

Employee Well-being and Occupational Health: An HRM Perspective in Life Science Research and Laboratory Settings

Vikas Chhabra

Assistant Professor

Department of Management & Commerce

Dev Bhoomi School of Professional Studies, Saharanpur

Abstract

Employee well-being and occupational health have been identified as important areas in the life science domain, as well as in the laboratory setting, where workers are exposed to complex physical, chemical, and psychosocial hazards, as well as high performance demands. Human Resource Management (HRM) can have a strategic impact on the creation of a healthy and safe working environment through its integration of health-oriented policies, safety culture, and employee-centred strategies. The present conceptual study, based on the analysis of the relevant literature published between 2015 and 2024, aims to investigate the role of HRM in the promotion of employee well-being and occupational health in the laboratory setting, through the development of an integrated conceptual framework. According to the study findings, the HRM interventions with health-oriented leadership and safety culture can play a significant role in the promotion of employee well-being, reducing burnout, and safety compliance. The study contributes to the existing literature by highlighting the gaps in the existing literature, such as the lack of HRM models in the laboratory environment and sector-specific HRM models and the inclusion of psychosocial and physical health dimensions. This study contributes to the existing HRM and occupational health literature with a holistic conceptual model of HRM in life science organizations.

Keywords: Employee well-being, occupational health, HRM, laboratory safety, life sciences, safety culture, psychosocial hazards

Introduction

Background of the Study

Organizations in life sciences, biotechnology, pharmaceutical R&D, and academic research centers are at the frontier of scientific innovation and discovery but are also embedded in an occupational risk landscape that includes exposure to biohazards, hazardous chemicals, ergonomic stress, long and variable working hours, and high levels of psychosocial pressure, including publish or perish expectations and high levels of cognitive demands (Gewin, 2021). The dual nature of these hazards, both physical and psychological, means that EWB and OH are at the heart of ethical practice and organizational success in these environments. Recent studies have also shown high levels of burnout and mental health pressure in academic and laboratory-based settings, especially exacerbated in the pre- and post-COVID-19 pandemic period. HRM is traditionally concerned with staffing, training, performance management, and employee relations. However, more recent HRM research has emphasized the role of HRM in driving EWB and OH cultures, especially with regard to integrating HRM with OH and using HRM to drive OH cultures. This study will synthesize multidisciplinary research to propose how HRM might be reconceptualized to play an integral role in OH and EWB in laboratory-based settings.

Problem Statement

While the role of safety protocols and compliance mechanisms (e.g., biosafety committees, standard operating procedures) is well emphasized, some life science organizations continue to experience deficiencies in terms of employees' well-being outcomes, indicating that technical controls are perhaps not enough. There is an unclear understanding of the applicability of HRM practices to laboratory research settings to address both physical and psychosocial hazards holistically. Moreover, while empirical studies on HRM are already available, especially in healthcare and industry settings in general, conceptualizations are still unclear for life sciences laboratory settings.

1.3 Research Gap

The literature shows three notable gaps:

1. A lack of HRM models designed to address laboratory/life science research settings rather than hospital or manufacturing settings;
2. A lack of integration between research on safety culture and HRM. Safety culture research is concerned with compliance and technical practice, but HRM drivers such as recruitment, performance management, and leadership development are little researched in terms of their impact on safety culture; and
3. A lack of conceptual consideration of psychological well-being issues such as burnout, moral stress, and work-life balance in relation to physical occupational health. Improving understanding in these areas would benefit both theory and practice in an industry where people are the main drivers of innovation.

Research Objectives

1. To synthesize interdisciplinary literature on HRM, occupational health, and safety culture as they relate to life science research and laboratory settings.
2. To identify HRM practices and leadership approaches that influence employee well-being and occupational health outcomes in laboratories.
3. To develop a conceptual framework linking HRM interventions to safety culture, psychosocial well-being, and occupational health performance.
4. To propose managerial recommendations and a future empirical research agenda to test the model in life science contexts.

Significance of the Study

This theoretical contribution will:

1. Help bridge the gap between HRM and occupational health research, with a sector-specific approach.
2. Help HR practitioners in the life sciences sector design an actionable framework for embedding well-being and safety aspirations into HR strategy.
3. Help researchers design empirical research into HRM interventions in laboratory settings. More conceptual clarity between HRM and occupational health research could help organizations avoid accidents, prevent burnout, and retain critical scientific staff—a socially and economically significant outcome.

