Journal of Educational Psychology and Pedagogical Sciences (JEPPS)
ISSN:2791-0393 (Print) eISSN: 2791-0407
Vol.4, No. 2, (Jul-Dec 2024): 55-72
https://jepps.su.edu.pk/article/44
DOI: https://doi.org/ 10.52587/jepps.v4i2.103

Safety at the Edge of Innovation in Science laboratories: Examining Occupational Health and Safety Compliance among University Researchers in Pakistan.

Tahira Alam*[1] & Muhammad Shoaib[2]

Abstract

This paper examines the determinants of Occupational Health and Safety (OHS) compliance among faculty and researchers conducting research and laboratory work in engineering universities in Pakistan, where individuals are exposed to hazardous materials, scientific researcher-intensive protocols, and the cognitive pressure associated with academic study. The research discusses the relationship among the leadership styles, job strain, perceived organizational support (POS), and the safety climate on the impact of OHS compliance. A quantitative survey research design was adopted. These 300 faculty members and research personnel who works in scientific laboratories in the best-rated engineering universities situated in Islamabad, Lahore and Peshawar. The results indicate that all three variables namely, Effective leadership, POS, and good safety climate have a positive relation with OHS compliance and job strain is associated with OHS compliance negatively. The other hypothesis proposed and tested in the research is the mediation and moderation hypothesis: POS mediates the relationship between OHS compliance and job strain, and the leadership and safety climate has been discovered as the moderators of paramount importance. Leadership and organizational support is critical to the development of safety-oriented culture and the prevention of occupation strain in high-risk academic setting.

Keywords: Occupational Health and Safety (OHS), Leadership Styles, Job Strain, Perceived Organizational Support (POS), Safety Compliance.

1. Introduction

Occupational Health and Safety (OHS) compliance is very important in contemporary institutions of learning, especially in those which are engineering oriented universities. An effective safety culture has become central as the number of risks that may occur while working in the laboratory, including chemical hazard, working with high-voltage equipment, and duration of work, is on the rise. Efficient OHS systems not only mitigate the risk of accidents but also improve the satisfaction of faculty and researchers, the reputation of the institute, and overall efficiency (Davis, 2024; Probst et al., 2020).

*[1] PhD Candidate, Department of Management Sciences, International Islamic University, Islamabad, Pakistan. E-Mail: tahira.phdmgt145@iiu.edu.pk
[2] Engineer, Fatima Jinnah Women University, Rawalpindi. E-Mail: Muhammad.shoaib@fjwu.edu.pk

In contrast to other industrial sectors that were once high-risk, academic research labs may lack a well-structured system of safety maintenance, especially in developing nations. In Pakistan, there has been a rapid growth of engineering institutions over the past few years; however, a deficiency in laboratories with a diverse scope has been noted, including a lack of training on safety, inadequate protective facilities, and a lack of accountability. Faculty members and other research staff frequently have to achieve high research, publishing, and grant-procuring rates-a mere condition that contributes to job stress and inhibits a commitment to safety measures (Boamah et al., 2021; Frontiers in Public Health, 2025).

The current study presents research aimed at determining the interaction between transformational leadership, job strain, perceived organizational support (POS), and safety climate regarding OHS compliance among teaching and research staff working in engineering laboratory settings within universities. Safety climate, understood as the collective perceptions of the significance and imposition of safety, has been identified as one of the key moderators that influence behaviors related to safety (Zohar, 1980; Ahmed et al., 2024). A positive safety climate is one that has open communication on the safety, the participation of the management and the provision of the resources they need (Clarke, 2020; Kurtessis et al., 2017). However, such a climate can only be maintained and established only to a large extent with the help of leadership acts and situations in jobs and support systems in an institution (Abu Bakar et al., 2025).

A vision, empowerment, and intrinsic motivation are the pillars of transformational leadership, and it is a formula that can encourage following safety standards in the institutions (Bass, 1985; Javaid et al., 2025). The reward and punishment approach, as a component of transactional leadership, can at best produce only superficial or short-time adherence to security regulations (Clarke, 2020). Job strain, in its turn, may lead to adverse health outcomes and safety behaviors, which is mainly caused by the insufficient decision-making latitude and the excessive work demand (Karasek, 1979; Van der Doef & Maes, 2021).

Perceived Organization Support (POS) is, namely, the perception that the employees feel that their organization values their input and well-being, and it plays a critical role in avoiding job stress and improving safety-related outcomes (Eisenberger et al., 2020; Mearns et al., 2017). In cases where faculty and researchers believe their university has sufficient resources, training, and a genuine concern for their well-being, they tend to establish safe working habits and comply with regulations (Qasim & Laghari, 2025).

Although academic work and employment have become increasingly complex, and there is greater exposure to occupational hazards, very little empirical evidence has been found on how leadership, job strain, POS, and safety climate interact with each other in the context of university laboratory settings in Pakistan. This study aims to fill a gap in the literature by examining these factors together and how leadership and organizational support can reduce the strain on a job and encourage adherence to OHS regulations.

2. LITERATURE REVIEW

Safety Climate

Zohar (1980) defines the safety climate as a consensus between the company workers and safety policies, practices or procedures of corporate safety. Hence, the perceived safety climate can be termed as the degree of care shown by an organization about the safety of its workers. Safety climate has been established as one of the key factors that predict the safety-related outcome, such as risk of accident, reported injuries, and the degree of OHS policy compliance. A number of indicators have been established in the literature as demonstrators

of a positive safety climate, viz., communicating the expectations of safety, training of employees, leadership facilitator, and recognition of the significance of safety at all levels in the organization of the company.

With this in mind, a major amount of research has been carried out on the safety climate to improve compliance to safety rules. As an illustration, Probst et al. (2020) performed a meta-synthesis based on the research in various industries, which helped them to generalize the cross-industry finding that an effective and positive safety climate of the organizational system reflects in the reduction in the number of accidents and increased regulations compliance once an organization has earned an OHSAS 18001 certification. The authors noted that when a safety climate is established in an industry, employees are more informed about the risks associated with tasks, adhere to safety protocols, and are more committed to performing activities that can reduce incidents (Tufail Ahmed et al., 2024).

