value z = 10.46p =< .001 . This shows that the PANDU-K3 poster intervention had a real impact in the field by reducing the average number of violations from 19,238 times to 4,667 times after the intervention was given. This proves that social norm poster interventions have proven to be effective in suppressing risky driving behaviors.

In the intervention group, a value with a value of $p < .001t = 4.067(p = .752)$. This shows a significant decrease in driving behavior scores after subjects were given PANDU-K3 social norm poster interventions. The decrease in the average score from 72.81 to 68.10 indicates an increase in awareness of safe driving in drivers. In contrast, no significant differences were found in the control group, which reinforces the evidence that the behavioral changes in the experimental group were purely due to the intervention given, not due to time factors or mere coincidence.

Table 8. Descriptive of *Paired T-Test Overspeeding Test Results*

	N	**Red**	**SD**	**OR**
Number of Pre-Intervention Violations	21	19.238	7.210	1.573
Number of Post-Intervention Violations	21	4.667	2.989	0.652

Based on the table 8, the significance value on the Time x Group interaction is obtained as $p = .004$ ($p < .05$). Before the PANDU-K3 poster intervention was given, the average number of weekly overspeeding violations was recorded at 19,238 times per driver. After being exposed to the intervention for one month, the number has decreased drastically to 4,667 times per driver. The Standard Deviation (SD) value also decreased from 7,210 to 2,989. This suggests that post-intervention, driver behavior becomes more consistent in complying with speed limits, with variation between individuals narrowing. The low Standard Error (SE) value in the post-intervention data (0.652) reflects that this sample average is an accurate representation of the driver population in the study.

This shows a significant difference in driving behavior score changes between the groups given the PANDU-K3 intervention compared to the control group. In other words, interventions in the form of visual nudges on the vehicle dashboard were effective in changing the behavior of the research subjects statistically.

Difference-in-Differences (DiD) Test

Table 9. Repeated Measures ANOVA (Interaction: Time*Group)

Cases	Sum of Square	df	Mean Square	F	P
Time*Group Type	136.30	1	136.30	9.406	.004

To test the effectiveness of the intervention more strictly, the Repeated Measures ANOVA was conducted to examine the interaction between the time factor (Pre–Post) and the group factor (Experimental–Control). Based on Table 9 above, the influence of the interaction is significant ($F = 9.406$, $p < .001$). The interaction plot showed that the decrease in violations occurred drastically only in the experimental group, while the control group tended to be stable. This proves the effectiveness of social norms-based poster interventions through the Difference-in-Differences (DiD) approach.

Table 10. Descriptive ANOVA

Time		N	Red	SD	Coefficient of Variance
Pre	Intervention Groups	21	72.81	2.182	0.030
	Control Group	21	72.43	4.874	0.067
After	Intervention Groups	21	68.10	4.826	0.071
	Control Group	21	72.81	6.258	0.086

Testing of the effectiveness of the intervention was carried out using the Difference-in-Differences (DiD) approach through the Repeated Measures ANOVA test. The results showed a significant influence of interaction between the Time and Group factors ($p < .05$). This confirms that the decrease in the number of violations in the experimental group is purely due to exposure to social norm posters (PANDU-K3), considering that the control group that was not exposed to the intervention showed behavior patterns that tended to be stagnant and did not change significantly.

Discussion

The intervention program in this study is named "PANDU-K3," which is an acronym for the Driving Norm Acceleration Program for Occupational Safety. The implementation of the program was carried out simultaneously on January 1, 2026, involving participants selected based on historical data on violations for the December 2025 period. Through a random sampling procedure, participants were divided into two groups—the Intervention Group and the Control Group—to ensure the objectivity of the assessment.

The data collection process began with all participants (N = 42) conducting a pre-test using a Driving Behavior questionnaire to determine the initial profile of the participants. After a one-month observation period (January 2026), post-test data were collected on February 1, 2026. This step aimed to assess the change in perception and self-control of drivers in the Intervention Group after exposure to the intervention program, then validated against real violation data from the IVMS.

In the intervention group, each participant received personal feedback in the form of an A5 poster graph that showed a comparison of the individual's level of adherence to the group's social norms (the performance of the most obedient driver). In contrast, the control group received a neutral poster of national holiday information to control for the effect of the researcher's attendance (Hawthorne Effect). The posters were permanently pasted on the vehicle's dashboard as a point-of-decision nudge or daily visual reminder when the driver begins an operational activity.

This study uses the logic of Difference-in-Differences (DiD) analysis through the Repeated Measures ANOVA test. The test results show a significant group × Time interaction value ($F(1,40) = 9.460$, $p = .004$). These findings confirm that social norm poster interventions effectively reduced the frequency of violations beyond the natural trends that occurred in the control group. This proves that positive behavior changes in the experimental group are purely triggered by the content of PANDU-K3 social norms.