Scope and Limitations

This paper will be considered a theoretical or conceptual paper, and the sources will be considered peer-reviewed literature, reviews, and high-quality sector reports, mostly between 2015 and 2024. The emphasis will be placed on the HRM levers in the life science domain, more precisely in the life science research and laboratory settings. The limitations will be considered based on the fact that the sources will be considered secondary sources, and primary data will not be considered. The second limitation will be considered based on the heterogeneity of the laboratory setting, and the model will be considered empirically validated.

Review of Literature

This review organizes key studies chronologically and thematically to track how HRM, occupational health, and safety culture scholarship have converged.

Safety Culture and Laboratory Compliance (2015–2019)

Early research in laboratory settings has been centered around compliance, reporting incidents, and technical measures. Ayi et al.'s (2018) research examined safety culture in a Canadian University, where there was a mixed response in terms of compliance and safety protocol attitudes. The research has shown that leadership visibility and employee training are critical factors in safety behavior. These studies form a precursor in understanding safety culture as a socio-technical system, rather than a series of checklists.

Expanding to Psychosocial Risks and Burnout (2019–2021)

As evidence of the mental health pressure in the world of academics and research continues to mount (research conducted during the pandemic years was particularly alarming), research has been conducted to show the rising rates of burnout, stress, and decreased well-being among research staff and lab workers (Gewin, 2021). In addition, meta-analysis studies on burnout and mental health in the health professions highlighted the importance of organizational support in the mitigation of burnout, which expanded the scope of occupational health to include the concept of psychosocial hazards.

HRM as Strategic for Well-Being (2020–2023)

Research in HRM has started to consider employees' well-being as an outcome of a bundle of HR practices, including training, autonomy, health, and performance. Integrative reviews and research have claimed that HPWPs could have a positive effect on employees' well-being if combined with health-oriented leadership (Hauff et al., 2022). In healthcare settings, bibliometric mapping research has shown that there was an increasing trend in research on HRM's contribution to workforce performance and health, while life sciences labs remained underrepresented.

Safety Culture Meets Strategic HRM and Sustainability (2022–2024)

Recent research has also investigated the financial and organizational performance outcomes associated with safety culture, and safety has been framed in relation to sustainable HRM (Bautista-Bernal et al., 2024; Kabiesz, 2024). This research implies that when HR practices are aligned with safety objectives, such as through recruitment, reward structures, and leadership development, safety performance outcomes improve and link to sustainability objectives. Empirical research does not often distinguish between laboratory settings, where biosafety and research protocols present distinctive management problems.

Laboratory-Specific Well-Being Studies (2022–2024)

Specific studies on laboratory workers, such as medical laboratory technologists and laboratory technicians, have found stressors at work, fear of the pandemic, and the relationship between perceived safety support and turnover intentions (Nowrouzi-Kia et al., 2022; Ullah et al., 2024). Supervisory support, training sufficiency, and staffing levels are also implicated.

Literature Gaps and Justification for Current Study

Nevertheless, some gaps exist in the literature, such as the lack of specific HRM models on the dual nature of laboratory risks, limited longitudinal or sector-specific empirical testing of HR bundles in laboratory settings, and unclear findings on the effectiveness of HR practices on integrating safety culture and well-being. This paper justifies the need for conceptual integration, with HRM bundles and leadership at the heart of occupational health outcomes in life science laboratory settings, providing hypotheses and mechanisms to be tested in the future.