Consistent with prior literature, the role of leadership in a safe climate is also highlighted. It is the leadership, especially in high-risk specific industries, owns a major responsibility for influencing workers' attitudes toward safety. Multifacts include leaders that are observed as being actively involved in issues to do with safety, visions conveyed in words that employees can understand that they have the backing of their employers in the safety regimen they wish to uphold. Consequently, safety programs rely heavily on leadership practices, as the safety climate supports structures that foster positive achievement.

Leadership and compliance with safety standards

For a long time, organizational leadership has been recognized as one of the key determinants of organizational performance, including safety compliance. Scientific papers have established that various leadership styles produce differing outcomes regarding OHS and the extent to which organizations conform to OHS regulations. Most attention has been paid to transformational leadership, which has been determined to be especially useful in developing a positive safety culture within an organization.

Transactional leadership is a style where leaders influence, encourage, and ensure that people's objectives within the organization are aligned. These leaders align their goals with aspects such as leadership development, employee interaction, and organizational goals and objectives, making employees feel part of the organization. Safety climate research has established the idea that transformational leaders improve safety behaviors by changing workers' attitudes and making them more accountable for safety activities, not through threats of penalties but by instilling an obligation to the team and the organization (Zhou et al., 2024).

For instance, Boamah et al. (2021) sought to establish the effect of leadership on safety compliance levels in high-risk sectors such as the health sector and manufacturing industries. They noted indications that transformational leadership had a positive impact on safety compliance levels. Successful leaders ensure that safety ownership extends down to the employee level and that a safety culture is nurtured within the organization. In such cultures, employees are inclined to participate in safety issues, inserting into the conversation the belief that safety precautions are essential for their individual self-preservation and professional achievements (Saxena, 2024). Moreover, it has been demonstrated that applying transformational leadership minimizes the impact of high job demands by providing employees with more control and encouragement to succeed.

Transactional leadership, where the leader uses the power of reward and punishment to motivate employees to achieve organizational objectives, does not c, create a culture of safety compared to transformational leadership. Although transactional leadership may secure short-term compliance with safety standards among subordinates, such behaviors are not

sustainable once extrinsic rewards are removed (Ahmad et al., 2024). In the extended review of leadership and safety compliance conducted by Clarke (2020), several outcomes indicated that transactional leadership serves the aim of resulting in motivated compliance, primarily driven by extrinsic motivational aspects rather than an intrinsic commitment to organizational safety. This makes it less sustainable, especially for industries where workers are regularly exposed to risks, such as engineering universities. In such working conditions, the safety values that leaders embody, rather than creating safety regulations that personnel will conform to in exchange for material incentives or threats of punishment, are crucial for the consistent implementation of safety measures.

The job strain among the employees and safety measures adopted by the employers.

As stated above, job strain is a type of stress resulting from high-level demands, low control, and a lack of resources to meet these demands. Job strain has been explored in the Job Demand-Control Model, also known as the Cognitive Demand-Control Model, proposed by Karasek (1979). According to this model, as workplace demands increase and control over them decreases, job strain also rises. In such circumstances, job strain may have backward effects on both the safety compliance and the general welfare of employees, and the organizational effectiveness.

Industry workers are one of the carriers of high job demands; hence subjected to creating job strain following the heavy targets of production and strenuous working conditions. Employees who have worked under pressure over a long period of time tend to overlook safety precautions since they get fatigued and in other instances, employers will force their employees to work without any concerns to safety precautions. Demonstrating one example, the study identified by Van der Doef and Maes (2021) took place at the textile industry and showed that job strain resulted in the breach of safety protocols. The survey results indicated that, high job strained workers tended to engage in activities which involved high risk, safety override or adopt risky means to attain the production target (Ali et al., 2024). These actions in most instances were accompanied by accidents which would have easily been avoided by paying attention to some institutes involving safety. The role of the leadership in reducing job strain by availing the employees with the means, voice and the support they require was also a matter of concern in the study. Managers and organizational leaders who ensure that employees understand they do not have control over their work and that their organizations support them are likely to reduce job strain on safety behavior.

Perceived Organizational Support (POS)

POS is among the most important factors influencing employees' behaviors and attitudes about safety issues. POS is a measure of how much employees feel the organization values and supports them. For instance, it is hypothesized from Social Exchange Theory (SET) that when working employees feel supported by the organization they are moving in, they are more willing. They will adhere to good organizational practices, including compliance with safety measures and maintaining safe workplaces. This two-way relationship implies that people in employment are optimistic about reciprocating with organizations by promoting positive work behavior.

Many researchers have supported the view that high POS levels are associated with better safety performance. Eisenberger et al. (2020) pointed out that employees who think that their organization cares for them, offers and ensures that they have all the resources required to perform safely and demonstrate concern for their welfare have high odds of embracing safe work practices and adhering to the requirements of the OHS laws (Ahmad. et al.,2024).

This is especially true in industries marked by high risks, such as the textile industry, where numerous workers are subjected to hazardous working conditions. It also explained that when workers believe their organization cares about their safety, they are more likely to be committed to safety programs and regulations. In their survey study on the textile manufacturing industry, employees revealed that POS was negatively related to job strain and positively related to job satisfaction and organizational safety compliance. Among various reasons, sufficient organizational support is what makes a person less stressed regarding job demands, as an individual is secure and assured about the organization's basic interest in their well-being. The findings reported that organizational commitment to supporting employees through offering appropriate staff training, healthcare, and proper communication and safety policies improves safety standards and Bertness for organizational performance.

As the leading literature on safety climate, leadership, job strain, and POS, the given field of study still has a significant research gap where the interplay of these elements has not been well explored, particularly within the Pakistani textile industry. Many prior research studies have targeted industries characterized by high levels of risk in Western environments, which may differ from those in developing environments in terms of regulation and business culture. Furthermore, the extensive infusion of cultural factors into the gadget's working environment, the poor working conditions in the textile sector in Pakistan, inadequate enforcement of safety regulations, and other factors affecting the safety behaviors of employees in the textile sector in Pakistan have not been established.