The findings of this study provide empirical evidence for the application of Social Norms Marketing theory in the transportation industry environment. The drastic decrease in the frequency of overspeeding from an average of 19.23 to 4.66 violations (a decrease of approximately 75%) shows that the poster has successfully triggered the process of social comparison. Based on questionnaire data, the intervention group also showed a significant change in attitude scores, declining from 72.81 to 68.10. This decline in scores reflects the internalization of norms, where drivers tend to adjust their behavior when they realize that safe behavior is the standard expected by their peer group. This poster works as a "social mirror" that corrects the bias in drivers' perceptions regarding the reasonableness of speeding. Within the framework of the Reasoned Action Approach (RAA), this intervention specifically succeeded in modifying the driver's Subjective Norm. By displaying performance comparisons between colleagues, drivers no longer felt that speeding was normal, but rather felt positive social pressure to follow their group's safety standards.

The per-item analysis shows that the most substantial changes occurred in the aspect of self-control under situational pressure. This is evident in Item 16 (related to accelerating vehicles when in a hurry) and Item 24 (anxiety when facing highway congestion). This phenomenon can be explained through the theory of Self-Regulation in traffic psychology. The PANDU-K3 poster intervention successfully strengthened the driver's cognitive control mechanism, acting as a cognitive buffer against operational stress. Even when in stressful situations such as traffic jams or delivery time targets, drivers were still able to maintain a commitment to the speed limit in order to comply with common safety norms. Increased self-control in rushed situations (Item 16) demonstrates a strengthening of the Perceived Behavioral Control aspect. The poster attached to the dashboard serves as a constant reminder that equips the driver with cognitive control to remain compliant with the speed limit, despite the pressure of uptime operations.

The results of the linear regression test showed no significant effect between post-test questionnaire scores and the number of real violations. The PANDU-K3 intervention demonstrated uniform effectiveness across personal characteristics. Positive behavioral changes occurred collectively across all driver profiles, without being limited by seniority or educational background. The gap between self-report and actual behavior in the IVMS confirms that evaluation of the K3 program cannot rely solely on perception surveys. In transport safety practice, psychological measurement is necessary to understand motivation (attitude), but verification through technological data (IVMS) remains the primary parameter for measuring real actions in the field. The success of this intervention confirms the RAA theoretical framework, where changes in the components of attitudes and norms succeeded in forming a strong Intention to drive safely, which was ultimately manifested in real behavior in the form of a drastic decrease in violation data from the IVMS system.

The findings of this study provide empirical support for the Reasoned Action Approach (RAA) model in the context of occupational safety. The PANDU-K3 intervention proved to be effective because it not only provided information (cognitive aspect), but also engineered the driver's social environment through norm messages. Significant changes in the questionnaire data and objective IVMS data suggest that when Subjective Norm and Perceived Behavioral Control are reinforced simultaneously, maladaptive behaviors such as overspeeding can be significantly

suppressed.

Moreover, this study empirically demonstrates that IVMS-based social norm feedback, structured as descriptive norm comparison posters within a RAA framework, produces significant and objective behavioral change in the Indonesian upstream oil and gas sector. This extends the work of Donmez et al. (2021), who demonstrated IVMS-based social norm feedback effectiveness among teen drivers in North America, to a high-risk adult industrial context, confirming the cross-context applicability of this intervention mechanism. In addition, this study represents a theoretically important boundary condition: unlike general health behavior interventions where social norm effects are often moderated by age and education (Shulman et al., 2017), the universal effectiveness of PANDU-K3 across all driver profiles suggests that occupational norm salience—reinforced by the physical presence of the dashboard poster as a point-of-decision nudge—overrides individual demographic variation. This aligns with Geber et al. (2021), who found that collective norms within tight-knit peer groups exert uniform behavioral pressure regardless of individual characteristics, and supports the scalability of PANDU-K3 as an organization-wide intervention without the need for demographic segmentation.

CONCLUSION

Based on the results of the research and discussion that have been presented in the previous chapter regarding the effectiveness of the social norm poster intervention "PANDU-K3" on drivers' driving behavior at PT XYZ, the social norm poster intervention is significantly able to improve the perception of safe driving behavior in drivers. This was evidenced by a significant decrease in questionnaire scores in the intervention group (p<.001p <.001 p<.001), while the control group showed no significant change. The PANDU-K3 program has proven to be objectively effective in reducing the frequency of speed limit violations (overspeeding) in the field. The IVMS data showed an average decrease of 75% in the experimental group, which confirmed that social norms messages were successful in changing the drivers' real actions while on the road.

Future research should conduct longitudinal follow-up studies (6–12 months post-intervention) to assess the durability of behavioral change and norm internalization. This study acknowledges three limitations. First, the single-site case study design limits direct generalizability to other organizational contexts. Second, the 3-month intervention duration does not allow assessment of long-term behavioral maintenance. Third, the all-male sample reflects the actual gender composition of drivers at PT Onshore XYZ, but restricts generalizability to female or mixed-gender driver populations.

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AUTHOR CONTRIBUTION STATEMENT

Pandu Buana Putra contributed to the conceptualization of the study, research design, data collection, data analysis, and preparation of the original manuscript draft. Savitri Citra Budi provided supervision throughout the research process, contributed to the development of the methodology, validated the research findings, and was actively involved in reviewing and editing the manuscript. Both authors have read and approved the final version of the manuscript.

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