Theoretical Integration of HRM and Occupational Health

The integration of HRM and OHWB can be explained through various theories. The theories provide an excellent conceptual foundation to understand the influence of HRM on employee well-being in the life science and laboratory setting. The most relevant model that explains the influence of HRM on employee well-being in the laboratory setting is the Job Demand-Resources Model. According to the model, employee well-being is the outcome of balancing job demands and job resources. Job demands in the laboratory setting include high cognitive demands, deadlines, and hazardous materials. If job demands are not properly managed, they lead to burnout, hence negatively impacting job performance. The role of HRM is significant in ensuring that the laboratory workforce is provided with sufficient job resources to cope with job demands. The second model that explains the influence of HRM on employee well-being in the laboratory setting is Maslow's Hierarchy of Needs. According to the model, safety and security are fundamental human needs. The workforce in the laboratory setting is exposed to physical and biological hazards, hence having the need for safety, which should be satisfied by the HR department. If the need is not satisfied, job satisfaction, turnover, and engagement are negatively affected. Similarly, Herzberg's Two Factor Theory of motivation also identifies two factors: Hygiene and Motivator. Hygiene factors are safe working conditions, organizational policies, etc. Lack of proper safety measures in the laboratory might lead to dissatisfaction and stress among the research staff. Another important theoretical perspective on organizational behavior is the Perceived Organizational Support construct. The POS construct explains the perception of the organizational actions on the part of the employees. Effective implementation of health and safety policies at HRM might lead to the perception of the research staff about the care and support of the organization. Safety Culture Theory also explains the importance of the value of safety in the organizational culture. HRM plays an important role in developing a safety culture in the organization. HRM recruits safe performers, trains employees on safety procedures, and develops organizational leaders. In life science research organizations, the presence of a strong safety culture is very important to reduce the number of accidents in the workplace. Therefore, the above theoretical perspectives on organizational behavior might provide an in-depth understanding of the influence of HRM on the physical and

psychological well-being of the research staff. This theoretical background can further strengthen the proposed conceptual model and highlights the multidimensional role of HRM in laboratory environments.

Research Methodology

Approach and Rationale

This is a theoretical (conceptual) study, which uses systematic literature synthesis and integrative analysis to develop a conceptual framework in a specific domain. The research method is as follows:

- a) selection of high-quality peer-reviewed literature, systematic reviews, and sector reports published in the range 2015-2024,
- b) extraction of constructs/mechanisms which link HRM practices to occupational health/well-being outcomes, and
- c) synthesis of these constructs/mechanisms into a conceptual model, which can be tested in future empirical research, according to the best practice guidelines for conceptual papers in the field of management and occupational health.

Data Sources and Selection Criteria

Sources were obtained from multidisciplinary databases such as PubMed/PMC, ScienceDirect, MDPI, Frontiers, BMJ Open, and top HRM journals. The criteria for a source to be considered relevant were its relevance to employee well-being, occupational health, lab safety, HRM practices, and leadership in research and healthcare settings, published from 2015 to 2024, and peer-reviewed and review articles from top journals. The criteria for a source to be excluded from consideration were opinion pieces and organizational materials with no empirical and theoretical value.

Analytical Strategy

A thematic coding system was developed based on the constructs (e.g., safety culture, psychosocial risk, HPWPs, leadership, and training). Causal mechanisms were derived from the literature where mediating or moderating effects are proposed (e.g.,

leadership → safety climate → safety compliance; HR practices → perceived organizational support → burnout reduction).

A conceptual model was developed as part of this study, and this model is the foundation upon which future studies can be conducted to empirically test the model using quantitative and qualitative methods in the laboratory setting.

Conceptual Framework and Data Synthesis

Core Constructs

1. HRM Bundles: recruitment & selection (safety competence), training & development (biosafety, psychosocial resilience), performance & reward systems (safety-oriented KPIs), staffing, workload, employee assistance programs.
2. Leadership and Safety Climate: health-oriented leadership, leader visibility, supportive supervision, creating a climate in which workers are encouraged to report accidents, prioritize safety.
3. Safety Culture and Technical Controls: institutional SOPs, biosafety committees, incident reporting, environment control—necessary but not sufficient conditions.
4. Psychosocial Well-Being: burnout, stress, job satisfaction, work-life balance, moral distress—mediators between HRM variables and outcomes.
5. Occupational Health Outcomes: incident rates, compliance, absenteeism, turnover intention, research quality indicators.

Proposed Relationships (Summary Propositions)

P1: HRM bundles including safety competence at hire, on-going safety and psychosocial training, and reward systems linked with safety and well-being are expected to have a positive influence on safety climate and psychosocial well-being.

P2: Health-oriented leadership moderates the relationship between HRM bundles and safety climate: when leaders are seen to emphasize health, HR practices are more likely to translate into safe behavior.

P3: Enhanced safety climate and psychosocial well-being are expected to mediate the relationship between HRM practices and occupational health outcomes (incident rates and turnover).

A simple model of the relationships between HRM bundles and occupational health outcomes via safety climate and psychosocial well-being, with a moderating effect of health-oriented leadership on the HRM bundles and safety climate relationship, provides a testable model of the relationships: HRM bundles → safety climate and psychosocial well-being (mediating variables) → occupational health outcomes.