This research, therefore, seeks to address this gap by assessing the link between leadership behavior, job demands, POS, and safety obeisance in the Pakistani textile industry. Through elucidation of these interactions, the research will provide valuable insights into how leadership practices and organizational support can effectively mitigate job strain and enhance compliance with OHS requirements. These dynamics enable the development of strategies to enhance safety in one of Pakistan's most critical sectors.

Hypothesis Development using Social Exchange Theory (SET)

Social Exchange Theory (SET), initially proposed by Michael R. Blau (1964), provides a framework that informs the mutualistic relationship between people and organizations. SET observes that Lab employees/researchers tend to be more positive toward their organizations when they feel that the organizations genuinely care about both their work and their well-being. Such individuals are attending to institutional requirements, such as OHS, and increasing their performance in the workplace while also proactively participating in hygiene schemes.

SET, with its focus on leading to the effect of cognitive and physical workload as well as organizational policies, presents a useful spectrum through which to view the study of leadership behavior, job strain, perceived organizational support (POS), and safety climate together contributing to compliance with occupational health and safety (OHS) regulations in the circumstances of university laboratories within the field of engineering. The theory also justifies the notion that respect and support among institutions and academic personnel can enhance a safer and more responsible workplace.

OHS Compliance and Job Strain

The Social Exchange Theory (SET) posits that the relational contexts that shape workplace demands influence perceptions of the demands made. In the case of engineering university laboratories, when faculty and researchers are expected to comply with OHS regulations, such as observing lab safety protocols, utilizing protective gear, or completing.

a safety course, they can be viewed as either beneficial or prohibitive, depending on how institutions frame and enforce these requirements.

In settings with high cognitive load, research pressure, and safety risks, compliance demands can be considered as one of the accompanying stressors, especially under conditions where there is no organizational support. Nevertheless, SET assumes that when Lab employees/researchers view these acts of compliance as a genuine manifestation of institutional consideration for their well-being, they will be more inclined to welcome such behavior and even be positively disposed toward it (Probst et al., 2020). Such instances demonstrate that compliance with safety regulations is not only a matter of duty but also a mutual act of perceived organizational concern. Nevertheless, the combined impact of physical and psychological demands is capable of leading to even greater job strain, which should be addressed through several practices aimed at mitigating and supporting related problems.

H1: OHS compliance is positively related to OHS compliance and job strain.

Job demands and resources and safety climate and perception of organizational support for organizational health and safety (POS)

One can establish that relationship reciprocity is vital in OHS compliance and Perceived Organizational Support or POS. POS consists of Lab employees/researchers' attitudes regarding their organization's concern for their welfare and the extent of organizational support they receive (Eisenberger et al., 2020). When some organizational standards aim to ensure high levels of OHS compliance, they serve as good examples of how organizations prioritize their Lab employees/researchers' safety. Such an act of prioritizing Lab employees/researchers' safety will likely be perceived as a measure of instrumental support.

According to Social Exchange Theory (SET), Lab employees/researchers are inclined to feel valued when they find that their organization is genuinely interested in their safety and well-being, especially in areas such as OHS regulation enforcement and fulfillment. Such a perception of the organization grants strength to the mutual relationship between Lab employees/researchers and the organization. Consequently, Lab employees/researchers tend to regard OHS compliance as more than a formality and an institutional requirement, but as a demonstration that the organization genuinely cares about the welfare of its Lab employees/researchers. People find this shared respect and concern, which strengthens connections through safety behaviors and contributes to a more responsible culture in the workplace.

H2: OHS compliance is positively related to Perceived Organizational Support (POS).

This hypothesis posits that compliance assurance focused on OHS can enhance employee perception of organizational support. In turn, if employees feel their organization values them and genuinely cares for their safety, they will adopt the safety measures and even start to prioritize their employer's goals. It becomes imperative to strengthen this aspect of the employer-employee relationship to facilitate the former's compliance with requirements while simultaneously creating a working environment that supports employees.

Perceived Organizational Support (POS) and Job Strain

Moreover, it is worth considering the moderating effect of Perceived Organizational Support (POS) on the relationship between work demands and work well-being. According to SET, when researchers are assured of their university's support, they are likely to develop

the necessary commitment level when handling their tasks and, consequently, have the ability to cope with stress within the organization. POS at work can reduce job strain by providing a form of protection that enables researchers to cope well with the physical and mental pressures characteristic of certain jobs (Kurtessis et al., 2017). The perception that one's organization supports them means they feel more secure and valued and thus can cope with stress arising from work. For instance, when textile workers are aware that their organization provides safety equipment, healthcare, and training in safety measures related to their working environment, they can better manage the potential risks associated with their employment, thereby decreasing job stress.

H3: Perceived Organizational Support (POS) is positively related to job strain.

This hypothesis postulates that overall employee job demands are reduced where employees are supported by their university. POS acts as a buffer, helping researchers manage job demands and placing them in a better position to handle stress in the workplace.

Perceived Organizational Support (POS) as the Mediating Variable

This has been achieved by identifying how various organizational elements relate to each other, serving as the cornerstone of Social Exchange Theory. According to Breaugh (2007), and more in line with the objectives of the current study, POS is hypothesized to play the role of a moderator and, therefore, an independent variable between OHS compliance requirements and job strain. Although there are additional demands triggered by compliance with OHS requirements, POS offers workers assurance and assistance to alleviate the pressures of compliance.

Suppose the researchers get a clear signal from the organization that they are supported while implementing and following OHS. In that case, they will likely suffer the loss of additional pressure due to compliance. Thus, POS functions as a mediator, shifting the negative influence of compliance requirements while framing the relationship between the employee and the organization as a mutually beneficial exchange (Eisenberger et al., 2020). High POS assures researchers that their work organization cares for them, which also mitigates job strain and increases their readiness to follow safety measures.

Hypothesis 4 (H4): POS mediates the relationship between OHS compliance and job strain.

This hypothesis indicates an inverse relationship between job strain and POS, which serves as a mediator. Thus, compliance requirements may lead to higher job demands, but POS can reduce them by utilizing available resources and offering moral support to handle the pressures.

Effective Leadership as a Moderator

Organizational leadership also plays a crucial role in shaping researchers' perceptions of the organizational environment and influencing their behavior. In particular, the transformative type of leadership, which focuses on motivation, inspiration, and researchers' psychological needs, is most efficient in encouraging positive safety behaviors and enhancing POS. Self: According to Social Exchange Theory, transformational leaders who serve as role models help researchers adopt safe behavioral patterns and safety as the core of the organizational culture (Boamah et al., 2021). Strong leadership enhances the correlation between OHS compliance requirements and POS, as it reinforces safety within the organization. If researchers perceive managed care, then safety compliance reactions follow in order, and researchers perceive organizational support at higher levels. On the other hand, while a weak or transactional leadership orientation may result in low levels of POS, OHS compliance may also be perceived as a burden by researchers, hence leading to

low levels of safety compliance.

H5: Effective leadership moderates the relationship between OHS and POS, such that the relationship becomes stronger in highly effective leadership and vice versa.

This hypothesis posits that an effective leadership style would supplement OHS compliance requirements for POS and improve business outcomes. Specifically, transformational leadership helps enhance researchers' feelings about organizational support by highlighting managerial interest in their safety and welfare.

Moderating Role of Safety Climate

That means a safety climate is the collective perception of an university regarding safety. A high safety climate promotes a shared responsibility between the university and its researchers to provide and maintain a safe organizational environment. Thus, supported by Social Exchange Theory, the study hypothesized that a positive safety climate would moderate the relationship between POS and job strain by allowing researchers to feel valued in the organizational setting (Zohar, 1980).

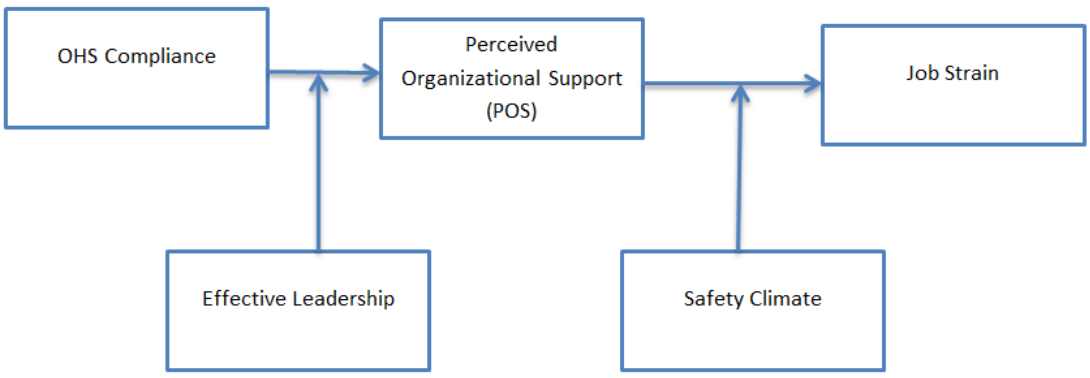
Cultures with a highly protective safety climate enhance the overall perception of organizational support and reduce job strain, regardless of challenging job demands. On the other hand, a poor safety climate might dilute the buffering role of POS by preventing researchers from noticing the university's safety assurance. A strong safety climate results in people within an university feeling obligated to prioritize safety, thereby decreasing workplace strain and increasing compliance with safety measures.

H6: The safety climate moderates the relationship between POS and job strain, such that the relationship becomes stronger in a high-safety climate and weaker in a low-safety climate.

This hypothesis posits that the safety climate is a significant factor in any university, helping to explain the relationship between POS and job strain. POS has an inspiring influence on nurturing a safe climate, which makes researchers feel more protected and less pressured.

Figure 1.

Conceptual Framework of the study



3. Methodology

The research design employed in the present study is a quantitative approach examining the relationships between leadership styles, job strain, safety climate, perceived organizational support (POS), and compliance with Occupational Health and Safety (OHS) regulations in engineering university laboratories in Pakistan. The quantitative method would allow for the collection of systematic data and will be used to test the hypotheses through statistical treatment. Considering that the academic research context has become increasingly complex, and safety protocols have become increasingly crucial in research laboratories, this research will focus on faculty and research personnel in engineering universities to provide empirical information with both practical and theoretical implications.

Research Design

The study employed a time-lagged survey design, where data collection was conducted simultaneously in engineering university laboratories across Pakistan. This approach offers a practical method for obtaining a comprehensive view of OHS compliance, leadership, job demands and control, safety culture, and POS in engineering university laboratories in Pakistan. A descriptive research design was also adopted, as it involved the use of hypothetical constructs to examine the strength and direction of the relationships between the variables.

Sample and Data Collection

The sample population of the study included teaching faculty and research staff located in the engineering university laboratories of the main academic centers in Pakistan, namely Islamabad, Lahore, Karachi, and Peshawar. The cities feature numerous prominent public and privately held institutions of engineering, providing a diverse and representative set of academic research settings.

Stratified sampling was employed to ensure sufficient coverage of each type of university, including large public universities, mid-sized and small private universities, as well as specialized engineering schools and institutions. The questionnaires sent out totaled 350, taking into consideration possible non-response or partially completed questionnaires. Information gathering was conducted through face-to-face surveys administered by pre-trained research assistants and online forms, which were secure and accessible at the institution, depending on the respondent's availability and accessibility. All 300 fully responded questionnaires survived the clearance of completeness and consistency issues, and this number gave adequate statistical power to test the hypothesized relationship embodied in the study variables.

Measures

The study employed a closed-ended questionnaire to measure the five key variables: leadership styles, job strain, safety climate, POS, and OHS compliance. All sections of the present questionnaire were developed from other validated scales in the literature measured at 5-points Likert scale; thus, the reliability and validity of the measures used in the study were ensured. The alpha values in table 1 depicted the internal consistency of the scales.