Appendix A: Diagram of the conceptual model

Conceptual Model Diagram

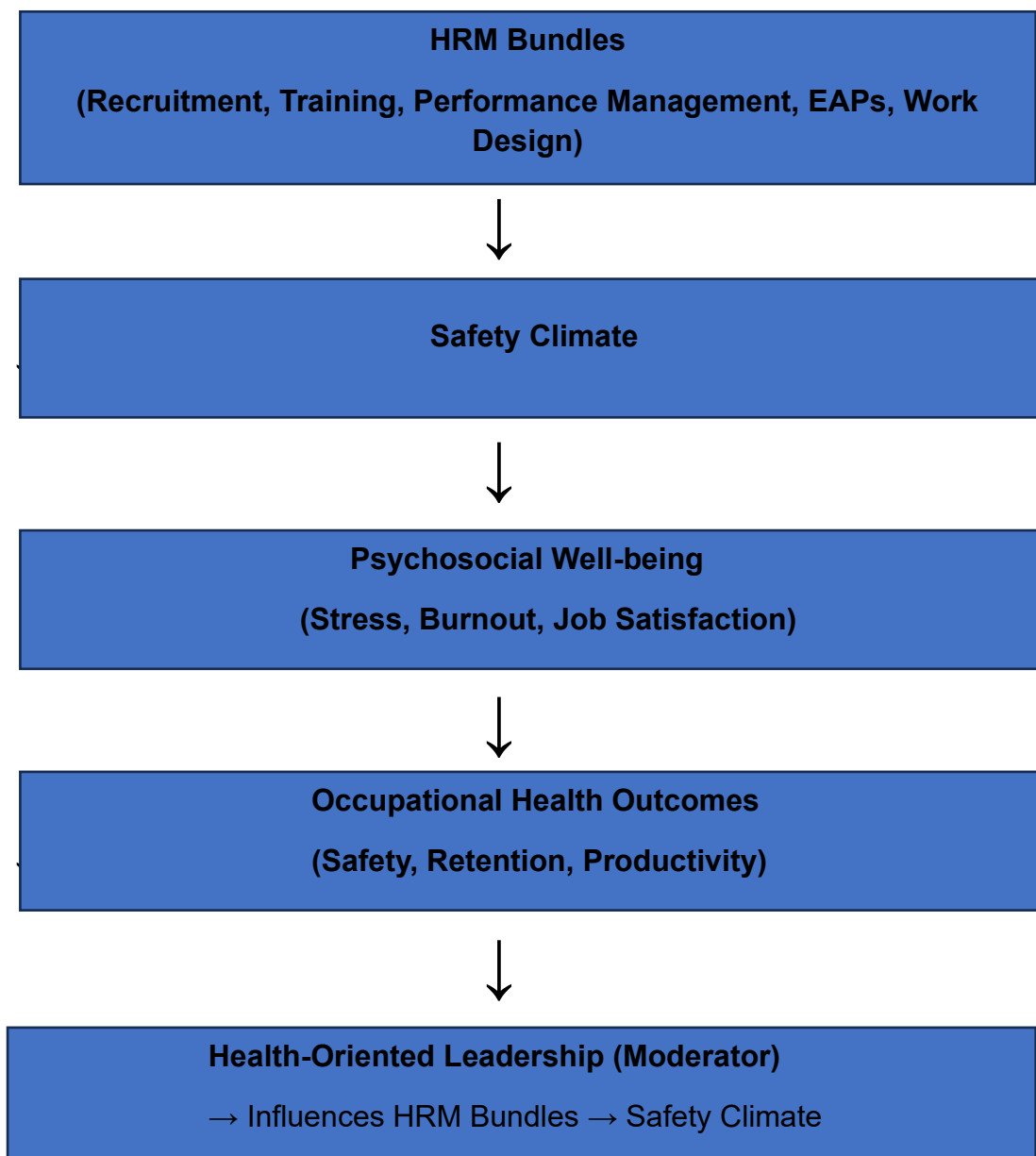


Figure 1: Conceptual Model of HRM, Safety Climate, and Employee Well-being in Laboratory Settings

This model indicates that HRM practices affect safety climate and psychosocial well-being, and this further impacts occupational health outcomes. Leadership for health acts as a moderator between HRM practices and safety climate.

Data Analysis & Interpretation (Synthesis of Evidence)

Because this is a theoretical paper, “data analysis” refers to synthesizing empirical patterns and effect directions reported across studies.

HRM Bundles and Well-Being

According to integrative reviews, combined interventions in HR practices have more significant effects than implementing separate interventions. For instance, better well-being outcomes result from the combined interventions of training + role clarity + employee participation + health programs, rather than implementing each intervention separately (Apascaritei et al., 2022). Laboratory studies have shown that biosafety training has more significant effects on increasing compliance, while interventions including psychosocial components, such as stress management and support, have more significant effects on reducing burnout.

Leadership and Safety Climate

Health-oriented leadership is another factor that surfaces repeatedly as a multiplier of HRD effects. Leadership walk rounds, staff engagement, and safety conversations led by leaders have been linked to more positive safety climate perception and reduced psychological distress. Research in healthcare and lab settings indicates leaders' behavior can account for variance in safety compliance beyond SOPs.

Psychosocial Well-Being as a Mechanism

Research has found that the prevalence of burnout is high in research and healthcare professions, with links to workload, lack of autonomy, and insecurity, which are HR-influenced factors. For laboratory staff, perceived organizational support and staffing have negative relationships with turnover intentions and burnout.

Outcomes: Safety, Retention, and Research Quality

Safety culture studies indicate a positive correlation between a strong safety culture and a lower frequency of safety incidents, and most important, a positive impact on financial and performance results. HR-based safety culture, in terms of its ability to incorporate performance metrics and reward structures, has potential benefits in terms of reducing safety incidents and absenteeism, and maintaining research continuity.

Interpretation Summary

The evidence base supports the conceptual model, indicating that HRM bundles, in conjunction with health-oriented leadership, positively contribute to safety climate and psychosocial well-being, which, in turn, positively contribute to occupational health outcomes. The relative effect sizes and boundary conditions, such as organization size, public vs. private labs, remain to be examined.

Findings and Discussion

Key Findings (Conceptual Synthesis)

- 1. HRM is at the centre:** HRM practices are not peripheral administrative activities but rather strategic tools for promoting safety and well-being in life science research settings.
- 2. An integrated practice is necessary:** The integration of technical safety management with HR management of psychosocial risks is more effective than either practice on its own.
- 3. Leadership multiplies the effects:** Health-oriented leadership is essential for amplifying the effectiveness of HRM practice in producing behavioural change and well-being.
- 4. Practice gaps are evident:** Many laboratories lack formalized HRM practice, with explicit linkages to safety and well-being objectives.

Theoretical Implications

This paper contributes to the advancement of HRM and OH research in a number of ways: (a) developing a sector-specific conceptual model for life science laboratories, (b) integrating psychosocial and physical risk management into a common HRM approach, and (c) highlighting leadership as a moderator. The conceptual model builds

on the HPWP theory, focusing on outcomes for H&S as a key, rather than subsidiary, effect of HR systems.

Practical Implications for HR Practitioners in Life Sciences

- **Recruitment:** Include safety competence and resilience indicators in selection criteria for lab roles.
- **Training:** Combine biosafety technical training with psychosocial resilience modules and leader training on health-oriented supervision.
- **Performance & Reward Systems:** Integrate safety KPIs and recognition for reporting incidents and participation in safety improvement.
- **Work Design:** Address workload balance and career support for early-career researchers to reduce burnout risk.
- **Leadership Development:** Train supervisors in health-oriented leadership tactics (e.g., walk-rounds, open communication).

Challenges in Implementing HRM-Based Well-being Practices

- Despite the acknowledged significance of worker well-being and occupational health, there are various challenges associated with the effective implementation of HRM-based interventions in life science research and laboratory settings.
- One of the main challenges is the resource constraint faced by various research centres, especially academic labs. In such cases, funding issues often limit investment in safety equipment, mental health programs, and worker support.
- Another major challenge is the high-pressure environment of research labs, where deadlines must be met, funding is competitive, and publication and project outcomes are often performance expectations. In such cases, it is difficult for HRM-based interventions to fully address worker burnout.
- Another challenge is the lack of awareness and training regarding psychosocial risk factors. In most cases, physical safety is a major priority, but mental health and stress issues often go neglected.

- Moreover, there is often a disconnect between policy and practice. In various cases, safety and worker well-being policies have been clearly stated, but effective implementation is often inconsistent.
- Resistance to change is another major challenge faced in HRM-based interventions. In some cases, workers and supervisors may be resistant to new HRM-based practices and safety measures if they are considered time-consuming.
- Finally, another challenge is the diversity of laboratory settings, where different HRM-based practices may have to be implemented for different labs.
- To address all these challenges, it is imperative to have a strategic HRM approach.