Table 1.
Variables' scales and Chronbach Alpha

	Variables	Scale Adapted	No of Items	Chronbach Alpha
1.	Effective Leadership (EL)	Multifactor Leadership Questionnaire (MLQ) (Bass & Avolo, 1995).	36	0.88
2.	Job Strain (JS)	Karasek's job demands–control scales (Karasek, 1979)	15	0.84
3.	Safety Climate (SC)	The Safety Climate Scale, developed by Zohar (2000),	16	0.84
4.	Perceived Organizational Support (POS):	Eisenberger et al.'s (2020)	12	0.90
5.	Occupational Health and Safety (OHS)	Törner & Pousette, 2009	19	0.77

Data Analysis

The variables were compared using SPSS and the Process Macro to determine whether mediation and moderation analyses were necessary to examine the interconnection. Descriptive statistics were computed to elicit features present in the data for establishing the sample's demography and examining the overall disposition of the responses. Further, the Multiple Regression Analysis was conducted to test the hypothesized relationships among leadership styles, job strain, safety climate, POS, and OHS compliance. In addition, Hierarchical regression analysis was employed to partially out the demographic variables and test each variable's additional predictive utility. Further, The Process Macro (Hayes, 2013) was used to perform a mediation analysis to determine whether POS has a mediating effect on leadership styles and OHS compliance. Moreover, Moderation analysis was conducted using the interaction terms to establish a safety climate as a potential moderator of the relationship. This study aimed to explore how leadership style explained variations in OHS compliance, with the safety climate in the university as the mediating variable to determine if and in what manner this relationship became more or less influential with the level of safety climate within the university.

4. Results and Discussion

The means, standard deviations, and Pearson's correlation coefficients of variables of the current study were calculated and presented in table 2.

Table 2

Means, standard deviations, correlations, and reliabilities for the variables

		Mean	**SD**	**OHS**	**JS**	**POS**	**EL**	**SC**
1	OHS	3.11	0.95	1				
2	JS	3.24	0.96	0.222***	1			
3	POS	2.63	0.71	0.216***	0.533***	1		
4	EL	2.748	0.77	0.255***	0.374***	0.359***	1	
5	SC	2.83	0.88	0.244***	0.45***	0.367***	0.345***	1

Note. N=300; ***p<.001

The OHS (Occupational Health and Safety Compliance) compliance score average was 3 (SD = 0. 95), which means that, on average, researchers were 'moderately' abide by the OHS regulations in their workplace. While, the perceived job strain index mean was 3.24 (SD = 0. 96), indicating that researchers experience moderate job strain as well.

The mean for POS was 2.63 (SD = 0.71), indicating that researchers have relatively low organizational support. A low POS score indicates that the researchers may not feel supported by their respective universities. Likewise, the mean score for effective leadership was found 2.748 (SD = 0.77), which is slightly less than average means, employee were of the view that leadership style wasn't effective. Similarly, the mean of safety climate was also found 2.83 (SD = 0.88), indicating that researchers have a slightly negative perception of safety in their workplace. Next, the correlation coefficients among all variables were found positively significant at $p<0.001$.

Mediation analysis

Table 3 presents the results of the mediation analysis, which tests the mediating effect of Perceived Organizational Support (POS) in the relationship between Occupational Health and Safety (OHS) compliance and Job Stress (JS). The analysis is based on Baron and Kenny's (1986) mediation model, in which POS is regarded as the mediator, and JS is the dependent variable (DV).

Table 2

Mediation Analysis (perceived organizational support mediated between OHS compliance and job strain)

Mediator: POS and DV: JS						
	β	**S.E**	**T**	***p***	**LLCI**	**ULCI**
OHS→JS	0.210	0.0469	4.48	0.000	.1180	.3026
POS→JS	0.24	0.05	5.27	0.001	.1506	.3301
OHS→POS	0.217	0.07	3.69	0.0003	.1017	.3328
Indirect Effect						
	β	**S.E**	**LLCI**	**ULI**		
OHS→POS→JS	0.1581	0.04	.0678	.2484		
Normal Theory Test for Indirect Effect						
	Effect	**S.E**	**Z**	***p***		
	0.05	0.017	2.99	0.0028		

Note: n=300; unstandardized regression coefficients are reported. Bootstrap sample size=5000.LL=lower limit; CI= confidence interval; UL = upper limit

Direct Effects

H1: OHS compliance is positively related to OHS compliance and job strain.

The significant β value (β = 0. 210, S. E. = 0. 0469, t = 4. 48, p < 0. 001, LLCI = 0. 1180, ULCI = 0. 3026) compliance that OHS has a direct significant impact on Job Strain. This suggests a marginal direct relationship between OHS compliance and job strain, indicating that higher levels of job strain are associated with higher levels of OHS compliance. This could be because, while practicing safety regulations, researchers may feel that more loads are being placed on them.

H3: Perceived Organizational Support (POS) is positively related to job strain (POS→JS).

The positive and significant β -value (β = 0. 24, S. E. =0. 05, T = 5. 27, p < 0. 001, LLCI = 0. 1506, ULCI = 0. 3301) shows the significant direct effect of POS on Job Strain (JS). This

may seem rather paradoxical because increased organizational support should decrease strain. However, in this context, it is possible that with higher support, higher expectations also come with it, or the sample consists of researchers in highly demanding positions; therefore, despite the support, they still feel pressured due to their jobs.

H2: OHS compliance is positively related to Perceived Organizational Support (POS).

The positively significant value of β for OHS → POS (β = 0. 217, S. E. = 0. 07, T = 3. 69, p < 0. 001, LLCI = 0. 1017, ULCI = 0. 3328) shows that a higher level of OHS compliance is associated with higher levels of POS. In other words, while researchers obey OHS regulations, they may feel that the university supports them because their willingness to comply with those regulations indicates the university's support.

Indirect Effects

Hypothesis 4 (H4): POS mediates the relationship between OHS compliance and job strain.

1. Mediating Role of POS in the Relation between OHS and JS: The results of Path Analysis (OHS → POS → JS) shows the significant indirect effect of OHS compliance on Job Strain (β = 0. 1581, S. E. = 0. 04, LLCI = 0. 0678, ULCI = 0. 2484). This indicates that POS partially explains the interaction between OHS compliance and Job Strain. More specifically, OHS compliance was found to indirectly enhance job strain through a positive relationship with perceived organizational support. This clearly illustrates how compliance with OHS leads to increased productivity, but productivity leads to increased job strain, which is probably attributed to the increased demand or expectations, as well as the lack of organizational support.

The normal theory test for the indirect effect also supports the abovementioned mediation analysis (Effect = 0. 05, S. E. = 0. 017, Z = 2. 99, p = 0. 0028). This also supports that POS partially explains the relationship between OHS compliance and Job Strain

Since the pace of OHS compliance is directly proportional to job strain, thus a slight increase in the job strain variable is predicted when OHS compliance is higher. Likewise, there is also a direct positive relationship between POS and JS, meaning that while researchers may experience high levels of POS, they may also have high levels of strain.

Applying further analysis of the relationships between OHS compliance and POS, it has been revealed that researchers' OHS affect their POS in the sense that they feel more supported by the university. As demonstrated, POS mediates the relationship between the level of OHS compliance and job strain to a large extent. This means that POS changes can help in explaining how OHS compliance affects job strain. The results suggest that higher OHS compliance is associated with higher levels of perceived organizational support, which in turn leads to higher job strain.

The implications regarding OHS compliance suggest that, although it gives workers the perception that their university supports them, it also increases job strain among POS researchers. This implies that adhering to safety standards, although desirable, adds to the work-related stresses and loads experienced by researchers. Moreover, the organizational support, which is beneficial, may also have some positive requests or loads that put pressure on the person. Enhancing OHS compliance or Support levels may not necessarily erode job demands. They must also ensure that the service support mechanisms implemented do not add pressure to relieve it within the same capacity.

Leadership can effectively target workload, job demands, and OHS compliance strategies to eradicate job insecurity. Thus, these results highlight the challenges of performing multifaceted safety and support roles in the workplace, where even constraints such as OHS

compliance and organizational support can compromise researchers' well-being.

Moderation analysis (Moderator: EL to OSH and DV: POS)

H5: Effective leadership moderates the relationship between OHS and POS, such that the relationship becomes stronger in highly effective leadership and vice versa.

Table 3 displays the results of the moderation analysis examining the extent to which Effective Leadership (EL) moderates the association between OHS compliance and Perceived Organizational Support (POS). To examine this, the moderating effect of leadership on the relationship between OHS compliance and POS is established and analyzed to understand if leadership enhances or dilutes the relationship's strength.

The Dependent Variable (DV) is POS, the Independent Variable (IV) is OHS compliance, and the Moderator is Effective Leadership (EL). The next term, OSH × EL, reflects the moderation effect whereby the extent of EL was used to regulate the relationship between OHS compliance and POS.

1. High (β = 3. 46, SE= 0. 645, t = 5. 378, p < 0. 001)

The equation's constant represents POS when OHS compliance and Effective Leadership (EL) equal zero. The positive constant is a number 3. The floor of a positive constant is equal to the positive constant. Be the positive constant. The value of the positive constant is 3. The positive constant is equal to three. 46 indicates that, on average, the university's researchers and those within similar enterprises perceive the extent of organizational support as moderate. This p-value is below 0.05 ($p < 0.001$), indicating that the model has a significant baseline value.

2. Direct effect of OHS on POS, Estimate = 0. 1439 SE = 0. 0524, t = 2. 744, p = 0. 065

The results indicated a positive direct relationship between OHS compliance and POS, with a coefficient estimate of $\beta = 0.1439$. Nonetheless, the main value of p ($p = 0.065$) is slightly higher than the accepted conventional level of 0.05 used to determine the significance of parameters. These findings support the hypothesis that a direct positive and significant relationship exists between OHS compliance and POS (Hypothesis 2a: POS = 0. 586 + 0. 349*VOHS).

3. The Direct Impact of EL on POS was calculated with regression coefficient of 0. 6634, standard error of 0. 0693, a t-statistic of 9. 579, and a p-value of less than 0. 001.

The direct impact of Effective Leadership (EL) on POS was found to be statistically significant, with a positive coefficient ($\beta = 0.6634$, $t = 9.579$) and $p < 0.001$. This strong effect indicates that perceived effective leadership has a considerable and direct positive impact on the perceived organizational support related to the need. In other words, a positive perception of leaders enhances researchers' perception of organizational support.

4. In the proposed model and in, POS (β = 0. 2331, SE = 0. 0672, t = 3. 472, p = 0. 006) was positively influenced by the EL's interaction effect with OHS.

The interaction term (OHS × EL) is significant at $p = 0.006$, and the positive coefficient ($\beta = 0.2331$) suggests that POS mediates the relationship between OHS and Effective Leadership. In particular, the positive correlation between leadership effectiveness and OHS compliance becomes more evident, particularly in POS. This means that there is a synergistic effect, where, singularly, the effect of leadership effectiveness on enhancing OHS compliance has an over-proportionate influence on the extent to which researchers perceive organizational support.

In the first model, OHS compliance has a marginal, positively direct effect on POS,

although the impact is not statistically significant.

This study also confirms the hypothesized positive relationship between effective leadership and POS, asserting that whenever researchers have positive perceptions of how their leadership is being done, they also feel that the university supports them.

The variation in the terms OHS and EL shows that Effective leadership enhances the positive correlation between OHS compliance and POS. In other words, the positive influence of compliance with OHS standards and its effect on employee's perception of the university's support in return is contingent on perceived leadership effectiveness. This means that, in universities with effective leadership, enhancements to OHS compliance will create a perception among researchers that the university is supportive of their well-being.

Table 3

Moderation Analysis

Moderator: EL to OSH and DV: POS				
	β	**S.E**	**t**	***P***
Constant	3.46	0.6450	5.3780	0.000
OSH	0.1439	0.0524	2.7444	0.065
EL	0.6634	0.0693	9.5793	0.000
OSH×EL	0.2331	0.0672	3.4718	0.006

Note: DV=POS IV=OSH, Moderator=EL

Moderation analysis (Moderator: SC to POS and DV: JS)

H6: The safety climate moderates the relationship between POS and job strain, such that the relationship becomes stronger in a high-safety climate and weaker in a low-safety climate.

Table 4 below presents a moderation analysis in which Safety Climate (SC) mediates the relationship between Perceived Organizational Support (POS) and Job Strain (JS). Therefore, this study investigates whether the moderating effect of perceived Safety Climate on the relationship between POS and JS holds.