Role of HRM in Promoting Employee Well-being in Laboratory Settings

The role of Human Resource Management (HRM) is very significant in the improvement of employee well-being in life science research and laboratory settings through the inclusion of physical and psychological support mechanisms. In this case, the role of HRM in the high-risk environment is not only confined to the execution of day-to-day operations, as the department becomes a strategic partner in the provision of a safe and healthy working environment.

The significant role of HRM in the improvement of employee well-being in the laboratory setting is the development and implementation of appropriate training mechanisms. Laboratory workers, in particular, need to be trained on issues related to biosafety, the handling of hazardous materials, and emergency preparedness. However, the physical and psychological well-being of the workers should also be considered, and appropriate mechanisms developed to train the workers on issues related to stress, emotional intelligence, and work-life balance.

Another crucial role that HRM plays in improving employee well-being in a laboratory setting is the development of a positive organizational culture. It is important for employees to feel comfortable talking about safety concerns, mental health issues, and seeking help without any fear of discrimination. The organizational culture plays a crucial role in improving the work culture.

Another role that HRM plays in improving employee well-being in a laboratory setting is through work design and work overload. In a laboratory setting, work overload and working for extended periods contribute significantly to employee burnout. The HR managers are required to ensure that employees are able to work within manageable workloads and deadlines.

Lastly, the role that HRM plays in improving employee well-being in a laboratory setting is through the development and implementation of EAPs. Employee Assistance Programs are crucial in improving employee well-being.

Finally, the role that HRM plays in improving employee well-being in a laboratory setting is through aligning organizational, leadership, and support factors. It is through this that the HRM plays a crucial role in improving organizational performance and sustainability.

Conclusion and Recommendations

Conclusion

The problem areas related to employee well-being and occupational health in life science research and laboratory settings are complex, and the link between technical safety and strategic HRM is critical. The synthesized evidence suggests that the implementation of HRM bundles and health-oriented leadership plays a vital role in influencing the safety climate and psychosocial well-being, hence having a positive influence on occupational health. The conceptual paper aims to fill the gap in theory by developing a framework and propositions for use in a laboratory setting.

Recommendations for Practice

1. Adopt an Integrated HR-Safety Strategy: Align recruitment, training, performance management, and reward systems with safety and well-being goals.
2. Invest in Leader Development: Foster leader behaviors that promote safety and support employees' well-being.
3. Adopt Psychosocial Risk Management: Include mental health support, work load reviews, and flexible work arrangements under occupational health programs.

4. Measure and Report: Use composite metrics that include safety compliance, well-being metrics (burnout, job satisfaction), and staff turnover.

Future Research Directions

- **Empirical Validation:** Longitudinal and cross-site empirical evaluation of the proposed model in academic, industrial, and hospital-based laboratories.
- **Intervention Studies:** Randomized and quasi-experimental designs to examine the effects of specific bundles of HR practices (e.g., biosafety and psychosocial training) and leader interventions.
- **Boundary Conditions:** Investigate the moderating effects of factors such as organization size, financial stability, and country-specific regulations.
- **Measurement Development:** Develop valid, lab-specific measures to assess the alignment of HRM with safety and well-being objectives.

Strategic HRM Interventions for Future-Ready Laboratories

- To improve the well-being of employees and occupational health in life science research organizations, it is essential to develop HRM strategies that are forward-thinking and adaptable to technological changes and workforce expectations.
- Firstly, organizations need to integrate technology-based HR tools to monitor employees' well-being. These tools will help organizations monitor employees' workload, stress levels, and compliance with safety regulations in real time.
- Secondly, organizations need to develop a culture of continuous learning. Employees need to be trained regularly on technical and psychological well-being. This will enable employees to cope with both technical and psychological challenges.
- Thirdly, organizations need to develop flexible work arrangements, especially for research employees. This will enable employees to have better work-life balance.
- Moreover, organizations need to develop strong engagement strategies. These will help to improve employees' morale and foster a sense of belonging.

- Another essential strategy is to develop leadership programs. Leaders need to be trained to recognize stress symptoms, promote employees' well-being, and foster a positive work culture.
- Finally, organizations need to develop comprehensive occupational health programs. These programs need to integrate both physical and mental well-being.

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