Table 4

Moderation Analysis

Moderator: SC to POS and DV: JS				
	B	**S.E**	**t**	***P***
Constant	3.46	0.6450	5.3780	0.000
POS	0.1509	0.0452	3.4745	0.070
SC	0.5543	0.0369	9.7538	0.000
POS×SC	0.3321	0.0726	3.8143	0.008

Note: DV=JS IV=POS, Moderator=SC

Job Strain (JS) is the Dependent Variable (DV), Perceived Organizational Support (POS) is the Independent Variable (IV), and Safety Climate (SC) is the moderator. The variable POS x SC is used to measure the moderating role of Safety Climate on POS with Job Strain.

1. Constant ($\beta = 3.46$, SE = 0. 645, t = 5. 378, $p < 0.001$)

The constant represents Job Strain (JS), where POS is equal to zero, and SC is equal to zero. The positive constant, as I can see, is 3.46, which is statistically significant ($p < 0.001$) and implies that, without negating or excluding POS and SC, the mean value of job strain is moderate among the researchers.

2. The relationship we hypothesized was POS → JS. This relationship yields an estimate of 0.1509, SE = 0.0452, t = 3.4745, p = 0.070.

The significance of the relationship between Perceived Organizational Support (POS) and Job Strain (JS) is marginally significant with the obtained p-value of 0. 07, which can be just considered as a tad beyond the conventional level of significance of 0. 05. The coefficient sign indicates that when organizational support is high, the job strain of the researchers rises slightly (β = 0. 1509). Another possibility is to consider that the term 'perceived organizational support' could, to a certain extent, be translated as researchers feeling that they bear a higher level of expectation from their organizations, leading to a higher strain level.

3. SCJP Direct Impact: This study revealed that the safety climate had a direct positive effect on job strain whereby the coefficient was (β = 0. 5543) and the significance level of (p < 0. 001).

The estimated path coefficient between Safety Climate (SC) and Job Strain (JS) is positive and statistically significant at the $p < 0.001$ level, indicating a direct relationship with a coefficient value of 0.5543. This implies that a perceived safety climate can influence job strain; therefore, firms with a higher score on perceived safety climate are likely to have lower job strain. This could be due to the higher workload or attention, more so in universities/labs where safety is of paramount importance, which may exert more pressure as everybody tries to be safe.

4. Moderation POS x SC on the results of the workload stress (POS × SC → JS) (β = 0, 3321, SE = 0, 0726, t = 3, 8143, p = 0, 008). The interaction term (POS × SC) is significant (F = 8. 754; p = 0. 008) with a positive value (t = 5. 647; β = 0. 3321). This indicates a partial mediating effect: Safety Climate (SC) mediates the relationship between Perceived Organizational Support (POS) and Job Strain (JS). More importantly, the positive interaction implies that when the safety climate is strong, the association between POS and JS is higher than at a low safety climate, and greater organizational support is associated with a higher level of job strain. That is, an interpersonal combination of high S-O and SC leads to a higher level of strain among the researchers.

The direct relationship between POS and Job Strain reveals that organizational support may lead to a slight increase in job strain, while its significance is not very substantial. A positive and significant relationship is established between safety climate and job strain, demonstrating that a safe climate enhances perceived job strain. This could be because researchers are more attentive and wary of ensuring safety measures, which in turn proves to be stressful and time-consuming.

The result further shows that the interaction term (POS × SC) is significant, indicating that Safety Climate moderates the relationship between POS and Job Strain. The two studies are as follows: In a particular respect, among groups with a robust safety organizational climate, a higher level of POS causes increased job strain. From this, one can deduce that while employers place a premium on safety, researchers' perception that their organizations support them may also experience increased pressure or stress from the extra measures employed to ensure safety measures are followed.

5. Conclusion

This study has established important connections between leadership, perceived organizational support (POS), safety climate, and OHS compliance in engineering university laboratories in Pakistan. One of the foremost conclusions is that there is a positive dependency between OHS compliance and job strain; as the maintenance of safety rules rises, the sense of pressure on faculty and researchers might also mount due to the additional burden in this

sphere. Results underscore the importance of promoting a high level of safety culture as a priority, but this must be balanced against the risk of job strain intervention. The university management should devise ways to protect faculty and research workers without overloading them and ensure that safety measures are implemented without compromising health.

That study highlights the fact that leadership practices must be tailored to the context of universities, where high cognitive workload and high-performance expectations are the norms. Those higher education institutions that match their safety measures with the needs of researchers can encourage compliance and reduce strain more effectively. Furthermore, the usefulness of the combined approach to leadership skill development, institutional support systems, and safety training embedded in comprehensive OHS systems is identified in the study.

Ultimately, this study can serve as a foundation for future research on occupational health and safety in the academic sphere. As engineering universities evolve in response to the needs of contemporary research and innovation, their leadership and safety management should also adapt to foster a sustainable, safe, and supportive working environment.

6. Recommendations

In practice, the results are useful in guiding appropriate action by university administrators and policymakers. To begin with, transformational leadership behaviors should be taught in leadership training programs to inspire, assist, and engage faculty and researchers in establishing a shared safety vision. Second, institutions should invest in interventions that enhance perceived organizational support for their researchers, including access to protective and comfortable equipment, clear information on safety and mental health services, and inclusive decision-making practices that do not overwhelm staff. Third, although establishing a robust safety climate is crucial, it should be done with caution to prevent creating environments where compliance pressures lead to burnout. Stress management programs with regular feedback loops can make significant progress in achieving a balance. Altogether, the research indicates that sustainable OHS compliance is possible in academic laboratories with the support of leadership, fair workload distribution, and a culture associated with safety culture and workforce welfare.

7. Limitation and Future Direction

The study employed a time-lagged research design, which makes its findings more likely to support the flow of relationships between leadership styles, job strain, perceived organizational support (POS), safety climate, and OHS compliance in engineering university laboratories. The study reduces the possibility of having common method bias and increases the validity of the results by separating the measurement of the key variables in time.

To begin with, despite the benefit of enhancing temporal validity provided by the time-lagged approach, it does not establish actual causality completely. In future studies, this could be supplemented with longitudinal panel designs or experimental methods to enhance the dynamic nature of the interactions between these variables.

Second, self-reported survey data presents various threats of bias in response. Subsequent research may involve additional methodologies for data collection, including supervisor evaluations, institutional records, or observational audits, to gain a broader picture of the behavior and compliance regarding safety.

Third, the study is limited to geographical restrictions, focusing on engineering universities in Pakistan. Although this context may be important, it is worth noting that future studies in

other scholarly domains or nations may improve the generalizability of the results and consider differences in culture or regulations concerning OHS practice. Lastly, the mediation and moderation were tested through regression and PROCESS analyses; however, future research could benefit from the application of structural equation modeling (SEM) to test the conceptual model and analyze latent constructs more comprehensively.

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the conduct, outcomes, or publication of this research. All procedures were carried out with full ethical consideration, and informed consent was obtained from the participants. The research was conducted independently, without any financial or personal relationships that could have influenced the results.

Authors Contributions

TA: Conceptualization, Data analysis, Writing – original draft. MS: Data collection, writing-review & editing

8. References

Ahmed, T., Jahanzaiba, M., Ali, M. A., Razac, M. H., Jawadd, M., & Zahoor, S. (2024). Safety climate in Pakistani universities' laboratories: An assessment of individual factors. *International Journal of Occupational Safety and Ergonomics, 30*(2), 330–342. https://doi.org/10.1080/10803548.2023.2298138

Ahmad, R., Nawaz, M. R., Ishaq, M. I., Khan, M. M., & Ashraf, H. A. (2024). Social exchange theory: Systematic review and future directions. *Frontiers in Psychology, 13*, 1159472. https://doi.org/10.3389/fpsyg.2024.1159472

Ahmad, R., Nawaz, M. R., Ishaq, M. I., Khan, M. M., & Ashraf, H. A. (2024). The role of employee engagement in fostering innovative work behavior, mediated by leadership, in small businesses. *International Journal of Advanced and Applied Sciences, 11*(2), 145–156. https://doi.org/10.21833/ijaas.2024.02.017

Ali, A., Zadow, A., Dollard, M. F., & Ziaian, T. (2024). Should psychosocial safety climate theory be extended to include climate strength? *Journal of Occupational Health Psychology, 29*(1), 23–38. https://doi.org/10.1037/ocp0000367

Abu Bakar, N., Bulgiba, A., & Isahak, M. (2025). Perceived psychosocial safety climate level and its association with occupational outcomes among clinical unit healthcare workers in a Malaysian hospital: A three-wave longitudinal study. *BMC Public Health, 25*, 1418. https://doi.org/10.1186/s12889-025-22562-1

Bass, B. M. (1985). *Leadership and performance beyond expectations*. Free Press.

Boamah, S. A., Laschinger, H. K. S., & Wong, C. (2021). The influence of transformational leadership on safety performance: The role of safety climate and safety participation. *Journal of Safety Research*, *77*, 124–133. https://doi.org/10.1016/j.jsr.2020.09.007

Clarke, S. (2020). Safety leadership: A meta-analytic review of transformational and transactional leadership and safety performance. *Journal of Occupational Health Psychology*, *25*(4), 416–428. https://doi.org/10.1037/ocp0000273.

Davis, K. K. (2024). *The Impact of Health-Oriented Leadership on Employee Strain and Organizational Support* (Doctoral dissertation, The Chicago School of Professional Psychology).

Eisenberger, R., Malone, G. P., & Presson, W. D. (2020). Optimizing perceived organizational support to enhance employee engagement. *SHRM-SIOP Science of HR Series*.

Javaid, Z. K., Shahzad, M. H., Khan, K., Milhem, M., Ali, S. A., & Al Astal, A. Y. (2025). Inclusive leadership and employee work engagement in the IT sector: The mediating roles of perceived organizational support, psychological safety, and organizational self-esteem. In R. K. Hamdan (Ed.), *Tech fusion in business and society* (pp. 123–140). Springer. https://doi.org/10.1007/978-3-031-84636-6_88.

Karasek, R. A. (1979). Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign. *Administrative Science Quarterly*, *24*(2), 285–308.

Kurtessis, J. N., Eisenberger, R., Ford, M. T., Buffardi, L. C., Stewart, K. A., & Adis, C. S. (2017). Perceived organizational support: A meta-analytic evaluation of organizational support theory. *Journal of Management*, *43*(6), 1854-1884. https://doi.org/10.1177/0149206315575553

Mearns, K., Hope, L., Ford, M. T., & Tetrick, L. E. (2017). Perceived organizational support and safety climate in high-risk industries: A meta-analysis. *Journal of Safety Research*, *60*, 17–23. https://doi.org/10.1016/j.jsr.2016.11.001

Pakistan Bureau of Statistics. (2022). *Labor force survey 2022: Employment and labor force participation*. Government of Pakistan.

Probst, T. M., Graso, M., Jiang, L., & Olson, R. (2020). Safety climate and organizational support: A meta-analysis of their effects on safety performance. *Journal of Applied Psychology*, *105*(10), 1077–1090. https://doi.org/10.1037/apl0000464

Qasim, M., & Laghari, A. A. (2025). Belonging through values: Ethical leadership, creativity, and psychological safety with ethical climate as a moderator. *Frontiers in Psychology, 16*, 1559427. https://doi.org/10.3389/fpsyg.2025.1559427

Saxena, R. R. (2024). Intelligent approaches to predictive analytics in occupational health and safety in India. *arXiv*. https://arxiv.org/abs/2412.16038.

Van der Doef, M., & Maes, S. (2021). The Job Demand-Control (-Support) Model and psychological well-being: A review of 20 years of empirical research. *Work & Stress*, *15*(3), 281–328. https://doi.org/10.1080/02678370110038110

Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. *Journal of Applied Psychology*, *65*(1), 96–102. https://doi.org/10.1037/0021-9010.65.1.96

Zhou, Y., Yang, J., Guo, K., Chen, P.-Y., Gao, T., Geyer, W., Moniz, N., Chawla, N. V., & Zhang, X. (2024). LabSafety Bench: Benchmarking LLMs on safety issues in scientific labs. *arXiv*. https://arxiv.org/abs/2410.14182